# Additional Results:

## Study Characteristics

### Fetal heart rate during acute exercise

#### Randomized controlled trials

There was one randomized controlled trial (RCT) which reported on FHR during exercise (n=7); it could not be included in the meta-analysis because it did not report standard deviations.1

#### Non-randomized interventions

There were three non-randomized interventions (n=70) reporting on FHR during acute exercise sessions.2-4 The women in these studies were tested between 24-40 weeks gestation, and all women were performing vigorous to high intensity aerobic exercise between 7 and 25 minutes.

#### Cross sectional studies

There were six cross-sectional studies (n=72) reporting on FHR during acute exercise sessions.5-10 The women were tested in the second5 and third trimester.6-10 Exercise modality included only aerobic exercise. Exercise sessions included low,9 moderate,7 8 10 and vigorous to high5 6 intensity activities performed for 5 to 40 minutes in duration. One study included women with small for gestational age (SGA) fetuses (n=20).11

#### Cohort Studies

There were nine cohort studies reporting on FHR during acute exercise sessions (n=193).11-19 The women were tested between 15-40 weeks gestation, and all but one study tested women exclusively in the third trimester.14 Exercise modality included aerobic activities11-14 16 17 19 and resistance training.15 18 Exercise intensity included low,15 18 moderate13 17 19 and vigorous12 16 activities ranging from 10 to 20 minutes in duration.

### Fetal heart rate following acute exercise

#### Randomized controlled trials

There were seven RCTs (n=245 women) reporting on FHR following acute exercise sessions.1 20-25 One study (n=13) could not be included in the meta-analysis because it did not report standard deviations.1 One study included women (n=17) who were diagnosed with gestational diabetes mellitus receiving insulin therapy.20 Women were 12-38 weeks gestation when they were tested for acute FHR responses. Exercise modality included aerobic,1 20-24 and yoga.25 Exercise intensity included low,25 moderate 1 21-24 and vigorous20 23 24 activities ranging from 3-60 minutes in duration.

#### Non-randomized interventions

There were four non-randomized interventions (n=130 women) reporting on FHR following acute exercise sessions.2-4 26 All but one study included women who were previously inactive.3 Women were tested in both the second and third trimesters in all studies.2-4 26 All exercise studies include aerobic activities of moderate2 and vigorous3 4 26 intensities ranging from 7 to 50 minutes in duration.

#### Cross Sectional Studies

There were 20 cross-sectional studies (n=513 women) reporting on FHR following acute exercise sessions.5-10 27-40 Women were tested between 26 and 41 weeks gestation. All but one study included aerobic exercise; this study was a resistance training study.30 Exercise sessions included low,6 9 32 34 moderate,7 8 10 30 32 33 35-40 and vigorous5 27-29 31 32 intensity activities ranging from 5 to 40 minutes in duration.

#### Cohort Studies

There were 33 cohort studies (n=882 women) reporting on FHR following acute exercise sessions.11-16 18 19 41-64 Women were tested between 12 and 41 weeks gestation. Exercise sessions included aerobic activities, 11-14 16 19 41-51 54-64 resistance training,15 18 52 and yoga.53 Exercise sessions included low,18 52 53 62 moderate11 13 14 19 49 55 57 61 and vigorous14 44-48 50 51 54 56 58-60 63 64 intensity activities ranging from 5 to 60 minutes in duration.

#### Case Control Studies

There were two case-control studies (n=84 women) reporting on FHR following acute exercise sessions.65 66 Women were tested between 22 weeks gestation65 and term (not defined).66 They all preformed aerobic exercise of low65 and moderate66 intensity for 17.5 to 60 minutes in duration.

### Incidence of bradycardia and tachycardia

#### Incidence of bradycardia at rest

There were 24 studies (n=1,711 women) reporting on the incidence of bradycardia at rest. They include two RCTs ,25 67 three non-randomized interventions,2 4 68 nine cross sectional,5 7 8 10 28 38 69-71 and 10 cohort studies.14 15 48 50 51 56 59 72-74 Two of the studies were identified to potentially have artifact, which would increase the reported incidence of bradycardia.7 71 Women were tested between 25-40 weeks gestation. With the exception of one resistance training study15 and one yoga intervention,25 all exercise sessions included aerobic exercise. Exercise sessions were of low,15 25 71 moderate,2 7 8 10 14 38 67-70 73 and vigorous intensity4 5 14 28 48 50 51 56 59 72 74. Exercise sessions were between 5 and 60 minutes in duration.

#### Incidence of tachycardia

There were 13 studies (n=644 women) reporting on the incidence of tachycardia at rest, during exercise, or following exercise.1 2 4 8 15 25 27 40 48 50 54 58 72 They include one RCTs,25 three non-randomized interventions,1 2 4 three cross sectional,8 27 40 and six cohort studies.15 48 50 54 58 72 All but one study included aerobic exercises; this study was a yoga session.25 Studies ranged from 7-60 minutes in duration and took place from 12-38 weeks gestation. Exercise sessions included low,15 25 moderate,1 2 8 40 and vigorous4 27 48 50 54 58 72 intensity activities.

### Chronic Prenatal Exercise

#### Effect of chronic prenatal exercise on fetal heart rate at rest

There were 16 studies (n=595 women) reporting on FHR at rest following an exercise intervention.1-4 21-26 49 54 75-78 Of these, there were eight RCTs (n=323 women), 1 21-25 75 three non-randomized interventions (n=70 women),1 2 4 one cross-sectional study (n=61 women) and four cohort studies (n=118 women). Of the RCTs, four included aerobic exercise only,1 21 22 26 one was a superiority trial comparing yoga to walking,75 while the other two included a combination of aerobic activities and resistance training.23 24 One RCT consisted of a single exercise session only (yoga).25 Two of the non-randomized interventions included aerobic exercise only4 and the third included a combination of aerobic activities and resistance training.2 Exercise frequency ranged from three to six days per week and consisted of sessions lasting 15 to 60 minutes. Nine of the interventions were supervised (all sessions supervised), 1-4 22-26 one was unsupervised,75 and it was unclear from one trial whether it was supervised or not.21 The compliance to the interventions was reported in six studies and ranged from 74-100%.2-4 23 24 49 Four studies included women who were previously inactive4 22-24 while the rest did not spcify previous exercise levels of the women.

#### Effect of chronic prenatal exercise on the fetal heart rate response during exercise

There were no RCTs reporting on FHR during exercise post-intervention. There were two non-randomized interventions (n=58 women) which reported on the change in FHR during exercise post-intervention. 2 4 One included aerobic activities only4 while the other included a combination of aerobic activities and resistance training intervention.2 The exercise frequency for both interventions was three times per week, at a moderate intensity for 15-25 minutes. 2 4 The acute exercise sessions included aerobic activities lasting from 7-15 minutes and were of moderate to vigorous intensity. 2 4 Both interventions were supervised, with compliance ranging between 74-86%.2 4 One study included women who were previously inactive,4 the other did not define previous physical activity levels of the women.2

#### Effect of chronic prenatal exercise on the fetal heart rate response following exercise

There were six studies (n=249 women) which reported on the change in FHR following exercise post-intervention.2 4 21-24 Four were RCTs (n=91 women) 21-24 and two were non-randomized interventions (n=58 women) 2 4 Three included aerobic activities only4 21 22 while the other three included a combination of aerobic activities and resistance training.2 23 24 The exercise frequency was three to six times per week, at a moderate to vigorous intensity for 15-60 minutes. 2 4 21-24 The acute exercise sessions included aerobic activities lasting from 3-20 minutes and were of moderate to vigorous intensity. 2 4 21-24 All but one21 interventions were supervised, with compliance ranging between 74-86%.2 4 23 24 Four studies included women who were previously inactive,4 22-24 and two did not define previous physical activity levels of the women.2 21

### Umbilical Artery Blood Flow

#### Umbilical artery blood flow during acute exercise

There were two studies (n=41 women) reporting on the change in umbilical artery blood flow during acute exercise sessions compared to rest.16 25 Both studies reported on the umbilical artery systolic/diastolic ratio (S/D; arbitrary units).16 25 One cohort study included an aerobic exercise session lasting less 12 minutes at a vigorous to high intensity,16 while the other was a randomized controlled trial which included a single yoga session (low intensity) for 60 minutes.25

#### Umbilical artery blood flow following acute exercise

There were 17 studies (n=469 women) reporting on the change in umbilical artery blood flow following acute exercise sessions compared to rest.16 25 29-31 34 41 42 46 49 61 70 74 79-82 Two studies (49 women) were RCTs,25 80 eight were cohort studies (279 women),16 41 42 46 49 61 74 81 82 and six studies (141 women) were cross-sectional.29-31 34 70 79 Ten studies (197 women) reported on the change in umbilical artery S/D following acute exercise. 16 25 29 31 34 42 46 49 70 74 Seven studies (293 women) reported on the change in umbilical artery pulsatility index (PI) following exercise.25 30 31 61 79 80 82. Five studies (128 women) reported on the change in umbilical artery resistance index (RI) following acute exercise.25 31 41 61 81 Women were tested between 14-42 weeks gestation. The exercise sessions were all aerobic exercise except one study which included yoga25 and one study which included resistance exercise.30 80 Three studies included women who were previously inactive,31 41 49 two included women who were active,31 79 and the rest were undefined. Exercise sessions were of low,25 34 80 moderate,30 42 49 61 70 81 82 and vigorous to high16 29 31 41 46 74 79 intensity. Exercise session were between 5-60 minutes in duration.

#### Effects of chronic exercise on umbilical blood flow

There were five studies (n=403 women) which reported on the effects of exercise intervention on resting umbilical artery S/D, PI, or RI.75 80 83-85 Three were RCTs, although one was a superiority trial comparing a yoga program to a walking program.75 There was one non-randomized intervention comparing a yoga program to walking program.84 Two studies (n=99 women) reported on umbilical artery S/D at rest following exercise intervention.75 83 Three studies (n=158 women) reported on umbilical artery PI at rest following exercise intervention.75 80 83 Two studies (n=99 women) reported on umbilical artery RI at rest following exercise intervention.75 83 Exercise frequency ranged from two to seven days per week. Exercise types included aerobic exercise,75 83 84 yoga,75 84 and pelvic floor muscle training (PFMT).80 The duration of the session lasted between 20 to 60 minutes and included low75 80 84 and moderate83 intensity activities. Two studies included supervised exercise sessions,80 83 while two did not.75 84

One RCT (n=26 women) reported on the umbilical artery PI response to acute exercise following exercise intervention.80 The intervention was supervised PFMT (low intensity) for two to seven days per week for approximately 20 minutes each session.80

### Uterine Artery Blood Flow

#### Uterine artery blood flow during acute exercise

There were two studies (n=32 women) reporting on the change in uterine artery blood flow during acute exercise sessions compared to rest.16 18 Both studies reported on the uterine artery S/D.16 18 One cohort study included aerobic activities for less than 12 minutes in duration at a vigorous intensity,16 while one cohort study included supine resistance exercise (leg lifts; low intensity) for 10 minutes.18

#### Uterine artery blood flow following acute exercise

There were 14 studies (n=429 women) reporting on the change in uterine artery blood flow following an acute exercise session compared to rest.16 18 31 34 36 41 61 65 80 81 86-89 One was a RCT (n=26 women),80 five were cross-sectional (n=193 women),31 34 36 86 87 seven were cohort studies (n=198 women),16 18 41 61 81 88 89 and one was a case control study (n=12 women).65 There were five studies (n=103 women) reporting on the change in uterine artery S/D following acute exercise. 16 18 31 34 86 There were seven studies (n=312 women) reporting on the change in uterine artery PI following acute exercise.31 36 61 65 80 87 88 There were five studies (n=117 women) reporting on the change un uterine artery RI following acute exercise.31 41 61 81 89 Women were tested between 16-41 weeks gestation and included aerobic activities in all but two studies which did resistance training18 or PFMT.80 Exercise sessions were 5-22 minutes in duration and were of low,18 65 80 89 moderate,36 61 81 and vigorous16 31 41 86 87 intensity activities.

#### Effects of chronic exercise on uterine artery blood flow

There were four studies (n=256 women) which reported on the effects of exercise intervention on resting uterine artery S/D, PI, or RI.75 80 84 85 Three studies (n=243 women) were RCTs,75 80 85 although one (n=59 women) was a superiority trial comparing a yoga program to a walking program.75 One study was a non-randomized intervention comparing yoga to walking.84 One study (n=59 women) reported on uterine artery S/D at rest following exercise intervention.75 Two studies (n=118 women) reported on uterine artery PI at rest following exercise intervention.75 80 One study (n=59 women) reported on uterine artery RI at rest following exercise intervention.75 Exercise frequency ranged from two to seven days per week, and included aerobic exercise,75 84 85 yoga,75 84 and pelvic floor muscle training (PFMT).80 Exercise sessions lasted 15 to 60 minutes in duration and included low75 80 84 and vigorous85 intensity activities. Two studies included supervised exercise sessions,80 85 while two did not.75 84

One study (n=26 women) reported on the uterine artery PI response to acute exercise following exercise intervention.80 The intervention was supervised PFMT (low intensity) for two to seven days per week for approximately 20 minutes each session.80

## Results for fetal tachycardia, the effects of chronic exercise on fetal heart rate, umbilical blood flow, and uterine blood flow.

### Fetal tachycardia

There was “very low” quality evidence from eight studies (n=505 women; 524 assessments) reporting the proportion of tachycardia at rest to be 3% (95% CI 0.00, 0.14; I2= 86%; See Online Supplement Figure 88; *proportions*).1 15 25 27 48 50 54 58 The quality of evidence was downgraded from “low” to “very low” due to serious inconsistency. There was “very low” quality evidence from five studies (n=77 women; 188 assessments) reporting tachycardia during 5% of acute exercise sessions (95% CI 0.02, 0.16; I2= 72%; See Online Supplement Figure 89; *proportions*).1 4 8 15 27 There was “very low” quality evidence from 13 studies (n=644 women; 769 assessments) reporting fetal tachycardia following exercise (up to 20 minutes) in 7% of exercise sessions (95% CI 0.03, 0.15; I2=83%; See Online Supplement Figure 90; *proportions*).1 2 4 8 15 25 27 40 48 50 54 58

### The effects of chronic exercise on resting fetal heart rate

There was “moderate” quality evidence from four RCTs (n=191 women) showing no impact of exercise training on resting FHR post-intervention (MD= -1.72 bpm, 95% CI -3.94, 0.50, I2= 0%, p=0.13, see Online Supplement Figure 15).21-24 The quality of evidence was downgraded from “high” to “moderate” due to serious risk of bias and serious inconsistency. The tests for subgroup differences performed for exercise-only interventions were not significant (see Online Supplement Figures 16 and 17).

There was “very low” quality evidence (downgraded due to serious risk of bias) from two non-randomized interventions (n=58 women) demonstrated a decrease in resting FHR of 2.1bpm in the exercise group compared to the control group post-intervention (95% CI -3.38, -0.89, I2= 0%, p=0.013, see Online Supplement Figure 18).2 4 The tests for subgroup differences performed for exercise-only interventions were not significant (see Online Supplement Figures 19 and 20). There was “low” quality evidence from one superiority trial (n=59 women) showed no difference in resting FHR following yoga or walking intervention (MD= 3.70bpm, 95%CI, 1.34, 8.74, I2=n/a, p=0.15; see Online Supplement Figure 21).75 Evidence was downgraded from “high” to “low” due to serious risk of bias and serious inconsistency. Four interventional studies (n=108 women; two RCTs and two non-randomized interventions) could not be included in the pooled analysis due to the absence of a control group,1 26 54 or because they only included FHR information from single exercise sessions.25 These studies found resting FHR was 6.5 to 18.5 bpm lower post-intervention in the exercise intervention group.

Further, there was “very low” quality of evidence from three cohort studies (n=120 women) reported on the effects of chronic prenatal exercise on resting FHR. Evidence was downgraded from “low” to “very low” due to serious inconsistency. One cohort study (n=32 women) reported a decrease in resting FHR in the exercise group compared to the control group in late pregnancy (MD= -9.21, 95% CI, -15.86, -2.55, I2=0%, p=0.007; see Online Supplement Figure 22).76 Two studies were not included in the pooled analysis because they had no control group,49 or did not present raw data.78 Additional data for these studies can be found in the Online Supplement **Table 1 & 2**. They reported that resting FHR decreased with advancing gestation in women who exercised,49 and that FHR at rest in the third trimester was correlated with minutes of LTPA spent in non-continuous activities (e.g. resistance training).78 There was “very low” quality evidence from one cross-sectional study (n=62 women; downgraded from “low” to “very low” due to serious inconsistency) reported decrease in resting FHR in the exercise group compared to the control group in late pregnancy (MD= -4.93, 95% CI, -8.32, -1.54, I2=90%, p=0.004; see Online Supplement Figure 23).3 77

### The effect of chronic exercise on the FHR response to acute exercise

#### FHR response during exercise

There was “very low” quality evidence from two non-randomized interventions (n=49 women) showing no difference in the FHR response during exercise between exercise and control groups (MD= -1.95bpm, 95% CI -15.06, 11.17, I2= 77%, p=0.77, see Online Supplement Figure 24).2 4 The quality of evidence was downgraded from “low” to “very low” due to serious risk of bias, serious inconsistency, and serious imprecision. The tests for subgroup differences performed for exercise-only interventions were not significant (see Online Supplement Figures 25 and 26).

#### FHR response following exercise

There was “low” quality evidence from four RCTs (n=193 women) showed no difference in the FHR between exercise and control groups following an acute exercise session (MD= -3.39bpm, 95% CI -10.51, 3.73, I2=81%, p=0.35, see Online Supplement Figure 27). 21-24 The quality of evidence was downgraded due to serious risk of bias and serious inconsistency. The tests for subgroup differences performed for exercise-only interventions were only significant when comparing studies by the type of exercise included in the intervention (p<0.00001) (see Online Supplement Figures 28 and 29). Specifically, there was “moderate” quality evidence (downgraded due to serious risk of bias) showing that the increase in FHR following acute exercise was greater in exercising women who participated in aerobic exercise only interventions (MD= 6.52 bpm, 95% CI, 2.31, 10.74, I2= 0%, p= 0.002) while the increase in FHR following acute exercise was lesser in the exercising women who engaged in interventions with various types of exercise (MD= -9.16bpm, 95% CI, -13.46, -4.86, I2= 0%, p< 0.0001; see Online Supplement Figure 29).

There was “very low” quality evidence (downgraded due to serious risk of bias) from two non-randomized interventions (n=58 women) showed no overall difference in FHR following exercise between exercise and control groups (MD= -1.19bpm, 95% CI -6.08, 3.70, I2= 0%, p=0.63, see Online Supplement Figure 30). The tests for subgroup differences performed for exercise-only interventions were not significant (see Online Supplement Figures 31 and 32).

### The effects of prenatal exercise on umbilical artery blood flow metrics

#### The effects of acute exercise on umbilical artery S/D ratio

There was “low” quality evidence from two studies (n=41 women) reporting on the change in umbilical artery S/D during acute exercise suggesting no change from resting values (MD= -0.04, 95% CI, -0.10, 0.01, I2= 0%, p=0.14, see Online Supplement Figure 33).

There was “very low” quality evidence from 10 studies (n=197 women) showing no changes in umbilical artery S/D within three minutes following acute exercise compared to baseline (MD= -0.00, 95% CI, -0.14, 0.13, I2= 67%, p= 0.97, see Online Supplement Figure 34).16 25 29 31 34 42 46 49 70 74 The quality of evidence was downgraded from “low” to “very low” due to serious inconsistency. The tests for subgroup differences were not significant for *a priori* subgroup analyses (see Online Supplement Figures 35 and 36). In contrast, the tests for subgroup differences were significant for *post-hoc* subgroup analysis when comparing studies looking at different exercise intensities and durations (see Online Supplement Figures 37-39). Specifically, there was “very low” to “low” quality evidence (downdgraded from “low” to “very low” due to serious inconsistency) showing that following acute exercise of low and vigorous intensity umbilical artery S/D was not altered (MD= -0.03, 95% CI, -0.5, 0.19, I2=3%, p=0.80; MD= 0.08, 95%CI, -0.03, 0.19, I2= 30%, p=0.17, respectively), whereas following acute exercise of moderate intensity activities, umbilical artery S/D was decreased by -0.30 (95% CI, -0.47, -0.13, I2= 11%, p= 0.0007). Moreover, there was “very low” to “low” quality evidence (downdgraded from “low” to “very low” due to serious inconsistency) reporting that acute exercise of 0-20minutes and > 40 minutes decreased umbilical artery S/D (MD -0.16, 95% CI, -0.32, -0.00, I2= 39%, p=0.05; MD= -0.09, 95%CI, -0.30, 0.12, I2= 0%, p=0.41, respectively), whereas acute exercise of 21-39 minutes did not alter umbilical artery S/D (MD= 0.02, 95%CI, -0.32, 0.36, I2=n/a, p=0.91).

#### The effects of acute exercise on umbilical artery PI

No study reported on the umbilical artery PI during acute exercise. There was “very low” quality evidence from six studies (n=280 women) showing no change in the umbilical artery PI within five minutes following exercise (MD= -0.01, 95%CI -0.04, 0.02, I2= 71%, p= 0.58, see Online Supplement Figure 40).25 30 31 79 80 82 The quality of evidence was downgraded due to serious inconsistency. The tests for subgroup differences were not significant for both *a priori* subgroup analyses and *post-hoc* subgroup analyses (see Online Supplement Figures 41-45). One cohort study (n=13 women) could not be included in the pooled analysis because it did not report mean or SD and showed that the umbilical artery PI decreased following exercise.61

#### The effects of acute exercise on umbilical artery RI

There were no studies reporting on umbilical artery RI during acute exercise. There was “low” quality evidence from four studies (n=115 women) showing no difference in umbilical artery RI following exercise (MD= -0.02, 95% CI -0.04, 0.00, I2= 0%, p=0.02, see Online Supplement Figure 46).25 31 41 81 The tests for subgroup differences were not significant for *a priori* subgroup analyses (see Online Supplement Figure 47 and 48). One cohort study (n=13 women) could not be included in the pooled analysis because it did not report mean or SD and showed that umbilical artery RI decreased following exercise.61

#### The effects of acute exercise on umbilical artery volumetric blood flow and mean blood velocity

There were no studies reporting on umbilical artery volumetric blood flow or mean blood velocity during exercise. There were no studies reporting on umbilical artery volumetric blood flow following acute exercise. Thre was “very low” quality evidence from one cohort study (n=14 women; graded from “low” to “very low” due to serious inconsistency) which reported no chnage in umbilical artery mean blood velocity following acute exercise (MD= 1.5, 95% CI, -4.2, 1.20, I2 = n/a, p=0.28; see Online Supplement Figure 49).41

#### The effects of chronic exercise on resting umbilical artery blood flow metrics

##### Resting umbilical artery S/D

There was “low” quality evidence from one RCT (n=40 women; downgraded due to serious risk of bias and serious inconsistency) showing a decrease in resting umbilical artery S/D in the women who exercised compared to the controls post-intervention (MD= -0.52, 95% CI -0.56, -0.48, I2= n/a, p<0.00001, see Online Supplement Figure 50).83 “Moderate” quality evidence from one RCT, which was a superiority trial, (n=59 women; downgraded due to serious inconsistency) showed a decrease in resting umbilical artery S/D in the yoga group compared to the walking group post-intervention (-0.30, 95%CI, -0.58, -0.02, I2 n/a, p= 0.04; see Online Supplement Figure 51).75

##### Resting umbilical artery PI

There was “moderate” quality evidence from two RCTs (n=99 women; downgraded due to serious risk of bias) reporting lower resting umbilical artery PI in the women who exercised compared to the controls post-intervention (MD= -0.06, 95% CI -0.08, -0.04, I2= 0%, p<0.00001, see Online Supplement Figure 52).80 83 “Moderate” quality evidence from one randomized controlled trial, which was a superiority trial, (59 women; downgraded due to serious inconsistency) showed lower resting umbilical artery PI in yoga compared to walking (-0.18, 95%CI -0.28, -0.08, I2 not applicable, p=0.0008; see Online Supplement Figure 53).75

##### Resting umbilical artery RI

There was “low” quality evidence from one RCT (n=40 women; downgraded from “high” to “low” due to serious risk of bias and serious inconsistency) reporting a decrease in umbilical artery RI in the women who exercised compared to the controls post-intervention (MD= -0.07, 95% CI -0.07, -0.06, I2 not applicable, p<0.00001; see Online Supplement Figure 54).83 There was “moderate” quality evidence from one randomized controlled trial, which was a superiority trial, (59 women; downgraded from “high” to “moderate” due to serious inconsistency) showed no difference between yoga or walking groups following the interventions (-0.03, 95% CI -0.07, 0.01, I2= n/a, p=0.11; see Online Supplement Figure 55).75

One non-randomized intervention could not be included in the pooled analysis because it did not report blood flow, S/D, PI or RI; there was “very low” quality evidence from this study (n=13 women; downgraded from “low” to “very low” due to serious inconsistency) reporting no difference between groups on the umbilical Doppler velocimetry score before and after a yoga intervention .84

#### The effects of chronic exercise on the response of umbilical artery blood flow metrics to acute exercise

There were no RCTs or non-randomized interventions reporting on the umbilical artery S/D, or RI response to acute exercise. There was “moderate” quality evidence from one RCT including pelvic floor muscle training (PFMT; n=26 women; downgraded from “high” to “moderate” due to serious inconsistency) reported on acute exercise responses of the umbilical artery PI before and after the intervention and showed a smaller change in PI following exercise in the intervention group; however, the control group did not do acute exercise and therefore they could not be compared.80

### The effects of prenatal exercise on uterine artery blood flow metrics

#### The effects of acute exercise on uterine artery S/D

There was “very low” quality evidence from two studies (n=32 women) reporting no change in uterine artery S/D during acute exercise compared to rest (MD= 0.20, 95%CI, -0.38, 0.77, I2= 95%, p=0.51; see Online Supplemnt Figure 56).16 18 The quality of evidence was downgraded from “low” to “very low” due to serious inconsistency. There was “very low” quality evidence from five studies (n=103 women) reporting no change in uterine S/D following acute exercise compared to rest (MD= 0.15, 95%CI, -0.08, 0.38, I2= 87%, p=0.20; see Online Supplement Figure 57).16 18 31 34 86 The tests for subgroup differences were only statistically significant when comparing studies including women with different previous previous physical activity levels and not by type of exercise (see Online Supplement Figures 58 and 59). Specifically, there was “very low” to “low” quality evidence (downgraded due to serious inconsistency) showing that uterine S/D did not change following exercise in previously inactive women (MD= -0.11, 95%CI, -0.32, 0.10, I2=n/a, p=0.31) or in previously active women (MD= 0.02, 95%CI, -0.10, 0.14, I2= 26%, p=0.75), but was increased by 0.56 (95% CI, 0.41, 0.70, I2-0%, p<0.00001) in those whose previous activity levels were not defined (see Online Supplement Figure 58). Moreover, the tests for subgroup differences were not statistically significant for *post hoc* subgroup analysis (see Online Supplement Figures 59-62).

#### The effects of acute exercise on uterine artery PI

No study reported on the uterine artery PI during acute exercise. There was “low” quality evidence from seven studies (n=309 women) reporting on the uterine artery PI following exercise. 31 36 61 65 80 87 88 The pooled estimate wasbased on five studies (n=205 women) and showed no change within five minutes following exercise (MD=-0.01, 95%CI, -0.04, 0.01, I2= 8%, p= 0.29, see Online Supplement Figure 63).31 36 65 80 87 The tests for subgroup differences were not statistically significant (see Online Supplement Figures 64 and 65). The two cohort studies (n=107 women) that could not be included in the pooled analysis (did not report SD,61 or reported moment of the median (MoM))88 showed no change in the uterine artery PI before and after acute exercise.61 88

#### The effects of acute exercise on uterine artery RI

Uterine artery RI was not determined during exercise in any study. There was “very low” quality evidence from four studies (n=104 women) indicating uterine artery RI was not changed following acute exercise (MD=0.01, 95%CI -0.02, 0.04, I2= 50%, p=0.44, see Online Supplement Figure 65).31 41 81 89 The quality of evidence was downgraded from “low to “very low” due to serious inconsistency. The tests for subgroup differences were not statistically significant (see Online Supplement Figure 67). In contrast, the tests for subgroup differences were statistically significant for *post-hoc* subgroup analyses (see Online Supplement Figures 68 and 69). Specifically, there was “very low” to “low” quality evidence (downgraded from “low” to “very low” due to serious inconsistency) showing that low intensity exercise increased uterine artery RI by 0.07 (95% CI, 0.02, 0.12, I2= n/a, p=0.005), whereas moderate and vigorous intensity exercise did not change uterine artery RI (MD= -0.03, 95% CI, -0.08, 0.02, I2=n/a, p=0.19; MD= 0.01, 95% CI, -0.01, 0.03, I2=0%, p=0.47, respectively). Further, there was “very low” to “low” quality evidence (downgraded from “low” to “very low” due to serious inconsistency) showing that durations of 0-20 minutes and 20+ minutes do not result in an increase in uterine artery RI (MD= -0.01, 95% CI, -0.03, 0.01, I2=0%, p=0.38; MD= 0.04, 95% CI, -0.00, 0.08, I2=n/a, p=0.07, respectively), while undefined exercise durations report n increase in uterine artery RI following exercise (MD=0.07, 95% CI, 0.02, 0.12, I2= n/a, p= 0.005). There was “very low” quality evidence from one cohort study (n=13; downgraded from “low” to “very low” due to serious inconsistency) that was narratively summarized (did not report SD) showed no change in the uterine artery RI before and after acute exercise.61

#### The effects of acute exercise on uterine artery blood flow

There was “very low” quality evidence from one study (n=14 women; downgraded from “low” to “very low” due to serious inconsistency) reporting on uterine artery blood flow (ml/min) and blood velocity (cm/s) during and following supine exercise.18 Specifically, volumetric blood flow (ml/min) was not changed from left-lateral rest to during supine exercise (MD= -55, 95%CI, -113.9, 3.98, I2= n/a, p=0.07; see Online Supplement Figure 70), and was unchanged at left-lateral rest following supine exercise (MD= -1.0, 95%CI -53.76, 51.76, I2= n/a, p=0.97; see Online Supplement Figure 71).18 Mean blood velocity (cm/s) was not changed from left-lateral rest to during supine exercise (MD= 5.0, 95% CI, -2.1, 12.1, I2=n/a, p=0.17; see Online Supplement Figure 72) and was not changed during left-lateral rest following supine exercise (MD= -1.0, 95% CI, -7.8, 5.8, I2= n/a, p=0.77; see Online Supplement Figure 73).18 This study also included a supine baseline which was not included in the pooled analysis; details can be found in Table 1.18

#### The effects of chronic exercise on resting uterine blood flow measurements

##### Uterine artery S/D

There was “moderate” quality evidence from one superiority trial (n=60 women; downgraded from “high” to “moderate” due to serious inconsistency) which reported that resting uterine artery S/D ratio was lower in the yoga group compared to the walking group (MD= -0.40, 95% CI -0.72, -0.08, I2 = 0%, p=0.01, see Online Supplement Figure 74).75

##### Uterine artery PI

There was “low” quality evidence from one RCT (n=59 women; downgraded from “high” to “low” due to serious risk of bias and serious inconsistency) reporting no difference in resting uterine artery PI between groups following an exercise intervention (MD= 0.02. 95% CI -0.10, 0.14, I2= n/a, p=0.75, see Online Supplement Figure 75).80 There was “moderate” quality evidence from one superiority trial (60 women, downgraded from “high” to “moderate” due to serious inconsistency) showing a decrease in resting uterine artery PI by -0.21 in the yoga group compared to the walking groups at the end of the intervention (95% CI -0.41, -0.01, I2 =0%, p=0.04, see Online Supplement Figure 76).75

##### Uterine artery RI

There was “moderate” quality evidence from one superiority trial (60 women, downgraded from “high” to “moderate” due to serious inconsistency) showing a decrease in resting uterine artery artery RI by -0.10 in the yoga group compared to the walking group (95% CI -0.16, -0.04, I2= 0%, p=0.002, see Online Supplement Figure 77).75 Two studies (n=245 women) could not be included in the pooled analysis because they were missing SD,85 or reported unusable values.84 Specifically, one RCT (n=125 women) reported on uterine artery PI at rest before and after intervention it showed no difference in resting uterine PI between exercise and control groups at the end of the intervention85 and one non-randomized intervention (n=120 women) showed no difference in uterine doppler velocimetry score between groups before and after a yoga intervention.84

#### The effects of chronic exercise on uterine artery blood flow metrics response to acute exercise

There were no studies reporting on uterine artery S/D, RI, volumetric blood flow or mean blood velocity response during or following acute exercise sessions post-intervention. There was “moderate” quality evidence (downgraded from “high” to “moderate” due to serious inconsistency) from one RCT (n=59 women) that was narratively summarized (did not report measure in control group) reported a greater decrease in uterine artery PI following acute exercise post-intervention in the exercise group (pelvic floor muscle training; PFMT).80

# Supplementary Tables: Study Characteristics

## Table 1: Study characteristics: Acute exercise sessions

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year, country, study type, study name | Sample size (n) | Age (years) | Complications/ pre-pregnancy PA level | PA Assessment | Definition of PA groups | Time point | Acute exercise session characteristics (FITT) | Results |
| Arfi.1986France.Cross-sectional6 | 14 | 25.6 ± 4 | N/A | Objective | Acute exercise session only | 37.9 ± 0.9 weeks | -Cycle ergometer-Resistance increased by 0.5watt/kg every 3 minutes -15.14min average | Data in forest plots |
| Artal et al.1984USACross-sectional.71 | 19 | 27 ± 1 | Moderately active | Self- reported & objective | Women performed one symptom limited VO2max test | 34 ± 3 weeks | -Treadmill-Incremental to maximal (160bpm max) -7.5min average | **Narrative Summary:**  -Case report for three women with fetuses experiencing bradycardia during exercise.  -This paper was identified to potentially have artifact in the FHR measurement during exercise. Therefore, a sensitivity analysis was done removing it from the bradycardia analysis. |
| Artal et al. 1986.  USA.  Cross-sectional.32 | Light: 15 Mod: 15  Strenuous: 15 | - | “Moderately fit with mild exercise group slightly less fit” | Objective | Acute exercise only. Mild, moderate & strenuous exercise sessions. | 34-35 weeks | -Treadmill -mild:15 minutes at 2.3-3.0 METs/2.0mph -moderate: 15 minutes at 5.0-6.0 METs/ 2.0mph @ 10% incline-strenuous: 7.0-9.0 METs/ 2.5mph incline increases 2% every minute to exhaustion (time varied) | **Data in forest plots** |
| Artal et al. 1995.  USA.  Cross-sectional.69 | 7 | 24.86 ± 2.18 | Sedentary. | Objective | All women participated in acute exercise sessions at sea level and at altitude. | 33.86 ± 1 weeks | -Cycle ergometer -Incremental 25W increase 3x5min stages, then increase every 2 minutes until max.  Sea level:  -MHRmax = 167.86; VO2max = 1.39L/min; 167.86 ml/kg/min  High Altitude:  -MHRmax = 161.64; VO2max = 1.21L/min; 164.64 ml/kg/min | **Data in forest plots**. |
| Avery et al. 1997  USA. RCT.67 | E: 15C: 14 | - | No current exercise regime >30 minutes 2x/week.GDM. | Self-reported, objective & LTPA | Women were enrolled in an RCT.  **FITT in Table 2**. | FHR was measured at supervised exercise sessions and bradycardia was reported across all 77 sessions. | -cycle ergometer  -30 minutes  -70% HRmax | **Data in forest plots**. |
| Avery et al.1999 Canada  Cohort15 | 12 | 29 ± 1 | Inexperienced/ Low (according to Health and Lifestyle questionnaire) | Objective & LTPA | Acute exercise session only Each exercise was done sitting and semi-supine | 31 ± 1 weeks | -Resistance Training: handgrip, single-leg extension, double-leg extension. -1 rep max (RM) and 10RM (80% of 1RM) | Data in forest plots |
| Backiuk et al.2008. Brazil.  RCT22 | E: 34 C: 27 | - | Sedentary | Objective & LTPA | Women were enrolled in a RCT.FITT in Table 2. | 19, 25, 35 weeks | -Treadmill -12 minutes  -four 3-min stages:  1) 2.7kph, 0%;  2) 2.7kph, 10%;  3) 4kph, 12%;  4) 5.5kph, 14%  -MHR at peak: 160-180 (fig 3) | Data in forest plots |
| Barakat et al.2008 Spain Cohort 17Barakat et al. 2010.  Spain.  Cross-sectional.79 | 20 | 29.6 ± 4.3 | 18 (90%) were active; 2 were not active (10%) | Self-reported, objective & LTPA | Acute exercise session only Data extracted to plots was at the end of 20 minutes of exercise. | 3rd trimester | -Cycle ergometer -20 minutes  -RPE: 12-14  - “moderate” intensity | **Narrative Summary:**  Mean FHR during exercise was 149 ± 5.91 (FHR increase was 11-36bpm, mean 24bpm)  Pearson correlation of FHR during exercise and gestational age: 006; p=0.803 |
| Baumann et al. 1989.  Switzerland.  Cohort.61 | 13 | - | Untrained | Objective & LTPA | Acute exercise session only. | 38 weeks | -semi-supine cycle ergometer (60º angle for exercise)-3 minutes for 5 trials with rest between to assess each vessel. | **Narrative Summary:**  Data is presented in Table 2 as medians and ranges and cannot be used in plots.  Uterine Artery RI (NSD pre-post)  pre- median 0.40; range 0.27-0.55  post- median: 0.39; range 0.26-0.55  Uterine Artery PI (NSD pre-post)  pre- median 0.64; range 0.48-0.98  post- median 0.69; range 0.40-1.06  Umbilical Artery RI (p<0.01 pre-post)  pre- median 0.59; range 0.46-0.71  post- median: 0.53; range 0.45-0.67  Umbilical Artery PI (p<0.02 pre-post)  pre- median 0.98; range 0.68-1.24  post- median 0.87; range 0.67-1.19  From the text: median FHR before exercise was 133 (range 114 to 166) after exercise also 133 (range 114 to 167). |
| Bgeginski et al.2015. Brazil.  Cohort.52 | 10 | 25.2 ± 4.4 | Sedentary prior to pregnancy. At 22-24 weeks women were not practicing regular exercise in the last three months. | Objective & LTPA | Three separate acute exercise sessions. | 22-24 weeks28-32 weeks 34-36 weeks | -Resistance exercise - bilateral leg extension & pec-deck fly machine  -1 & 3 sets of 15 reps each  -weight at 50% of 1 rep max  -MHR varied (98.7 ± 11.9 to 114.8 ± 17.0). | **Narrative Summary:** As per statistician (NB) recommendation, FHR was determined as the average value from of all four types of activity at each gestational age. Therefore, only three data points are presented in the forest plots. At 28-32 weeks n=6  At 34-36 weeks n=5  **Data in forest plots**. |
| Bonen et al. 1992.  Canada.  Cross-Sectional10 | T2: 6  T3: 8 | - | - | Self-reported & objective | All women were regularly active (2-3x/week) and participated in aerobics classes (n-10) or walking (n=2).Acute exercise sessions included for this study. | 2nd trimester & 3rd trimester | -Cycle ergometer -30 minutes  T2: 67W; 4.1L/min  T3: 78W; 6.4L/min | **Narrative Summary:**  -FHR measures in figure 1 were not possible to extract due to the quality of the image. “FHR did not differ between T2 & T3 at rest, during exercise, or after exercise (P>0.05; Figure 1). Responses in heart rates did not differ over time between the two groups (groups x time, p>0.05)” |
| Bonnin,1997. Finland.  Cohort.41 | 14 | 28 ± 7 | Sedentary prior to pregnancy | Objective & LTPA | Exercise was performed in the sitting position | 36 ± 3 weeks | -Cycle ergometer - 3-9minutes  - incremental; 3minute stages at 60,90 & 120Watts  -peak: 80 ± 8 %HRmax (153 ± 14 bpm) | -Umbilical artery blood flow is also presented as a maximum systolic velocity (extracted from figure 4) At rest: 28.8 ± 3.8  Following exercise (1min): 30.3 ± 5.9 |
| Brenner et al. 1999CanadaNon- randomized Intervention2 | E(T2): 14 E(T3): 14  C: 6 | E: 28.7 ± 3.5 C: 29.3 ± 3.2 |  | Objective & LTPA | Women were enrolled in a non-randomized exercise intervention.FITT in table 2 | 37 ± 1 weeks | -Cycle ergometer-Incremental to RPE 18 or 170bpm -8.9 ± 0.7 minutes average | **Narrative Summary:** We contacted the authors for clarification about differences between table 4 and figure. The values for FHR in table 4 represent and average over 20 minutes. Therefore, for recovery data, we extracted the 1-minute time point from Figure 2. |
| Bung.1993. Germany.  RCT.20 | E: 17 C: 17 | E:38.97 ±1.74 C:38.18 ±2.04 | All women having GDM and requiring insulin | Objective | -Women were enrolled in a RCT. FITT in table 2-Women also performed symptom limited VO2max sessions. | 27-41 weeks | -Semi-reclined cycle ergometer -45 minutes  -50% VO2max | **Data in forest plots**. |
| Carpenter et al. 1988.USA.Cohort14 | 45 | 29.0 ± 3.7 | 21 reported vigorous exercise one or more times per week pre-pregnancy.16 reported regular exercise during pregnancy. | Objective & LTPA | Subjects were studied twice on separate days.One submaximal exercise session and one maximal exercise session. | 25.2 ± 3.0 weeks | Submaximal sessions:-Cycle ergometer-0, 30, and 60W for 6-min each work loadMaximal sessions:-Cycle ergometer-Started at 60 W, increased every 2min to fatigue. | Data in forest plots |
| Chaddha et al. 2005.  Canada.  Case control.65 | Healthy: 23 Complicated: 12 | Healthy:34.4 ± 6.38 Complicated: 29.6 ± 3.2 | Women in the complicated group had uteroplacental insufficiency (uterine artery PI >1.45) | Objective & LTPA | Acute exercise only | 22-26 weeks | -cycle ergometer -5 minutes  -10% & 15% of “maximum” (not defined) | **Data in forest plots**. |
| Clapp.1985. USA.  Cross sectional.33 | 6 | - | - | Objective | Acute exercise only | 20 & 32 weeks | -treadmill -20 minutes  “running” (no speed or grade given) | Data in forest plots |
| Clapp et al.1993 USA  Cohort12 | 120 | - | “well-conditioned women” | Self-reported & LTPA | Women continued to exercise at 50% or more of their pre-conception exercise levels (running or aerobics, ≥3x/week, ≥30 minutes).FITT in table 2 | 33-38 weeks | -Cycle ergometer-60 ± 3% of VO2max-20 minutes | Data in forest plots |
| Clapp et al. 1995  USA  Case Control.66 | E:31C:29 | 31 ± 1 | - | Self-reported & LTPA | Control group exercised until 28 weeks gestation and then discontinued exercise regularly. |  | -Various aerobic (running, swimming, stair machine, aerobics, bicycling)-3 to 6x/week-20 to 60 minutes-50 to 88% VO2max-exercise up until onset of labor with last exercise session occurring within 48 hours of delivery | Narrative Summary:Women in the exercise group were selected at 36-38 weeks gestation based on “an exercise associated increase in FHR >5bpm after regular exercise. "The magnitude of the increase in FHR with maternal exercise ranged between 8-34 bpm" |
| Clapp et al.2000. USA.  RCT.21 | E: 6 C:6 | E: 30 ± 1 C: 31 ± 1 | Pre-pregnancy VO2max (ml/kg/min) E: 42.8 ± 2.7  C: 38.2 ± 2.4 | Objective, Total PA, & LTPA | Women were enrolled in a RCT. Separated based on their pre-pregnancy VO2max and regularly (>3x/ week) vs not regularly exercising. **FITT in table 2** | 15, 26, 37 weeks | -Treadmill -20 minutes  -55% pre-pregnancy VO2max | Data in forest plots |
| Collings et al.1983 USA  Non-randomized intervention3 | E: 12 C: 8 | - |  | Objective & LTPA | Women were enrolled in a non-randomized intervention.FITT in table 2 | unclear | -Cycle ergometer -65-70% VO2, MHR 152  -10 minutes | **Data in forest plots**. |
| Collings et al. 1985.  USA.  Cohort54 | 25 for FHR data n=11 | 25-35 | - | Objective & LTPA | Women were participating in regular exercise program.FITT in table 2 | 28, 32, 34, 36 & 38 weeks | -aerobic exercise (walking, jogging, stationary bike) -10min warm up, 30min aerobics  -68.5% of maximal aerobic capacity | **Data in forest plots**. |
| Cooper et al.1987. Australia.  Cohort55 | 14 | 30 ± 3 | - | Objective& LTPA | Acute exercise session only.Data for FHR was presented as a mean of all six exercise sessions (2T & 3T, at 2,3 & 4 METS). | 21 ± 2 weeks 36 ± 1 weeks | -Treadmill- 10-minutes at each 2,3, & 4 METS (3kph at 0%, 3.5% & 7%) | Data in forest plots. |
| Dale et al.1982. USA.  Cohort56 | E (pro): 12 E (retro): 21 C: 11For FHR data n=4 | Retro: 30 Pro(E &C): 28 | All exercise groups were runners (average 4yrs experience).Control women were non-runners | Self-reported & LTPA | Retrospective:-1T- 14.2 mpw;-2T- 10.9 mpw;-3T- 6.6 mpw;-8 of 21 (38%) competed in races during pregnancyProspective:-1T- 13 mpw;-2T- 12.9 mpw;-3T- 9.2mpw;- 4 of 11 competed in races during pregnancy | 31-38 weeks | -Running -no other information given | **Data in forest plots**. |
| Dressendorfer et al. 1980.  USA.  Cohort13 | 54 | Range: 26-30 | “exercising women with above average CV fitness” | Self-reported & LTPA | Women continued swimming throughout pregnancy (30-45min; 3-4x/week).Completed two acute exercise sessions each. | 32-39 weeks | -Cycle ergometer -Incremental, 150kg-m/min load increases  -Time varied; at least four stages (up to 600kg-m)  -160bpm max | **Narrative Summary:**  Baseline FHR was 142 (range 135-152); FHR during peak exercise was 149 ± 5 bpm. SD not given. |
| Einsenberg de Smoler et al. 1974.  Mexico.  Cross-sectional.39 | 16 | - | - | Objective | Acute exercise session only. | 36 weeks | -Treadmill Variable:  -10 min  -4 stages:  1.7mph/3min; 3.0mph/2min; 4.0mph/2min; 5.0mph/3min  Constant:  -30 min  -2.5mph | **Narrative Summary:**  Variable: rest, 133; post-exercise, 141  Constant: rest, 136; post-exercise, 141  SD not given. |
| Erkkola et al.1992FinlandCohort16 | 8 | 31.4 ± 4.9 | The subjects had not pursued athletics or undertaken any “hard physical training” during pregnancy. | Objective & LTPA | Acute exercise session only. | 36.9 ± 1.1 weeks | -Cycle ergometer -4minutes stages at 73, 114, & 161 watts per stage | Data in forest plots |
| Ertan et al. 2004.  USA.  Cohort.81 | Healthy: 33 Complicated: 10 | - | Complicated pregnancies= IUGR | Objective & LTPA | Acute exercise session only. | 3rd trimester | -Cycle ergometer -10minutes  -1.25W/kg (moderate exercise; mean= 79 ± 11W) | **Data in forest plots**. |
| Ferland et al. 2013.  Canada.  Cohort.88 | 94 PA 0-1: 15  PA 2-4: 36  PA >4: 43 | Subdivided by PA frequency (per month): PA 0-1: 27.7  PA 2-4: 29.2  PA >4: 29.5 |  | Self-reported & total PA | Subdivided by PA frequency (per month): 0-1; 2-4, >4 . | 11-13 weeks | -Resting measures only. | **Narrative Summary:** Uterine artery data presented as a multiple of the median and could not be extracted to plots:Associations between frequency of PA and uterine artery mean PI (MoM) 2-4x/month: B (95%CI):  -0.006 (-0.186 to 0.175), p=0.95  >4x/month: B (95%CI):  0.031 (-0.147 to 0.209), p=0.73  From text: There is a "trend towards decreasing [mean PI] with increasing PA frequency" |
| Golomer et al. 1989.  France.  Cohort.62 | 10 For FHR data n=5 | 28yr 8 month ± 3yr 5 month | - | Unclear | Acute exercise sessions once per month. | 3-8 months | -Walking with or without carrying weights (5kg) -30 meters | **Narrative Summary:**  -FHR data was reported as a range and therefore could not be extracted to the plots.  FHR at rest was 140-160bpm. Following exercise there was no significant increase in FHR (values not reported). |
| Hackett et al. 1992.  UK.  Cohort.89 | Healthy: 12 Normal: 14  Abnormal: 8 | Healthy:27.7 ± 7.2 Normal:  25.1 ±4.7  Abnormal:  25.8 ± 4.6 | None of them had ever been enrolled in a physical training program. | Objective & LTPA | Acute exercise session only. | 3rd trimester | -Cycle ergometer -50 watts  -Duration not given | Data in forest plots |
| Hall et al. 1987.  USA.  Cohort.73 | E(L): 82 E(M): 309  E(H): 61  C: 393 | E(L): 26.2 E(M): 24.5  E(H): 25.2  C: 30.0 | - | Objective & LTPA | Women self-selected into the exercise program. Groups were created based on the number of sessions the women attended (mean 0.8, 15, 32, 64 sessions for control, low, medium, and high exercise groups, respectively). **FITT in table 2.** | 28 & 38 weeks | -Various aerobic, resistance, & stretching  -45 minutes  -85%HRmax; <140bpm | Data in forest plots |
| Hauth et al. 1982.  USA.  Cross-sectional.40 | 7 | - | Active prior to and during pregnancy | Self-reported & Objective | Women routinely jogged ≥1.5 miles, ≥3x/week -Studied before and after one session for this study -15 assessments complete for FHR data (does not say how many per woman) | 28-38 weeks | -Jogging (not treadmill) -12 to 14.5 minutes  -1.5miles | **Narrative Summary:** (FHR):  -FHR data presented as a range and therefore could not be extracted to plots.  Rest: 140-155  Post-exercise: 155-204  **Data in forest plots**. |
| Jeffreys et al. 2008  USA  Cohort18 | 14 | 34 ± 3 | Physically active | Self-reported and LTPA | Women continued regular exercise throughout pregnancy, including supine exercise.FITT in table 2 | 3rd trimester | -left lateral rest, supine rest, supine exercise (abdominal crunches and leg exercise), left lateral recovery -RPE 13-17  -10 minutes | **Narrative Summary:** -Used left lateral rest as baseline for plots. Supine Rest data as follows: FHR: 137 ± 11 Uterine blood flow (ml/min): 267 ± 93 Uterine blood velocity (cm/s): 32 ± 11  Uterine Artery S/D: 2.0 ± 0.6 Data in forest plots |
| Jones et al. 1985.  USA.  Cohort.63 | 4 | - | “aerobically conditioned women” | Self-reported & objective | -Women were all running >4x/week; ≥3miles @ 10min/mile pace or better during their pregnancies. -Studied before and after one exercise session in each trimester for this study. | 24 ± 1 weeks 32 ± 1 weeks | -Running- not on treadmill -30 minutes  -80 to 90% of predicted VO2max | **Narrative Summary:** FHR data was given without SD, therefore could not be extracted to plots. Resting FHR was 132bpm. FHR increased 15bpm above resting values after exercise. |
| Jovanovic et al.1985. USA  Cross sectional7 | 6 | 28.5 ± 1.7 | - | Self-reported a& LTPA | Women exercised throughout pregnancy (jogging, bicycling, other; at least 2x/week; self-reported).Data for acute exercise session only. | 3rd trimester | -cycle ergometer -12.8 ±1.7 min  -79 ± 9Watts | **Narrative Summary:** Potential artifact during exercise, therefore sensitivity analysis was performed removing it from both acute FHR analysis and bradycardia analysis. |
| Kardel et al. 2009.  Norway.  Cohort.  STORK.72 | 59 | 30.3 ± 3.9 | - | Objective & LTPA | Acute exercise session only. | 35-37 weeks | -cycle ergometer-8 to 12 minutes-incremental (increased 10% of predicted max per minute) At peak:  MHR=174 ± 8.5  VO2 (L/min) =2.1 ± 0.3  Work load=171.3± 29.3Watts  RPE=8.6 ± 1.2 | Data in forest plots |
| Katz et al.1988USACohort (Longitudtinal)19 | 12One subject did not participate in 35week assessment | 29.5 | 6 sedentary5 light activity1 moderate activity | Objective | Acute exercise sessions only. | 16 ± 1 weeks 26 ± 1 weeks36 ± 1 weeks | -Cycle ergometer -Incremental exercise was performed beginning at zero workload, with increasing load of 12-25W in 3-minute stages. After reaching 60% of age predicted HR max, subjects pedaled for 3 minutes at that workload | Data in forest plots |
| Katz et al.1990. USA.  Cross sectional.27 | 7 | - | - | Objective | Acute exercise session only. | 25 weeks | Water exercise: -immersed bicycle  -20 minutes  -70% HRmax (1.38l/min)  Land exercise:  -Cycle ergometer  -20 minutes  -70% HRmax (1.40l/min) | Data in forest plots. |
| Kennelly et al.2002. Ireland.  Cohort47 | 22 | 25.96 ± 4.9 | - | Objective | Acute exercise session only. | 30-34 weeks | -Cycle ergometer -incremental (time varied)  -peak at 85.8 ± 4.2% HRmax; 102.3 ± 15.7 Watt; VO2 23.9 ± 5.6 (ml/kg/min) | Narrative Summary:The nadir of the umbilical artery PI was at 5 minutes post exercise. |
| Kennelly et al.2002. Ireland.  Cohort.48 | No: 112 Mild: 119  Mod: 27 | None:25.8 ± 5.6 Mild:  28.4 ± 5.1  Mod:  30.4 ± 4.3 | Varied | Objective & LTPA | Acute exercise session only. FHR combined for all women (not reported based on activity level). | 32-38 weeks | -Cycle ergometer -Incremental exercise; increased by 10W each minute at a constant speed of 50-60rpm. Aim was to reach AT.  -time varied | Data in forest plots. |
| Lindqvist et al. 2003.  Sweden.  Cohort.90 | 14 | 29 ± 5 | Healthy and physically active but not participating in specific exercise programs. | Objective & LTPA | Acute exercise session only. | “Throughout pregnancy” | -Cycle ergometer-85% HRmax-Duration not given | Narrative Summary: “no abnormal FHR tracings” |
| Lotgering et al.1998. Netherlands.  Cohort.64 | 22 | - | Women did not exercise regularly before or during pregnancy | Objective | Acute exercise session only. Data was calculated from median and IQR. | 18-36 weeks | -Cycle ergometer -5 minutes  -75Watt | **Data in forest plots**. |
| Lynch et al.2003 Australia.  Cohort.49 | 23 | 28.7 ± 4 | Sedentary in the first four months of pregnancy. | Self-reported & LTPA | FHR taken before and after supervised exercise sessions (swimming) during a longitudinal study where all women were part of a structured exercise program. **FITT in table 2.** | 16, 20, 24, 28, 32 & 36 weeks | Exercise program:-Swimming -40minutes  -<70%HRmax, <140bpm  Fitness testing:  (16wks only)  -Cycle ergometer  -incremental: initial load 60rpm, no resistance; increase 0.5-1Kp every 3 minutes “depending on exercise history”. | **Data in forest plots** |
| Macphail et al.2000. Canada.  Cohort50 | 23 | 32 ± 4 | All women had a BMI <37 pre-pregnancy and were active throughout pregnancy. | Objective & LTPA | Acute exercise session only. Used data from 10-minute baseline closest to exercise, and first 10-minute recovery. | Range:31-38 weeksMean:35±1.6 weeks | -Cycle ergometer -incremental: 20W for 4min, increased 20W/min to fatigue.  -Peak 184W; MHR 176 ± 6 | Data in forest plots. |
| Manders et al.1997. Netherlands.  Cross-sectional.28 | 12 | 20-36 Median: 29 | None of the women was a conditioned athlete. | Objective. | Acute exercise session only. | 29-32 weeks | -Cycle ergometer -Incremental: initial load of 50W, increased 25W every 5min to maximal exertion, and maintained for 5min at maximal load.  -peak: 53-99% HRmax (mean: 82%)  -15-30min (mean: 20) | **Data in forest plots**. |
| Marsal et al.1979. Sweden.  Cohort.57 | 40 | 18-30 Median: 25 | - | Objective & LTPA | Acute exercise session only. | Range:32-37 weeks Median:  34 weeks | -Bed cycle ergometer -5 minutes  -80Watts | Data in forest plots. |
| McMurray et al.1995 USA  Cross-sectional5 | 10 | 32 ± 5 | Varied. | Objective | Acute exercise session only. Data during exercise was extracted as the last data point during exercise. | 21-28 weeks | -Dance, walking, treadmill -40 minutes  -133-135bpm | Data in forest plots. |
| Moore et al. 1988.  USA.  Cross-sectional.86 | 11 | 26.6 | 8/11 were regular exercisers during their pregnancy (3x/wk; 1hr) | Self-reported & LTPA | Acute exercise session only | 16-28 weeks | -Cycle ergometer-Incremental-60-75%HRmax-up to 20min | Data in forest plots. |
| Morrow et al.1989. Canada.  Cross-sectional.34 | 15 | - | - | Objective | Acute exercise session only. | 36-41 weeks | -Cycle ergometer -5 minutes  -20W | **Data in forest plots** |
| Nabeshima et al.1997 Japan.  Cross-sectional.29 | Healthy: 17 Complicated:7 | - | Complication= IUGR- not extracted | Objective | Acute exercise session only. | 36-42 weeks | -Treadmill -Incremental: 3kph, increase every 3min (4 stages: 0, 15, 20, & 25%).  -peak MHR: 150bpm  -4-15min (mean: 8.8± 2.8) | Data in forest plots. |
| Nesler et al. 1988.  USA.  Cross-sectional.9 | 2T: n= 123T: n= 13 | - | “healthy, regularly exercising women” | Self-reported  & Objective | Participants all participated in a YMCA pregnancy fitness program (no details given). | 2T: 24-28 weeks3T: 32-36 weeks | -Supine abdominal exercises-5 minutes | **Narrative Summary:** FHR data is described as “percent maximal pulse” at rest and during exercise. 24-28weeks  max (rest): 40 +/-5  max (EX): 46 +/-5  32-36weeks  max (rest): 40 +/- 29  max (EX): 49 +/-6 |
| O’Neill et al.1996, Australia.  Cohort.43 | 11 | 30.3 ± 3.3 | -5 sedentary -2 somewhat active  -4 “trained” | Objective & LTPA | All women performed three acute exercise tests (A, B & C).Test C includes 15min of exercise (Test B), up to 15min rest, and then an additional 15min exercise (Test C) all on the same day. Therefore, the baseline for test C and B are the same. | 34-37 weeks | Test A: -cycle ergometer  -15 minutes  -MHR 138; 62.5W  Test B:  -cycle ergometer  -15 minutes  -MHR 156; 87.5W  Test C:  -cycle ergometer  -30min total  -MHR 142; 87.5W | **Data in forest plots**. |
| O’Neill et al.1991 Australia.  Cohort.42 | study n= 21For FHR data:MHR<140bpm: 10 MHR>140bpm: 8 | MHR<140bpm 28.9 ± 4.2  MHR>140bpm 27.9 ± 4.6 | Varied. | Objective | Acute exercise session only. | 34-38 weeks | MHR<140bpm  -Cycle ergometer  -Incremental (time varied)  -HRpeak <140bpm  MHR>140bpm  -cycle ergometer  -incremental (time varied)  HRpeak >140bpm | Data in forest plots. |
| O’Neill, et al.2006. Australia.  Cohort.44 | Semi-supine: 27Upright: 23 | Group 1:30 ± 5 Group 2:  30 ± 4 | Group 1:  19% trained, 59% sedentary  Group 2:  22% trained, 65% sedentary | Objective & LTPA | Acute exercise session only. | 34-36 weeks | Group 1:-semi-supine (45º) cycling -12 minutes  -resistance increased until MHR was 135-145bpm  Group 2:  -upright cycling  -10 minutes at MHR 135-145 | Data in forest plots. |
| Paolone et al. 1987  USA  Cross-sectional8 | 4 | 28 | - | Objective | Three acute exercise sessions. | 30-37 weeks | -Treadmill: 1.5-2.0mph -Cycle: 50,60,70rpm  -5 minutes | Narrative Summary:For the treadmill exercise, we use the pre-exercise sitting values for extraction because the recovery position was also sitting. The standing, resting FHR values were 140 ± 3.6 |
| Perales et al.2015. Spain.  RCT.23  NCT 01723293 | E: 38 C: 25 | 31.9 ±3.2 | - | Objective & LTPA | All Women were participating in a RCT.FITT in table 2 | 34.08 ± 2.27 weeks | 40% HRR-walking-3minutes60% HRR-walking-3minutes | Data in forest plots |
| Pijpers et al.1984 Netherlands  Cross-sectional.35 | E: 14C: 14FHR data from n=11 (all from exercise group | 26.1 Range:  22-29 | All nulliparous women | Objective | Women performed two sequential exercise sessions separated by a rest period. Women in the control group did not exercise. | Range:34-38 weeks Mean:  35.6 weeks | Stimulus 1 (period III) & Stimulus 2 (period VIII): -bed-type cycle ergometer  -5 minutes  -25W stimulus 1 & 2 are extracted as separate sessions in plots. | **Data in forest plots**. |
| Polis et al.2015. USA.  Cohort.53 | E(1): 10 E(2): 8  E(3): 7 | All: 31.7± 3.1 E(1):32.2±3.4  E(2):30.3±2.0  E(3):32.7±3.5 | E(1): regular yoga practiceE(2): yoga familiarE(3): no yoga experience | Self-reported & Total PA | Acute exercise session only | 35-38 weeks | -Yoga (26 postures)-110-115minutesIntensity/inclusion:-SBP <200mmHg-MHR<HRmax (220-age)-SaO2>94%-FHR110-160–no uterine contractions | Data in forest plots |
| Pomerance et al. 1974  USA  Cohort.58 | 54 | - | Pre-pregnancy weight between 100-169lbs | Objective | Acute exercise session only. | 35-37 weeks | -Cycle ergometer | Narrative Summary:Definition of bradycardia was not consistent with clinical definitions (<110bpm), and data from paper shows that FHR did not decrease below 110bpm, therefore instances of bradycardia reported in this paper were not included in bradycardia analysis. |
| Rafla & Beazely, 1991.  UK.  Cross-sectional.70 | 21 | - | - | Objective | Acute exercise session only. | 3rd trimester | -Cycle ergometer -5 minutes  -70% of submaximal exercise | **Data in forest plots**. |
| Rafla & Cook. 1999.  UK.  Cross-sectional.38 | 193 | Range: 16-38 | UncomplicatedThis study recruited 44 “high risk women” including 9 women with diabetes, 18 with IUGR and 17 with unspecified hypertensive disorders not used in the analysis. | Objective | Acute exercise session only. | 3rd trimester | -Cycle ergometer -5 minutes  -70% of submaximal exercise | **Data in forest plots**.  **Narrative Summary (FHR):**  SD and p-values not given for FHR, so could not be included in forest plots.  Rest: 143  Recovery: 143.4 |
| Rafla & Etokowo. 1998.  UK.  Cross-sectional.87 | 102 | Range: 17-38 | -78 women “involved in active sports”-24 women“not involved in active sports” | Objective | Acute exercise session only | 25-39 weeks | -Cycle ergometer -5 minutes  -67.2% (range: 51-90) | **Data in forest plots**. |
| Rafla et al. 1999.  UK.  Cohort.82 | 143 | 25.5 | “healthy” | Objective & LTPA | Acute exercise session only | 3rd trimester | -Cycle ergometer -5 minutes  -MHR 116-200bpm; mean= 144bpm  -55-90%VO2max | Data in forest plots. |
| Rakhshani et al. 2015.  India. RCT.75 | yoga: 27walking: 31 | yoga:27.2 ± 4.8walking:27.5 ±5.5 | All “high-risk pregnant women” none experiencing PE, 3 had PIH. | Self-reported, objective & LTPA | Women were enrolled in an exercise intervention (RCT) where one group attended yoga classes while the other group walked on their own. **FITT in table 2.** | 12, 20, & 28 weeksOnly uterine artery SD, RI & PI have measures at 12 weeks, all other measures done at 20 & 28 weeks only. | Exercise group:-Yoga -60 minutes  Control group:  “conventional antenatal exercises; walking” | **Data in forest plots**. |
| Rauramo et al.1987. Finland.  Cohort.59 | Healthy: 38 Diabetes: 11  n varied following exercise: Healthy, n=31 Diabetes, n=8 | Healthy:27 ± 3 Diabetes:  27 ± 5 | The other two groups were women with preeclampsia (n=13) and women with cholestasis (n= 9) not included in the analysis. | Objective & LTPA | Acute exercise session only.FHR data was extracted for the first timepoint following exercise only. | 32-40 weeks | -Cycle ergometer -submaximal  Healthy:  -MHR peak =152 ± 12  Diabetes:  -MHR peak =149 ± 6 | -**Data in forest plots**. |
| Roldan et al.2015. Spain.  RCT.24 | E: 25 C:20 | - | - | Objective & LTPA | Women were enrolled in an exercise intervention (RCT). They performed one acute exercise session in which FHR was measured in the third trimester. **FITT in table 2** | 34-36 weeks | -Treadmill -40% and 60%  -3 minutes each stage | **Data in forest plots**. |
| Ruissen et al1990 Netherlands  Cross-sectional.30 | 23 | 28.8 | - | Objective | Acute exercise session only. | 14-37 weeks | 20 deep knee bends No other information given. | Data in forest plots. |
| Shilpa et al.2016. USA.  No intervention RCT.25  “TRY YOGA” | E: 23 C: 23 | E: 25.5 ± 4.4 C: 25.4 ± 4.6 | No previous yoga experience | Objective & LTPA | Women were enrolled in a “RCT” however only one acute session was performed. | 28-37 weeks | -Yoga -60 minutes  -23 postures Women in the control group watched a PowerPoint presentation on exercise and nutrition during pregnancy in the seated position for 60-minutes. | **Data in forest plots**. |
| Sibley et al. 1981.  USA  RCT.1 | E: 7C: 6 | 25.5 ± 3.6 | Varied egress of fitness and ability | Objective & LTPA | Women were enrolled in a RCT. FITT in Table 2 | 13-36 weeks. | -Swimming-60minutes-MHR 110-163 | Narrative Summary:-Data has no SD and no control group to compare to for FHR data, therefore could not be extracted to plots. “Actual fetal heart rate values in beats per minute for the conditioning program ranged from 133 - 155 prior to exercise, from 140- 187 during exercise, and from 137-160 at 5 min of recovery.” |
| Silveira,2010. Brazil.  Non-RCT intervention.26 | 133 | ≤19: 9 20-24: 23  25-219: 57  30-34: 29  ≥35: 15 | Sedentary | Objective & LTPA | Women were enrolled in a non-randomized intervention. **FITT in Table 2** | 24-27 weeks28-31 weeks32-35 weeks36-40 weeksWomen are included in more than one range. Number of sessions for each woman is 1.8 | -Aqua aerobics -50 minutes  -60 to 90% HRmax | Data in forest plots. |
| Sorensen et al.1986 Denmark.  Cross-sectional.37 | 22 | Range:17-37 Median: 24 | Sedentary | Objective | Acute exercise session only.Data was calculated from median and IQR | 18-36 weeks | -Cycle ergometer -5 minutes  -75W | **Data in forest plots**. |
| Steegers et al.1988 Netherlands.  Cross-sectional.36 | 20 | 25 ± 4 | Had not taken part in exercise programs before or during pregnancy | Self-reported & Objective | Two acute exercise sessions on the same day.FHR baseline was taken before both treadmill sessions and FHR post-exercise was taken after the second 10-minute treadmill session. The time between (rest) was not given. For subgroup analysis 10 minutes of exercise was used. | 34 ± 2 weeks | Treadmill 1: -incremental to 130bpm (equivalent to 65% HRmax; 50% VO2max)  -time varied  Treadmill 2:  -10 minutes at 130bpm | **Data in forest plots**. |
| Szymanski et al.2012. USA.  Cross-sectional.31 | Inactive: 15 Regularly active: 15  Highly active: 15 | Inactive: 32.9 Regularly active: 34.3  Highly active: 32.9 | Inactive group was sedentary before pregnancy.Groups defined according to activity in last 6 months (includes pre-pregnancy): Inactive defined as < 20min 3x/week;Regularly active defined as mild-moderate activity 20min 3x/week; Highly active (mostly runners) defined as vigorously active >3x/week | Self-reported & LTPA | Acute exercise session only. | 30 weeks | -Treadmill-Incremental: warm-up at 3.0 mph and 0%, then incline increased 2% every 2min. At 12%, speed increased 0.2 mph every 2min -Time to volitional fatigue: Inactive: 12.1 ± 6 min Regular: 16.6 ± 3.4 min  Highly: 22.3 ± 2.9 min | **Data in forest plots.** |
| Tufnell et al. 1990  UK  Cohort11 | AGA: 50 SGA: 20 | - | - | Objective & LTPA | Acute exercise session only. | 35-40 weeks | -Up/down 30 flights of stairs -10 minutes  - moderate | Narrative Summary:The FHR responses after "warming" were not included in the plots and are:Resting, AGA: 143 ± 9.9; SGA: 139.7 ± 5.4. During exercise, AGA: 151.1 ± 6.3; SGA: 137.2 ± 12.2.Following exercise, AGA: 143.2 ± 10.1; SGA: 139.4 ± 7.8 |
| Van Doorrn et al.1993. Netherlands.  Cohort.45 | 33 | 30.9 ± 0.7 | - | Objective & LTPA | Acute exercise session only. | 16.1 ± 1.0 weeks25.3 ± 0.7 weeks35.0 ± 0.6 weeks | -Cycle ergometer -Incremental: 3minute at 30W, followed by a 10W increase every 30s to maximal.  -MHR max = 174 ± 2  -Time varied | Data in forest plots. |
| Van Leeuwan et al. 2014  USA.  Cross-sectional.91 | E: 21 C: 19 | Range:20-35 | 21 exercised regularly (criteria for assignment to exercise group) | Self-reported & LTPA | MPAQ used to assign groups to exercise or control. Women in the exercise group exercised regularly (at least 30min 3x/week). | 36 weeks | -Sitting- slightly reclined -18 minutes  -Rest | Narrative Summary:FHR was only determined at rest and was therefore not included in the plots. |
| Vega et al.2011. Germany.  Cohort.51 | 20 | 35.2 ± 3.6 | - | Objective & LTPA | Acute exercise session only. | 32-36 weeks | -Cycle ergometer -Incremental: 25W increase every 2 minutes to 150bpm (RPE 16 ± 0.9).  -Time varied | Data in forest plots. |
| Veille et al.1985. USA.  Cohort.60 | Walking: 10 Cycle: 10 Total women n=17. | 31 ± 1 | 95% exercised pre-pregnancy | Self-reported & Objective | Acute exercise session only | Range:32-40 weeks Mean:  35 ± 2 weeks | Group 1: -walking on track  -10 to 15minutes  Group 2:  -cycle ergometer  -10 to 15 minutes  -50W | Data in forest plots. |
| Veille et al. 1989.  USA.  Cohort.74 | 18 | 29.4 ± 3.7 | 15 women active pre-pregnancy and continued to exercise regularly throughout pregnancy. | Self-reported & objective. | Acute exercise session only. | 28.4 ± 6.3 weeks | -cycle ergometer -150kpm increase every 3min to 85% HRmax  -time varied | Data in forest plots |
| Watson et al. 1991  USA  Cohort.46 | 13 | 30 Range:  24-34 | Not participating in organized exercise program. | Objective | Acute exercise session only | 25 & 35 weeks | -Tethered swim: weight was added to provide resistance, 3 min swim at each resistance with 1 min break between-Cycle ergometer: increasing resistance by 25W every 3 minutes until volitional maximum. | Narrative Summary:Definition of bradycardia was not consistent with clinical definitions (<110bpm), and data from paper shows that FHR did not decrease below 110bpm, therefore instances of bradycardia reported in this paper were not included in bradycardia analysis. |
| Webb et al, 1994.  Canada.  Non-randomized intervention4 | E: 22 C: 16 | E: 30.2 ± 0.9 C: 29.1 ± 0.9 | Previously sedentary women “not regularly participating in recreational or occupational physical activity” | Self-reported & Objective | Women were enrolled in a non-randomized intervention. Participation in the exercise program (exercise group) was voluntary (self-selected) **FITT in Table 2.** | 28 ± 1 weeks 37 ± 1 weeks | -Upright cycling -15 minutes  -145 to 150bpm | Data in forest plots. |

**Abbreviations:** AT, anaerobic threshold; AGA, average for gestational age; BMI, body mass index; bpm, beats per minute; C, control group; E, exercise group; FHR, fetal heart rate; FITT, frequency, intensity, timing, type; GDM, gestational diabetes mellitus; HR, heart arte; IQR, interquartile range; IUGR, intrauterine growth restriction; LTPA, leisure time physical activity; MET, metabolic equivalent; MoM, multiple of the median; MHR, maternal heart rate; mpw, miles per week; PA, physical activity; PE, preeclampsia; PI, Pulsatility index; PIH, pregnancy induced hypertension; RCT, randomized controlled trial; RI, resistance index; RPE, rating of perceived exertion; SD, standard deviation; S/D, systolic diastolic ratio; SGA, small for gestational age; UmbA, umbilical artery; UtA, uterine artery; VO2, velocity of oxygen (measure of oxygen use); W, watts; 2T, second trimester; 3T, third trimester

## Table 2. Study characteristics: Exercise interventions/ chronic exercise studies

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year, country, study type, study name | Sample size (n) | Age, years | Complications/ pre-pregnancy PA level | PA Assessment | Exercise Intervention (FITT) | Intervention start point & length | Compliance | Outcomes (Including Narrative Data) |
| Artal et al. 2007  USA. Non-RCT intervention.68 | E: 39 C: 57 | E: 32.4 ± 5.3 C: 30.6 ± 5.5 | -Overweight/ Obese-GDM.-Not taking insulin. | Objective & LTPA | -7x/week-cycle ergometer-semi-self-enrollment into groups -1x/week supervised | Start:>GDM diagnosis(<33wk) Length:  unclear | 50% >150min/ week. -30/39 women regularly exercised (153min/wk on average). | Narrative Summary:-Co-intervention (Diet) -Data was unable to be extracted to plots because it was unclear (“abnormal tracings” not defined).  -If women were prescribed insulin, they were dropped from the study. |
| Avery et al. 1997  USA.  RCT.67 | E: 15 C: 14 | - | No current exercise regime >30 minutes 2x/week. GDM. | Self-reported, objective & LTPA | Supervised -2x/week  -cycle ergometer  -30 minutes  70% HRmax  Self-Reported  -1 to 2x/week  -walking  -70% HRmax | Start:>GDM diagnosis (<34wk)  E: 28.7 ± 3.0 weeks  C: 26.3 ±8.1 weeks  Length:  Remainder of pregnancy | Not reported. | **Data in forest plots.**  **Narrative Summary:**  Bradycardia was reported for 77 exercise sessions. |
| Brenner et al. 1999.Canada.Non-RCT Intervention.2 | E(T2):14 E(T3):14 C: 6 | E: 28.7 ± 3.5 C: 29.3 ± 3.2 | - | Objective & LTPA | -3x/week -140-150bpm (70% HRmax)  -15-25minutes  -Aerobic (cycle ergometer) & muscular conditioning  -Supervised | Start:18-20 weeks Length: unclear | -attendance to classes-self reportedE(T2): 82±47  E(T3): 74% | Data in forest plots |
| Backiuk et al. 2008.  Brazil  RCT.22 | E: 34 C:27 | - | Sedentary | Regular, moderate practice or water aerobics. | - 3x /week -70% HRmax  -50 minutes -Water aerobics - Supervised | From first assessment to delivery | Author contacted- no reply | Data in forest plots |
| Bung.1993. Germany. RCT.20 | E: 17 C: 17  FHR in exercise group only | E:38.97 ±1.74C:38.18 ± 2.04 | All women having GDM and requiring insulin | Objective | -3x/week-Semi-reclined cycle ergometer -45 minutes (3x 15min stages interspersed with 5min rest)  -50% VO2max (varied)  -supervised | Start: unclear.(after GDM diagnosis) Length: unclear | Author contacted- no reply | Data in forest plotsNarrative Summary:Data for FHR is from before and after the 45-minute exercise sessions at 50% of VO2max. Symptom limited VO2max tests were performed every 3-4 weeks and target workload adjusted |
| Clapp et al. 2000.  USA.  RCT.21 | E: 6 C: 6 | E: 30 ± 1C: 31 ±1 | Pre-pregnancy VO2max (ml/kg/min) E: 42.8 ± 2.7 C: 38.2 ± 2.4 Women were recruited from a larger RCT (no reference given). | Objective, Total PA, & LTPA | -Randomized to perform either aerobics, treadmill, or stair-stepping at ≥55% pre-pregnancy VO2max-4 to 6x/week -40 to 60min  -unclear if supervised or not | Start: pre-conception Length: unclear | Author contacted- no reply | Data in forest plots. |
| Collings et al.1983 USA Non-randomized intervention3 | E: 12C: 8 | - | - | Objective & LTPA | -3x/week-50-70% VO2max-cycle ergometer-40minutes-supervised | Start: 22.5weeksLength:7-9 weeks (mean 13.4) | - | Data in forest plots.Narrative Summary: FHR at rest, during, and following exercise post-intervention could not be included in plots because it had no control group and combined data for both pre-and-post-intervention timepoints. From text (with respect to exercise testing): “FHR remained well within the normal range of 120-160bpm)” |
| Collings et al. 1985.  USA. Cohort.54 | 25 | 25-35 | - | Objective & LTPA | -3x/week -aerobic exercise  -intensity & time not given  -supervise  -FHR data extracted for acute exercise sessions only (see Table 1). | Start:13-18 weeks Continued until 38wks | - | **Data in forest plots.** |
| de Oliveria Melo et al. 2012.  Brazil.  RCT.85  NCT00641550 | E(13):62 E(20):62  C:62 | E(13):24 ± 5.8 E(20):  26 ± 5.3  C:  24 ± 5.4 | Sedentary at study admission (13&20w) | Objective & LTPA | -3x/week -60-80% HRmax; RPE 12-16  -start at 15minutes, increased over time (varied by person).  -walking  -supervised | Start:13 or 20 weeks Length:  Continued to 38 weeks | >85% for both groups. attendance taken | Narrative Summary:Data was extracted from Figures 3A & 3C, however did not have SD and therefore could not include in plots. **-UmbA PI- 13/20 weeks rest:**  E(13): 1.18002; E(20): 1.202985; C: 1.198815  **-UmbA PI- 38 weeks rest:**  E(13): 0.8339895; E(20): 0.8663465; C: 0.8230285  **-UtA PI- 13/20 weeks rest:**  E(13): 1.59764; E(20): 1.56627; C: 1.60472  **-UtA PI -38 weeks rest:**  E(13): 0.662732; E(20): 0.648567; C: 0.702192 |
| E-Mekawy et al. 2012.  Egypt.  RCT.83 | E: 20C:20 | Range: 25-32 | Women had pre-existing diabetes (type 2) before pregnancy. All receiving insulin therapy | Objective | -3x/week-cycle ergometer-60% HRmax-30minutes-supervised | Start:20 weeksLength:16 weeks | Author contacted- no reply | **Data in forest plots.** |
| Gustafson et al. 2011.  USA. Cohort.76 | E: 24C: 27for FHR data n=15 per group | - | - | Self-reported & LTPA | -3x/week - aerobic exercise  -moderate to vigorous  ≥30 minutes | N/A FHR was taken at rest | -Self-reported-Based on MPAQ | Narrative Summary:FHR taken during breathing & apnea, both extracted.Data in forest plots |
| Hall et al. 1987.  USA. Cohort.73 | E(L): 82 E(M): 309  E(H): 61 C: 393 | E(L): 26.2 E(M): 24.5  E(H): 25.2 C: 30.0 | - | Objective & LTPA | Self-selected exercise groups based on number of sessions attended. Control: 0-10  Low: 11-20  Medium: 21-59  High: 60-99  Sessions consisted of:  -45 minutes  -85%HRmax; <140bpm  -Various aerobic, resistance, & stretching  -Supervised | Start: Unclear  Length:  Continued to 38 weeks | Separated into groups based on compliance (# of classes attended). |  |
| Lynch et al.2003 Australia. Cohort.49 | 23 | 28.7 ± 4 | Sedentary in the first four months of pregnancy. | Self-reported & LTPA | -3x/week-Swimming -40minutes  -<70%HRmax, <140bpm  -supervised  FHR measures made at separate session. Details in **Table 1.** | Start:16 weeksLength: continues to 28- 36weeks | 100% attendance | Data in forest plots.Narrative Summary: No control group to compare to. From text: “The mean fetal heart rates decreased with advancing gestational age”.  FHR pre-intervention: 152 ± 10  FHR post-intervention: 136 ± 13 |
| Narendran et al. 2005.  India. Non-RCT intervention. | Yoga:68Walking: 52 | Yoga:26.5 ± 3.9Walking:26.8 ± 4.6 | - | Self-reported & LTPA | Yoga:-7x/week-60minutesWalking-2x/day-30minutes-Doppler values at rest only. | Start:18-20 weeksLength: continued to delivery | “Compliance was ensured by frequent telephone calls and strict maintenance of an activity diary.”Values not given. | Narrative Summary:“control group” was advised to walk 30 minutes twice per day during the study period. Therefore, could not be considered a non-exercise control. |
| May et al. 2010.  USA. Cross-sectional.77 | E: 26C: 35 | E:29.0±4C:29.6±4 | - | Self-reported & LTPA | Women were regularly exercising (>30minutes of aerobic exercise, 3x per week). | N/AFHR was taken at rest. | -Self-reported-Based on MPAQ | Narrative Summary:FHR taken during fetal active and quiet states at rest, both extracted. **Data in forest plots.** |
| May et al. 2014.  USA.  Cohort.78 | 40 | Range: 23-39 | - | Self-reported & LTPA | Women separated into two groups based on MPAQ data:Continuous LTPA:-e.g. walking or jogging-133.6(127.3) minNon-continuous LTPA:-e.g. weight lifting or yoga-51.8(70.5) min | N/AFHR was taken at rest at 36 weeks | -Self-reported -Based on MPAQ | **Narrative summary:**  Zero order correlation between FHR and minutes of LTPA performed by mothers in three-months preceding the 36-week gestational age point  Continuous LTPA: -0.07 (NSD)  Non-continuous LTPA: -0.34 (p<0.05)  Associations between FHR and minutes of LTPA:  Continuous LTPA: β, 0.054, t-value, 0.35 (NSD)  Non-continuous LTPA: β, -0.248, t-value, -0.162 (NSD) |
| Okido et al. 2015BrazilRCT.80 | E: 26C: 33 | E: 23.41 ± 5.31 C: 23.38 ± 4.79 | - | Objective & LTPA | -2-7x/week-10 sets of maximum pelvic floor muscle contractions held for 6–8 s followed by three fast contractions.-repeated in four different positions in the following sequence: left lateral decubitus, sitting, four arm supports, and standing.-approximately 20 min.-supervised | Start: 18-20 weeksLength: 10 weeks | =84.6% attendance at supervised sessions | **Data in forest plots.**  **Narrative summary:**  Uterine and umbilical artery PI from pre-following acute exercise was not reported in the control group post-intervention.  Pre-intervention  Umbilical PI rest: 1.10 ± 0.1  Umbilical PI following exercise: 1.14 ± 0.13  Uterine PI rest: 0.68 ± 0.17  Uterine PI following exercise: 0.69 ± 0.28  Post-Intervention  Umbilical PI rest: 0.91 ± 0.19  Umbilical PI following exercise: 0.90 ± 0.18  Uterine PI rest: 0.69 ± 0.28  Umbilical PI following exercise: 0.60 ± 0.16 |
| Perales et al.2015. Spain.  RCT.23 NCT 01723293 | E: 38C: 25 | 31.9 ±3.2 | - | Objective & LTPA | -3x/week-55-60minutes total/session -7 to 8 minutes warm up-aerobic dance for 25-30 minutes at 55-60% HRR-10 minutes of pelvic floor muscle training–average BORG 12.2-Supervised.FHR was measured at acute session at 34 weeks (see Table 1). | Start:9-12 weeksLength:To end of 3rd trimester. 38-40 weeks | >80% adherence to program | **Data in forest plots.** |
| Rakhshani et al. 2015.  India.75  RCT. | yoga:27 walking: 31 | yoga:27.2 ± 4.8 walking: 27.5 ±5.5 | All “high-risk pregnant women” none experiencing PE, 3 had PIH. | Self-reported, objective & LTPA | Yoga & breathing - 60 minutes  -3x/week  -supervised  Walking  -30 minutes  -7x/week  -unsupervised | Start:12 weeks Length:  16 weeks | yoga: 79% 41% drop out  27 analyzed  walking: 100%  32% drop out | Data in forest plots. |
| Roldan et al.2015. Spain. RCT.24 | E: 25C:20 | - | - | Objective & LTPA | -3x/week-Combination of resistance training, aerobics, and PFMT -155 to 180min/week  -supervised | Start:10-15 weeks Length:  38-39 weeks; 80 sessions | 100% of women attended at least 80% of classes. | Data in forest plots. |
| Sibley et al. 1981.  USA  RCT.1 | E: 7 C: 6 | 25.5 ± 3.6 | Varied egress of fitness and ability | Objective & LTPA | -3x/week-Swimming -60 minutes  -MHR 110-163  -Supervised. | Start:13-26 weeks Length:  10 weeks | Emailed author. No reply. | Data in forest plots.Narrative Summary:-Data has no SD and no control group to compare to for FHR data, therefore could not be extracted to plots. “Actual fetal heart rate values in beats per minute for the conditioning program ranged from 133 - 155 prior to exercise, from 140- 187 during exercise, and from 137-160 at 5 min of recovery.” |
| Silveira,2010. Brazil. Non-RCT intervention.26 | 133 | ≤19: 9 20-24: 23  25-29: 57  30-34: 29 ≥35: 15 | Sedentary | Objective & LTPA | -Water aerobics -50 minutes  -60 to 90% HRmax  -supervised  -frequency not given | Unclear | Unclear | Data in forest plots. |
| Webb et al, 1994.  Canada. Non-RCT intervention.4 | E: 22C: 16 | E: 30.2 ± 0.9C: 29.1 ± 0.9 | Previously sedentary women “not regularly participating in recreational or occupational physical activity” | Self-reported & Objective | -Self-selection into exercise group -3x/week  -upright cycling  -70% HRmax  - increased from 14 to 25 minutes in 2T; constant at 25 minutes in 3T  -supervised group classes | Start:2nd trimester Length:  20 weeks | -Attendance to classes-Instructor monitored2T: 82 ± 2% 3T: 76 ± 3% | Data in forest plots. |

**Abbreviations:** bpm, beats per minute; C, control group; E, exercise group; FHR, fetal heart rate; FITT, frequency, intensity, timing, type; GDM, gestational diabetes mellitus; HR, heart rate; LTPA, leisure time physical activity; MHR, maternal heart rate; PA, physical activity; PE, preeclampsia; PFMT, pelvic floor muscle training; PI, Pulsatility index; PIH, pregnancy induced hypertension; RCT, randomized controlled trial; SD, standard deviation; UtA, uterine artery; UmbA, umbilical artery; VO2, velocity of oxygen (measure of oxygen use); 2T, second trimester; 3T, third trimester

# Supplementary Tables: GRADE analysis

## Fetal heart rate during exercise

### Online Supplement Table 3: The association between prenatal exercise and fetal heart rate response from before to during exercise.

| **Quality assessment** | | | | | | | **№ of participants** | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Acute Prenatal Exercise** | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise and fetal heart rate response from before to during exercise. | | | | | | | | | | | |
| 19 (pooled estimate of effect, n=15a; 4 studies synthesized narratively) | observational studies | not serious b | serious c | not serious | not serious | none | 291 | - | MD **6.35 higher** (2.3 higher to 10.41 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Narrative synthesis: Four studies were included (n=57). Three studies reported an increase in fetal heart rate from before to after an acute bout of exercise.1 9 13 In contrast, Bonen et al.10 indicated that fetal heart rate did not differ between trimesters during exercise. | | |

**CI:** Confidence interval; **MD:** Mean difference; **OR:** Odds ratio

#### Explanations

a. Eight studies reported data on different sub-groups of women. These studies were only counted once.

b. No serious risk of bias. Reporting bias was an issue in 4 studies (results were narratively reported).

c. Serious inconsistency. High heterogeneity (I2 >50%).

## Fetal heart rate following exercise

### Online Supplement Table 4: Association between prenatal exercise and fetal heart rate from before to after exercise.

| **Quality assessment** | | | | | | | **№ of participants** | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Acute prenatal exercise** | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise and fetal heart rate from before to after exercise. | | | | | | | | | | | |
| 65 (pooled estimate of effect, n=54g; 11 studies synthesized narratively) | observational studies | not serious o | serious a | not serious | not serious | none | 1494 | - | MD **4.05 higher** (2.98 higher to 5.12 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Narrative synthesis: Eleven studies were included (n=360). Eight studies demonstrated an increase in FHR 1 9 13 38-40 63 66 and three studies report no change in FHR 10 61 62 following acute exercise. | |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after aerobic exercise alone. | | | | | | | | | | | |
| 48 i | observational studies | not serious | serious a | not serious | not serious | none | 1388 | - | MD **4.41 higher** (3.28 higher to 5.54 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after resistance training alone. | | | | | | | | | | | |
| 4 d | observational studies | not serious | not serious | not serious | not serious | none | 58 | - | MD **0.38 higher** (2.26 lower to 3.02 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after yoga exercise. | | | | | | | | | | | |
| 2 c | observational studies | not serious | not serious | not serious | not serious | none | 48 | - | MD **0.17 lower** (2.82 lower to 2.49 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise in the second trimester and fetal heart rate response from before to after exercise. | | | | | | | | | | | |
| 15 j | observational studies | not serious | serious a | not serious | not serious | none | 236 | - | MD **2.01 higher** (0.21 higher to 3.8 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise in the third trimester and fetal heart rate response from before to after exercise. | | | | | | | | | | | |
| 49 k | observational studies | not serious | serious a | not serious | not serious | none | 1244 | - | MD **4.61 higher** (3.36 higher to 5.86 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after exercise in trimester not specified or combined. | | | | | | | | | | | |
| 1 | observational studies | not serious | serious e | not serious | not serious f | none | 14 | - | MD **7.1 higher** (5.69 higher to 8.51 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after exercise of unspecified duration. | | | | | | | | | | | |
| 11 h | observational studies | not serious | serious a | not serious | not serious | none | 443 | - | MD **1.39 higher** (0.79 lower to 3.57 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after exercise of 0-20 min. | | | | | | | | | | | |
| 35 l | observational studies | not serious | serious a | not serious | not serious | none | 861 | - | MD **4.57 higher** (3.29 higher to 5.84 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after exercise of 21-40 min. | | | | | | | | | | | |
| 5 b | observational studies | not serious | serious a | not serious | not serious | none | 60 | - | MD **6.51 higher** (2.88 higher to 10.15 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response from before to after exercise > 40 min. | | | | | | | | | | | |
| 4 d | observational studies | not serious | serious a | not serious | not serious | none | 130 | - | MD **1.38 higher** (2.28 lower to 5.05 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response before to after exercise using 2D Ultrasound. | | | | | | | | | | | |
| 4 d | observational studies | not serious | serious a | not serious | not serious | none | 79 | - | MD **8.32 higher** (3.06 higher to 13.59 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response before to after exercise using Doppler Ultrasound. | | | | | | | | | | | |
| 40 m | observational studies | not serious | serious a | not serious | not serious | none | 1022 | - | MD **3.46 higher** (2.16 higher to 4.77 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response before to after exercise using Electronic Fetal Monitor or Telemetry. | | | | | | | | | | | |
| 10 n | observational studies | not serious | serious a | not serious | not serious | none | 339 | - | MD **4.66 higher** (2.63 higher to 6.7 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and fetal heart rate response before to after exercise using Ausculation. | | | | | | | | | | | |
| 1 | observational studies | not serious | serious e | not serious | not serious f | none | 54 | - | MD **0.44 lower** (3.07 lower to 2.19 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |

**CI:** Confidence interval; **MD:** Mean difference; **OR:** Odds ratio

#### Explanations

a. Serious inconsistency. High heterogeneity (I2 >50%)

b. Three studies reported data on different sub-groups of women. These studies were counted only once.

c. One study reported data on different sub-groups of women. This study was counted only once.

d. Two studies reported data on different sub-groups of women. These studies were counted only once.

e. Serious inconsistency. Only only one study included.

f. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason.

g. Thirty-two studies reported data on different sub-groups of women. These studies were counted only once.

h. Four studies reported data on different sub-groups of women. These studies were counted only once.

i. Twenty-nine studies reported data on different sub-groups of women. These studies were counted only once.

j. Eleven studies reported data on different sub-groups of women. These studies were counted only once.

k. Twenty-five studies reported data on different sub-groups of women. These studies were counted only once.

l. Twenty-four studies reported data on different sub-groups of women. These studies were counted only once.

m. Twenty-one studies reported data on different sub-groups of women. These studies were counted only once.

n. Eight studies reported data on different sub-groups of women. These studies were counted only once.

o. No serious risk of bias. Reporting bias was an issue in 11 studies (results were reported narratively).

## Effects of chronic prenatal exercise on FHR

### Online Supplement Table 5: Association between prenatal exercise and fetal heart rate post-intervention.

| **Quality assessment** | | | | | | | **№ of participants** | | | | **Effect** | | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Prenatal Exercise** | | **No Exercise** | | **Relative (95% CI)** | | **Absolute (95% CI)** |
| Association between prenatal exercise (exercise only interventions) and fetal heart rate at rest post intervention. | | | | | | | | | | | | | | | |
| 4 | randomized trials | serious h | not serious | not serious | not serious | none | 103 | | 88 | | - | | MD **1.72 lower** (3.94 lower to 0.5 higher) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Evidence from non-randomized interventions (exercise only interventions) and fetal heart rate at rest post-intervention. | | | | | | | | | | | | | | | |
| 2 | observational studies g | serious k | not serious | not serious | not serious | none | 36 | | 22 | | - | | MD **2.13 lower** (3.38 lower to 0.89 lower) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between different types of exercise (walking vs. yoga) and fetal heart rate at rest after exercise post-intervention. | | | | | | | | | | | | | | | |
| 1 | randomized trials | serious j | serious e | not serious | not serious f | none | 27 | | 32 | | - | | MD **3.7 higher** (1.34 lower to 8.74 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Evidence from a cohort study and fetal heart rate at rest after exercise post-intervention. | | | | | | | | | | | | | | | |
| 3 (pooled estimate of effect, n=1 c; 2 studies synthesized narratively) | observational studies l | not serious | serious e | not serious | not serious f | none | 16 | 16 | | - | | MD **9.21 lower** (15.86 lower to 2.55 lower) | | ⨁◯◯◯ VERY LOW | CRITICAL |
| Narrative synthesis: Two studies were included (n=63). One study reported that fetal heart rate at rest was correlated with minutes of leisure time physical activity.78 The second study reported that average fetal heart rate decreased from pre to post intervention (as gestation advanced).49 | | | | | | |
| Evidence from a cross sectional study and fetal heart rate at rest after exercise post-intervention. | | | | | | | | | | | | | | | |
| 1 c | observational studies m | not serious | serious e | not serious | not serious f | none | 26 | | 36 | | - | | MD **4.93 lower** (8.32 lower to 1.54 lower) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Evidence from non-randomized interventions: Association between exercise only interventions and fetal heart rate during exercise post-Intervention. | | | | | | | | | | | | | | | |
| 2 | observational studies g | serious k | serious a | not serious | serious b | none | 31 | | 18 | | - | | MD **1.95 lower** (15.06 lower to 11.17 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Evidence from non-randomized interventions: Subgroup analysis: Association between exercise only interventions and fetal heart rate during exercise post-intervention in women who were previously active. | | | | | | | | | | | | | | | |
| 1 | observational studies g | serious j | serious e | not serious | not serious f | none | 9 | | 2 | | - | | MD **10.2 lower** (22.73 lower to 2.33 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Evidence from non-randomized interventions: Subgroup analysis: Association between exercise only interventions and fetal heart rate during exercise post-Intervention in women who were previously inactive. | | | | | | | | | | | | | | | |
| 1 | observational studies g | serious k | serious e | not serious | not serious f | none | 22 | | 16 | | - | | MD **3.48 higher** (0.59 higher to 6.37 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Evidence from non-randomized interventions: Subgroup analysis: Association between exercise only interventions and fetal heart rate during aerobic exercise alone post-intervention. | | | | | | | | | | | | | | | |
| 1 | observational studies g | serious j | serious e | not serious | not serious f | none | 22 | | 16 | | - | | MD **3.48 higher** (0.59 higher to 6.37 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Evidence from non-randomized interventions: Subgroup analysis: Association between exercise only interventions and fetal heart rate during different types of exercise post-intervention. | | | | | | | | | | | | | | | |
| 1 | observational studies g | serious k | serious e | not serious | not serious f | none | 9 | | 2 | | - | | MD **10.2 lower** (22.73 lower to 2.33 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise (exercise only interventions) and fetal heart rate following acute exercise post-Intervention. | | | | | | | | | | | | | | | |
| 4 d | randomized trials | serious k | serious a | not serious | not serious | none | 104 | | 89 | | - | | MD **3.39 lower** (10.51 lower to 3.73 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between exercise only interventions and fetal heart rate following acute exercise post-intervention of aerobic exercise alone. | | | | | | | | | | | | | | | |
| 2 | randomized trials | serious i | not serious | not serious | not serious | none | 40 | | 43 | | - | | MD **6.52 higher** (2.31 higher to 10.74 higher) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Subgroup analysis: Association between exercise only interventions and fetal heart rate following acute exercise post-intervention including combinations of different types of exercise. | | | | | | | | | | | | | | | |
| 2 d | randomized trials | serious k | not serious | not serious | not serious | none | 64 | | 46 | | - | | MD **9.16 lower** (13.46 lower to 4.86 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Evidence from non-randomized interventions: Association between prenatal exercise (exercise only interventions) and fetal heart rate following acute exercise post-intervention. | | | | | | | | | | | | | | | |
| 2 | observational studies g | serious j | not serious | not serious | not serious | none | 36 | | 22 | | - | | MD **1.19 lower** (6.08 lower to 3.7 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |

**CI:** Confidence interval; **MD:** Mean difference; **OR:** Odds ratio

#### Explanations

a. Serious inconsistency. High heterogeneity (I2 >50%)

b. Serious imprecision. The 95% CI crossed the line of no effect, and is wide, such that the interpretation of the data would be different if the true effect were at one end of the CI or the other.

c. One study reported data on different sub-groups of women. This study was counted only once.

d. Two studies reported data on different sub-groups of women. These studies were counted only once.

e. Serious inconsistency. Only one study included.

f. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason.

g. Non-randomized intervention

h. Serious risk of bias. High performance and attrition risk of bias. Unclear risk of selection bias; it was unclear if sequence was adequately generated and if allocation was adequately concealed.

i. Serious risk of bias. High performance risk of bias.

j. Serious risk of bias. High attrition risk of bias.

k. Serious risk of bias. High risk of performance and attrition bias.

l. Cohort study

m. Cross-sectional study

n. No serious risk of bias. Reporting bias was an issue in one study; results were reported narratively.

## Effects of prenatal exercise on fetal bradycardia and tachycardia

### Online Supplement Table 6: The association between prenatal exercise (acute) and fetal bradycardia and tachycardia.

| **Quality assessment** | | | | | | | **№ of participants** | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Acute prenatal exercise** | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise and fetal bradycardia at rest. | | | | | | | | | | | |
| 8 d | observational studies | not serious | not serious | not serious | not serious | none | 423 | **OR 0.00** (0.00 to 0.03) | **-- per 1,000** (from -- to 0 fewer) | ⨁⨁◯◯ LOW | CRITICAL |
| Sensitivity analysis: Association between prenatal exercise and fetal bradycardia at rest without artifact. | | | | | | | | | | | |
| 7 d | observational studies | not serious | not serious | not serious | not serious | none | 4117 | **OR 0.00** (0.00 to 0.03) | **-- per 1,000** (from -- to 0 fewer) | ⨁⨁◯◯ LOW | CRITICAL |
| Association between prenatal exercise and fetal bradycardia during exercise. | | | | | | | | | | | |
| 7 e | observational studies | not serious | serious a | not serious | not serious | none | 755 | **OR 0.01** (0.01 to 0.01) | **0 fewer per 1,000** (from 0 fewer to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Sensitivity analysis: Association between prenatal exercise and fetal bradycardia during exercise without artifact. | | | | | | | | | | | |
| 6 e | observational studies | not serious | serious a | not serious | not serious | none | 749 | **OR 0.01** (0.00 to 0.04) | **0 fewer per 1,000** (from -- to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and fetal bradycardia after exercise. | | | | | | | | | | | |
| 22 c | observational studies | not serious | serious a | not serious | not serious | none | 1614 | **OR 0.01** (0.00 to 0.03) | **0 fewer per 1,000** (from -- to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Sensitivity analysis: Association between prenatal exercise and fetal bradycardia after exercise without artifact. | | | | | | | | | | | |
| 20 c | observational studies | not serious | serious a | not serious | not serious | none | 1589 | **OR 0.01** (0.00 to 0.03) | **0 fewer per 1,000** (from -- to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and fetal tachycardia at rest. | | | | | | | | | | | |
| 8 d | observational studies | not serious | serious a | not serious | not serious | none | 505 | **OR 0.03** (0.00 to 0.14) | **0 fewer per 1,000** (from -- to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and fetal tachycardia during exercise. | | | | | | | | | | | |
| 6 b | observational studies | not serious | serious a | not serious | not serious | none | 77 | **OR 0.50** (0.20 to 0.16) | **1 fewer per 1,000** (from 0 fewer to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and fetal tachycardia after exercise. | | | | | | | | | | | |
| 14 b | observational studies | not serious | serious a | not serious | not serious | none | 644 | **OR 0.07** (0.03 to 0.15) | **0 fewer per 1,000** (from 0 fewer to 0 fewer) | ⨁◯◯◯ VERY LOW | CRITICAL |

**CI:** Confidence interval; **MD:** Mean difference; **OR:** Odds ratio

#### Explanations

a. Serious inconsistency. High heterogeneity (I2 >50%)

b. Three studies reported data on different sub-groups of women. These studies were counted only once.

c. Seven studies reported data on different sub-groups of women. These studies were counted only once.

d. Two studies reported data on different sub-groups of women. These studies were counted only once.

e. Four studies reported data on different sub-groups of women. These studies were counted only once.

## Umbilical blood flow during and following acute prenatal exercise

### Online Supplement Table 7: The association between prenatal exercise and umbilical blood flow.

| **Quality assessment** | | | | | | | | | | | | | | **№ of participants** | | | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | | **Study design** | | **Risk of bias** | | **Inconsistency** | | **Indirectness** | | **Imprecision** | | **Other considerations** | | **Prenatal exercise** | | | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to during exercise. | | | | | | | | | | | | | | | | | | | | |
| 3 (pooled estimate of effect, n=2; 1 study reported narratively) | | observational studies | | not serious g | | not serious | | not serious | | not serious | | none | | 41 | - | | | MD **0.04 lower** (0.1 lower to 0.01 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Narrative summary: One study (n=14) reported that umbilical blood flow decreased with exercise in the supine position compared to left-lateral rest.18 | | | |
| Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise. | | | | | | | | | | | | | | | | | | | | |
| 10 a | | observational studies | | not serious | | serious b | | not serious | | not serious | | none | | 197 | | | - | MD **0**  (0.14 lower to 0.13 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of low intensity. | | | | | | | | | | | | | | | | | | | | |
| 2 | | observational studies | | not serious | | serious b | | not serious | | not serious | | none | | 38 | | | - | MD **0.03 lower** (0.25 lower to 0.19 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of moderate intensity. | | | | | | | | | | | | | | | | | | | | |
| 3 c | | observational studies | | not serious | | not serious | | not serious | | not serious | | none | | 48 | | | - | MD **0.03 lower** (0.47 lower to 0.13 lower) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of vigorous intensity. | | | | | | | | | | | | | | | | | | | | |
| 6 d | | observational studies | | not serious | | not serious | | not serious | | not serious | | none | | 111 | | | - | MD **0.08 higher** (0.03 lower to 0.19 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of 0-20 min. | | | | | | | | | | | | | | | | | | | | |
| 6 d | | observational studies | | not serious | | not serious | | not serious | | not serious | | none | | 119 | | | - | MD **0.16 lower** (0.32 lower to 0 ) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of 20-39 min. | | | | | | | | | | | | | | | | | | | | |
| 1 | | observational studies | | not serious | | serious e | | not serious | | not serious f | | none | | 15 | | | - | MD **0.02 higher** (0.32 lower to 0.36 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of 40 minutes or greater. | | | | | | | | | | | | | | | | | | | | |
| 2 c | | observational studies | | not serious | | not serious | | not serious | | not serious | | none | | 32 | | | - | MD **0.09 lower** (0.3 lower to 0.12 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and umbilical systolic/diastolic (S/D) ratio blood flow velocities from before to after exercise of duration not specified. | | | | | | | | | | | | | | | | | | | | |
| 2 c | | observational studies | | not serious | | not serious | | not serious | | not serious | | none | | 31 | | | - | MD **0.18 higher** (0.08 higher to 0.28 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Association between prenatal exercise and umbilical blood flow pulsatility index (PI) from before to after exercise. | | | | | | | | | | | | | | | | | | | | |
| 7 (pooled estimate of effect, n=6d; 1 study reported narratively) | | observational studies | | not serious g | | serious b | | not serious | | not serious | | none | | 280 | | | - | MD **0.01 lower** (0.04 lower to 0.02 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Narrative summary: One study was included (n=13) and reported that umbilical blood flow pulsatility index decreased following acute exercise.61 | | | | |
| Association between prenatal exercise and umbilical blood flow resistance index (RI) from before to after exercise. | | | | | | | | | | | | | | | | | | | | |
| 5 (pooled estimate of effect, n=4c; 1 study reported narratively) | | observational studies | | not serious g | | not serious | | not serious | | not serious | | none | | 115 | | | - | MD **0.02 lower** (0.04 lower to 0 ) | ⨁⨁◯◯ LOW | CRITICAL |
| Narrative summary: One study was included (n=13) and reported that umbilical blood flow resistance index decreased following acute exercise.61 | | | | |
| Association between prenatal exercise and umbilical blood flow velocity from before to after exercise. | | | | | | | | | | | | | | | | | | | | |
| 1 | observational studies | | not serious | | serious e | | not serious | | not serious f | | none | | 14 | | | - | | MD **1.5 higher** (1.2 lower to 4.2 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |

**CI:** Confidence interval; **MD:** Mean difference

#### Explanations

a. Four studies reported data on different sub-groups of women. These studies were counted only once.

b. Serious inconsistency. High heterogeneity (I2 >50%).

c. One study reported data on different sub-groups of women. This study was counted only once.

d. Two studies reported data on different sub-groups of women. These studies were counted only once.

e. Serious inconsistency. Only one study included.

f. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason.

g. No serious risk of bias. Reporting bias was an issue in one study; results were reported narratively.

## Effects of chronic exercise on umbilical artery blood flow

### Online Supplement Table 8: The association between prenatal exercise trials and umbilical blood flow.

| **Quality assessment** | | | | | | | **№ of participants** | | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **exercise (acute or chronic)** | **no exercise or different frequency, intensity, time, volume and type of exercise** | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise (exercise only interventions) and umbilical blood flow systolic/diastolic ratio (S/D) at rest post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | serious c | serious a | not serious | not serious b | none | 20 | 20 | - | MD **0.52 lower** (0.56 lower to 0.48 lower) | ⨁⨁◯◯ LOW | CRITICAL |
| Association between prenatal exercise (superiority trial) and umbilical blood flow systolic/diastolic ratio (S/D) at rest post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | not serious | serious a | not serious | not serious b | none | 27 | 32 | - | MD **0.3 lower** (0.58 lower to 0.02 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise (exercise only interventions) and umbilical blood flow pulsatile index (PI) at rest post-intervention. | | | | | | | | | | | | |
| 2 | randomized trials | serious c | not serious | not serious | not serious | none | 46 | 53 | - | MD **0.06 lower** (0.08 lower to 0.04 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise (superiority trial) and umbilical blood flow pulsatile index (PI) at rest post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | not serious | serious a | not serious | not serious b | none | 27 | 32 | - | MD **0.18 lower** (0.28 lower to 0.08 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise (exercise only interventions) and umbilical blood flow resistance index (RI) at rest post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | serious c | serious a | not serious | not serious b | none | 20 | 20 | - | MD **0.07 lower** (0.07 lower to 0.06 lower) | ⨁⨁◯◯ LOW | CRITICAL |
| Association between prenatal exercise (superiority trial) and umbilical blood flow resistance index (RI) at rest post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | not serious | serious a | not serious | not serious b | none | 27 | 32 | - | MD **0.03 lower** (0.07 lower to 0.01 higher) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Evidence from a non-randomized intervention: Association between prenatal exercise and umbilical Doppler velocimetry score at rest post-intervention. | | | | | | | | | | | | |
| 1 | observational | not serious d | serious a | not serious | not serious b | none | Narrative summary: One study was included (n=13) and reported that the umbilical Doppler velocimetry score did not change between groups.84 | | | | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and umbilical blood flow pulsatile index (PI) after acute exercise post-intervention. | | | | | | | | | | | | |
| 1 | randomized trial | not serious d | serious a | not serious | not serious b | none | Narrative summary: One study was included (n=26) and reported that the umbilical blood flow pulsatile index (PI) did not change after acute exercise post-intervention in the intervention group. The control group was not measured.80 | | | | ⨁⨁⨁◯ MODERATE | CRITICAL |

CI: Confidence interval; MD: Mean difference

#### Explanations

a. Serious inconsistency. Only one study included.

b. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason.

c. Serious risk of bias. High risk of performance and attrition bias.

d. No serious risk of bias. Reporting bias was an issue in one study; results were reported narratively.

## Uterine artery blood flow during and following acute prenatal exercise

### Online Supplement Table 9: The association between prenatal exercise and uterine blood flow.

| **Quality assessment** | | | | | | | | **№ of participants** | **Effect** | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Prenatal exercise** | **Relative (95% CI)** | **Absolute (95% CI)** |
| Association between prenatal exercise and uterine artery systolic/diastolic (S/D) ratio from before to during exercise. | | | | | | | | | | | | |
| 2 | observational studies | not serious | | serious a | not serious | not serious | none | 32 | - | MD **0.2 higher** (0.38 lower to 0.77 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and uterine artery systolic/diastolic (S/D) ratio from before to after exercise | | | | | | | | | | | | |
| 5 b | observational studies | not serious | | serious a | not serious | not serious | none | 103 | - | MD **0.15 higher** (0.08 lower to 0.38 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery systolic/diastolic (S/D) ratio from before to after exercise in women who were previously inactive. | | | | | | | | | | | | |
| 1 | observational studies | not serious | | serious c | not serious | not serious d | none | 15 | - | MD **0.11 lower** (0.32 lower to 0.1 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery systolic/diastolic (S/D) ratio from before to after exercise in women who were previously active. | | | | | | | | | | | | |
| 3 b | observational studies | not serious | | not serious | not serious | not serious | none | 55 | - | MD **0.02 higher** (0.1 lower to 0.14 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery systolic/diastolic (S/D) ratio from before to after exercise in women with previously unspecified activity levels. | | | | | | | | | | | | |
| 2 | observational studies | not serious | | not serious | not serious | not serious | none | 33 | - | MD **0.56 higher** (0.41 higher to 0.7 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Association between prenatal exercise and uterine artery pulsatility index (PI) from before to after exercise. | | | | | | | | | | | | |
| 7 (pooled estimate of effect, n=5e; 2 studies synthesized narratively) | observational studies | not serious g | | not serious | not serious | not serious | none | 205 | - | MD **0.01 lower** (0.04 lower to 0.01 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Narrative synthesis: Two studies were included (n=107) and reported no change in the uterine artery PI from before to after exercise.61 88 | | |
| Association between prenatal exercise and uterine artery resistance index (RI) from before to after exercise. | | | | | | | | | | | | |
| 5 (pooled estimate of effect, n=4f; 1 study reported narratively) | observational studies | not serious g | | serious a | not serious | not serious | none | 104 | - | MD **0.01 higher** (0.02 lower to 0.04 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Narrative summary: One study was included (n=13) and showed no change in uterine artery RI from before to after exercise.61 | | |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise of low intensity. | | | | | | | | | | | | |
| 1 | observational studies | not serious | | serious c | not serious | not serious d | none | 12 | - | MD **0.07 higher** (0.02 higher to 0.12 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise of moderate intensity. | | | | | | | | | | | | |
| 1 | observational studies | not serious | | serious c | not serious | not serious d | none | 33 | - | MD **0.03 lower** (0.08 lower to 0.02 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise of vigorous intensity. | | | | | | | | | | | | |
| 2 f | observational studies | not serious | | not serious | not serious | not serious | none | 59 | - | MD **0.01 higher** (0.01 lower to 0.03 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise <20 min. | | | | | | | | | | | | |
| 3 f | observational studies | not serious | | not serious | not serious | not serious | none | 77 | - | MD **0.01 lower** (0.03 lower to 0.01 higher) | ⨁⨁◯◯ LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise of 20 min. or greater. | | | | | | | | | | | | |
| 1 | observational studies | not serious | | serious c | not serious | not serious | none | 15 | - | MD **0.04 higher** (0 to 0.08 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Subgroup analysis: Association between prenatal exercise and uterine artery (RI) from before to after exercise with unspecified duration. | | | | | | | | | | | | |
| 1 | observational studies | not serious | | serious c | not serious | not serious | none | 12 | - | MD **0.07 higher** (0.02 higher to 0.12 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| Association between prenatal exercise and uterine blood flow (ml/min) from before to during exercise. | | | | | | | | | | | | |
| 1 | observational studies | | not serious | serious a | not serious | not serious b | none | 14 | - | MD **55 lower** (113.9 lower to 3.9 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| **Additional data from study included in the pooled estimate.** When baseline values occurred in the supine position, there was no change in uterine blood flow (ml/min) from before to during supine exercise. 18 h | | |
| Association between prenatal exercise and uterine blood flow (ml/min) from before to after exercise. | | | | | | | | | | | | |
| 1 | observational studies | | not serious | serious a | not serious | not serious b | none | 14 | - | MD **1 lower** (53.76 lower to 51.76 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| **Additional data from study included in the pooled estimate.** When baseline values occurred in the supine position, there was no change in uterine blood flow (ml/min) from before to after supine exercise. 18 h | | |  |  |
| Association between prenatal exercise and uterine blood velocity (cm/s) from before to during exercise. | | | | | | | | | | | | |
| 1 | observational studies | | not serious | serious a | not serious | not serious b | none | 14 | - | MD **5 higher** (2.1 lower to 12.1 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| **Additional data from study included in the pooled estimate.** When baseline values occurred in the supine position, there was no change in uterine blood velocity (cm/s) from before to during supine exercise.18 h | | |  |  |
| Association between prenatal exercise and uterine blood velocity (cm/s) from before to after exercise. | | | | | | | | | | | | |
| 1 | observational studies | | not serious | serious a | not serious | not serious b | none | 14 | - | MD **1 lower** (7.8 lower to 5.8 higher) | ⨁◯◯◯ VERY LOW | CRITICAL |
| **Additional data from study included in the pooled estimate.** When baseline values occurred in the supine position, there was no change in uterine blood velocity (cm/s) from before to after supine exercise. 18 h | | |

**CI:** Confidence interval; **MD:** Mean difference

#### Explanations

a. Serious inconsistency. High heterogeneity (I2 >50%).

b. One study reported data on different sub-groups of women. This study was only counted once.

c. Serious inconsistency. Only one study was included.

d. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason

e. Three studies reported data on different sub-groups of women. These studies were counted only once.

f. Two studies reported data on different sub-groups of women. These studies were counted only once.

g. No serious risk of bias. Reporting bias was an issue in one study; results were reported narratively.

h. One study reported data that was included in the meta-analysis and additional data reported narratively. This study was counted only once.

## Effects of chronic exercise on uterine artery blood flow

### Online Supplement Table 10: The association between prenatal exercise trials and uterine artery blood flow.

| **Quality assessment** | | | | | | | **№ of participants** | | | | **Effect** | | | **Quality** | **Importance** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **Prenatal exercise** | | **No exercise** | | **Relative (95% CI)** | | **Absolute (95% CI)** |
| Association between prenatal exercise (superiority trial) and uterine artery systolic/ diastolic ratios (S/D) at rest post-intervention. | | | | | | | | | | | | | | | |
| 1 a | randomized trials | not serious | serious b | not serious | not serious c | none | 28 | | 32 | | - | | MD **0.4 lower** (0.72 lower to 0.08 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise (exercise only interventions) and uterine artery pulsatility index (PI) at rest post-intervention. | | | | | | | | | | | | | | | |
| 3 (pooled estimate of effect, n=1; 2 studies synthesized narratively) | randomized trials | serious d | serious b | not serious | not serious c | none | 26 | 33 | | - | | MD **0.02 higher** (0.1 lower to 0.14 higher) | | ⨁⨁◯◯ LOW | CRITICAL |
| Narrative synthesis: Two studies were included (n=245) and reported no difference in uterine artery PI between exercise and control groups.84 85 | | | | | | |
| Association between prenatal exercise (superiority trial) and uterine artery pulsatility index (PI) at rest post-intervention. | | | | | | | | | | | | | | | |
| 1 a | randomized trial | not serious | serious b | not serious | not serious c | none | 28 | | 32 | | - | | MD **0.21 lower** (0.41 lower to 0.01 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise (superiority trial) and uterine artery resistance index (RI) at rest post-intervention. | | | | | | | | | | | | | | | |
| 1 a | randomized trial | not serious | serious b | not serious | not serious c | none | 28 | | 32 | | - | | MD **0.1 lower** (0.16 lower to 0.04 lower) | ⨁⨁⨁◯ MODERATE | CRITICAL |
| Association between prenatal exercise and uterine blood flow pulsatile index (PI) after acute exercise post-intervention. | | | | | | | | | | | | | | | |
| 1 | randomized trial | not serious | serious b | not serious | not serious c | none | Narrative summary: One study was included (n=26) and reported that the uterine blood flow pulsatile index (PI) did not change after acute exercise post-intervention in the intervention group. The control group was not measured.80 | | | | | | | ⨁⨁⨁◯ MODERATE | CRITICAL |

CI: Confidence interval; MD: Mean difference

#### Explanations

a. One study reported data on different sub-groups of women. This study was counted only once.

b. Serious inconsistency. Only one study was included.

c. No serious imprecision; only one study but already downgraded for serious inconsistency for this reason

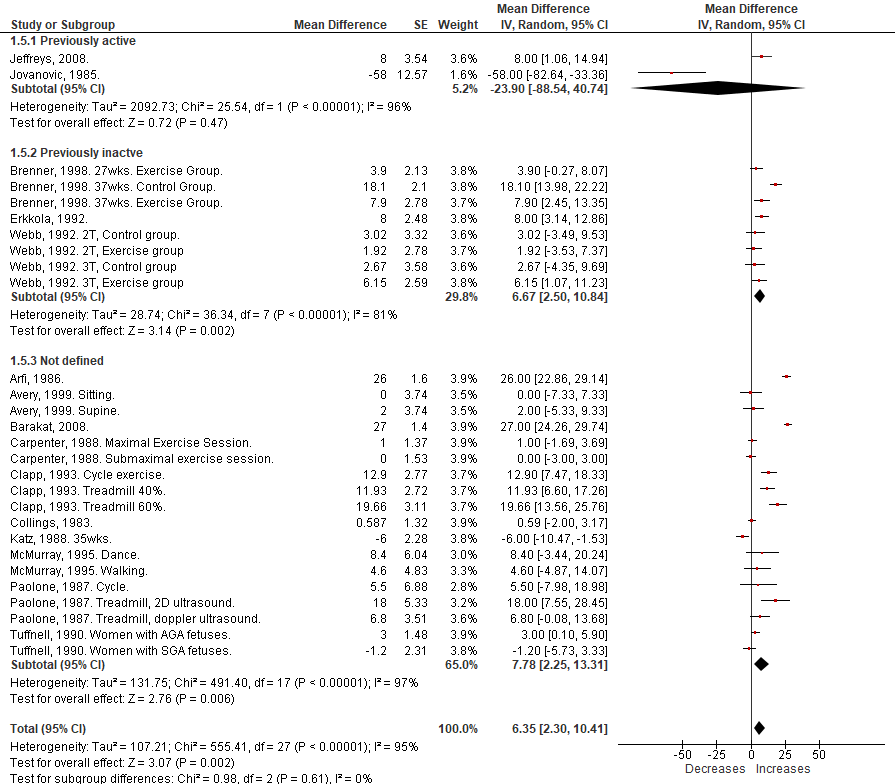
d. Serious risk of bias. High risk of attrition bias. Reporting bias was an issue in one study; results were reported narratively.

# Supplemental Figures: Forest Plots

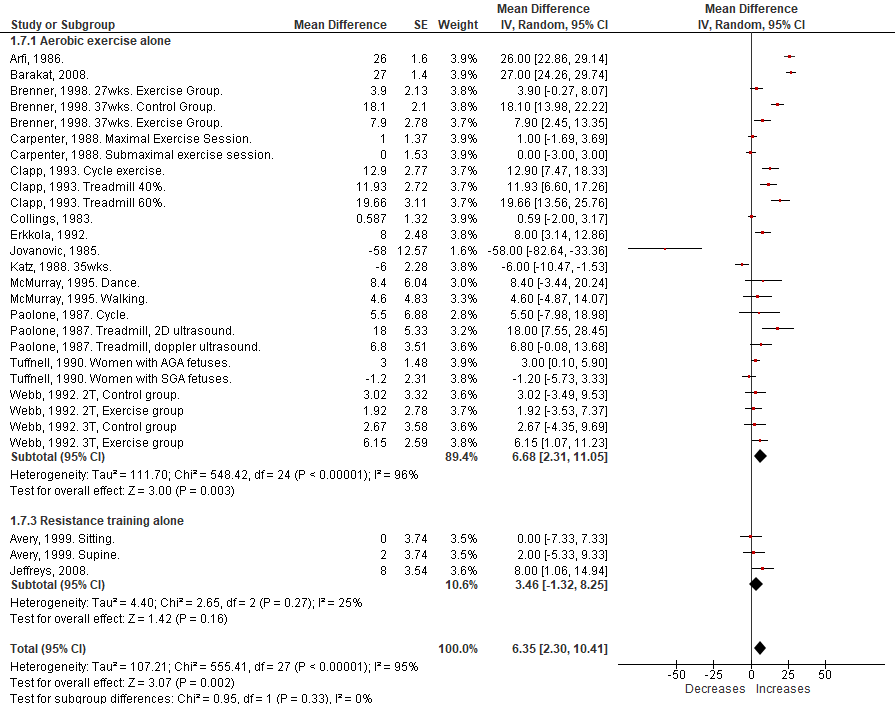
## Fetal heart rate during exercise



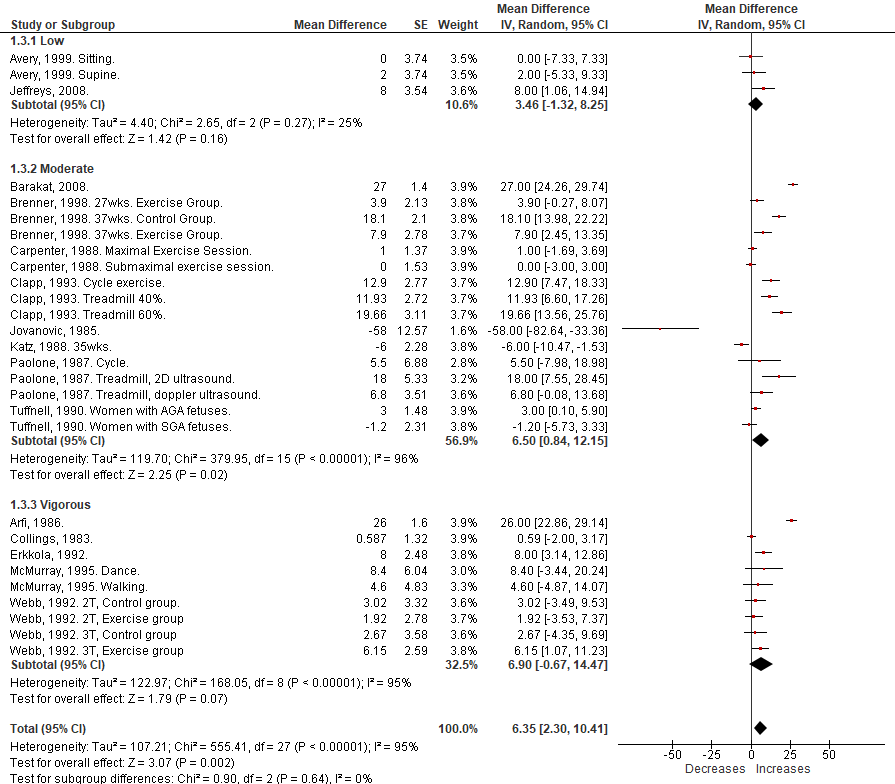
*Online Supplement Figure 1.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Sensitivity analyses removing study with potential bias.7 FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age.

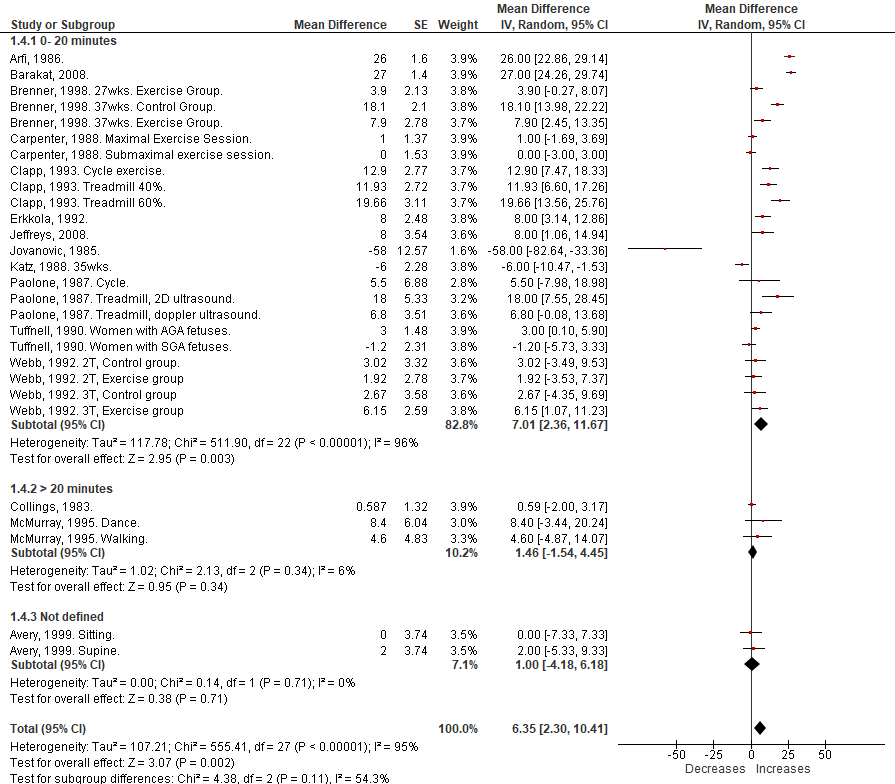


*Online Supplement Figure 2.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing women who were previously active to those previous inactive. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.

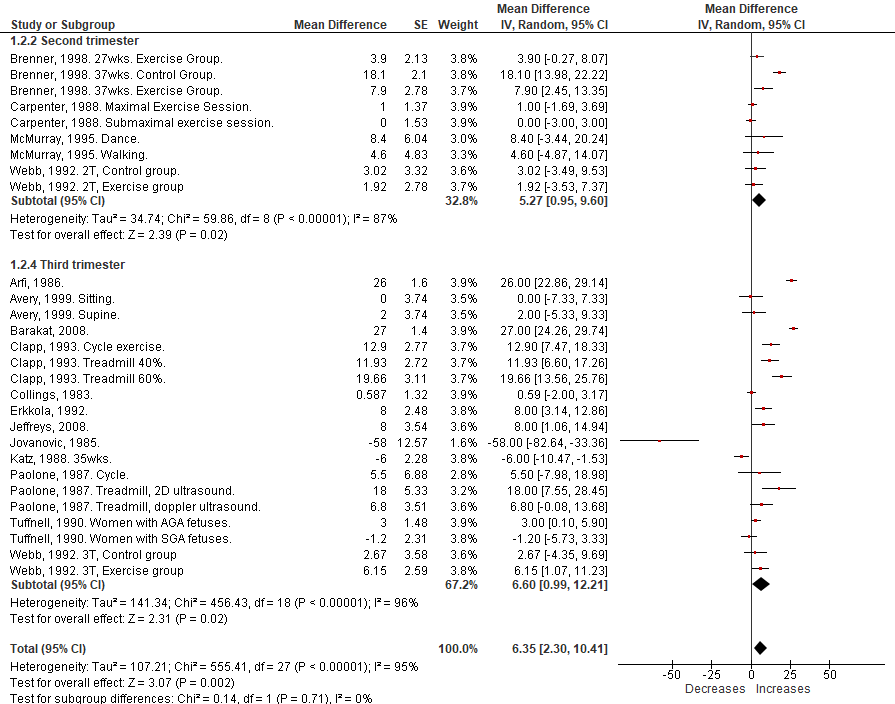


*Online Supplement Figure 3.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing women engaging in aerobic versus resistance training activities. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.

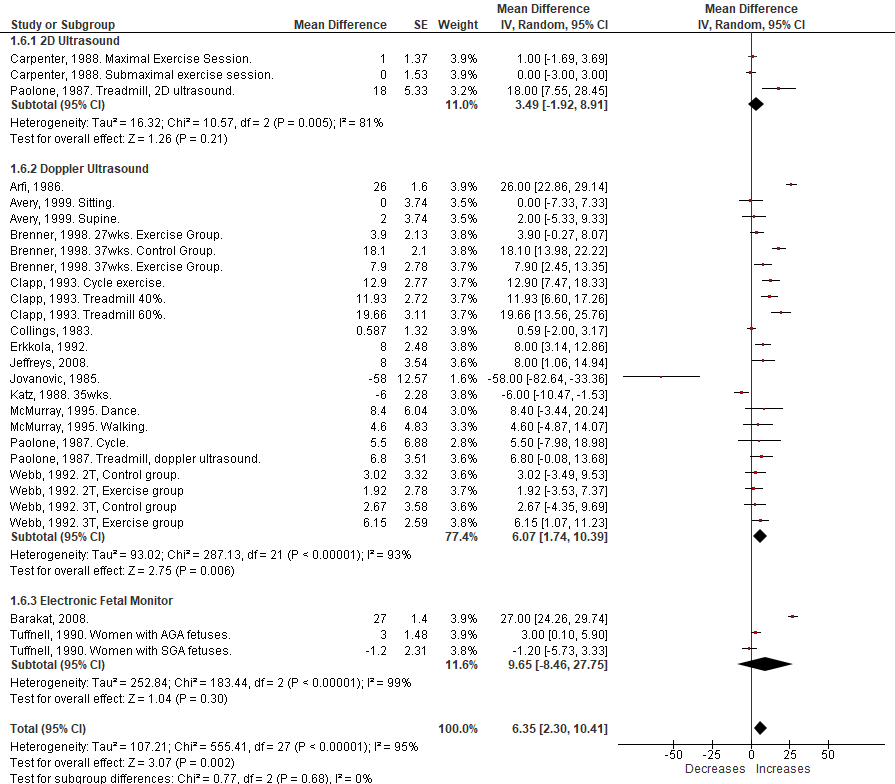
*Online Supplement Figure 4.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing women engaging in activities of different intensities. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.



*Online Supplement Figure 5.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing women engaging in activities of different durations. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.

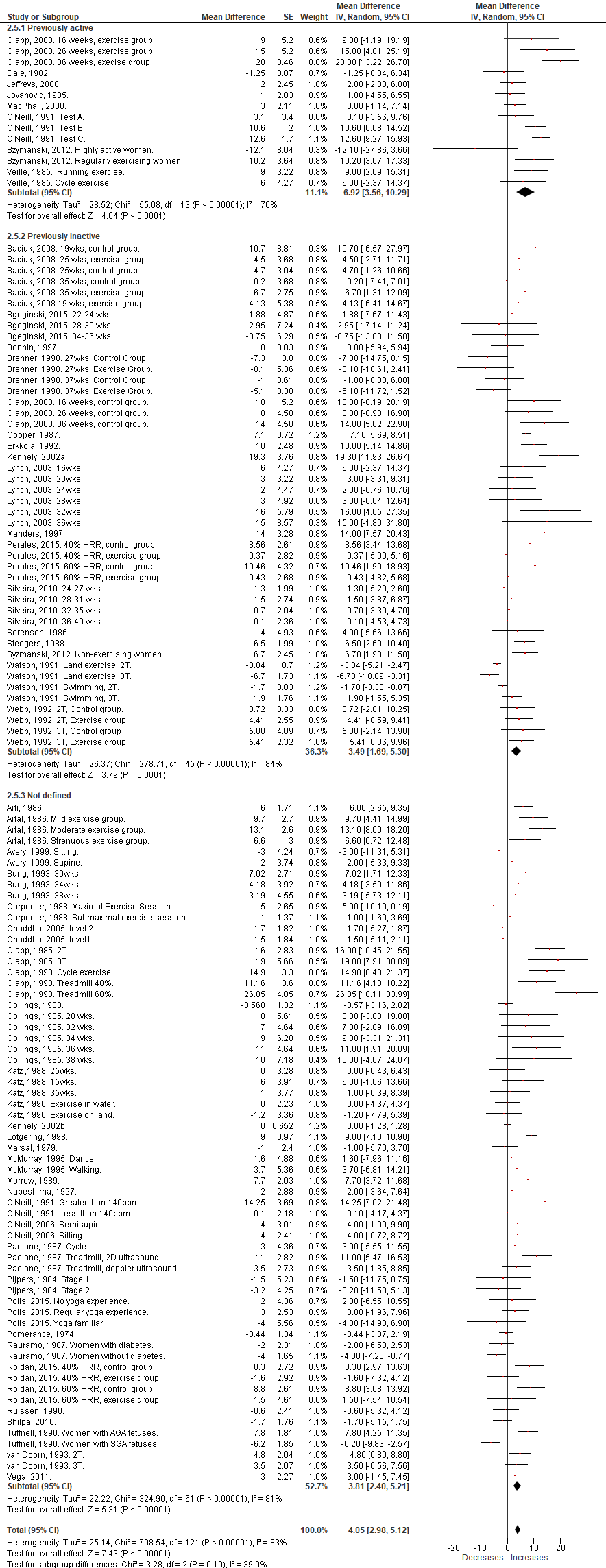


*Online Supplement Figure 6.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing women engaging in activities in the second and third trimester. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.

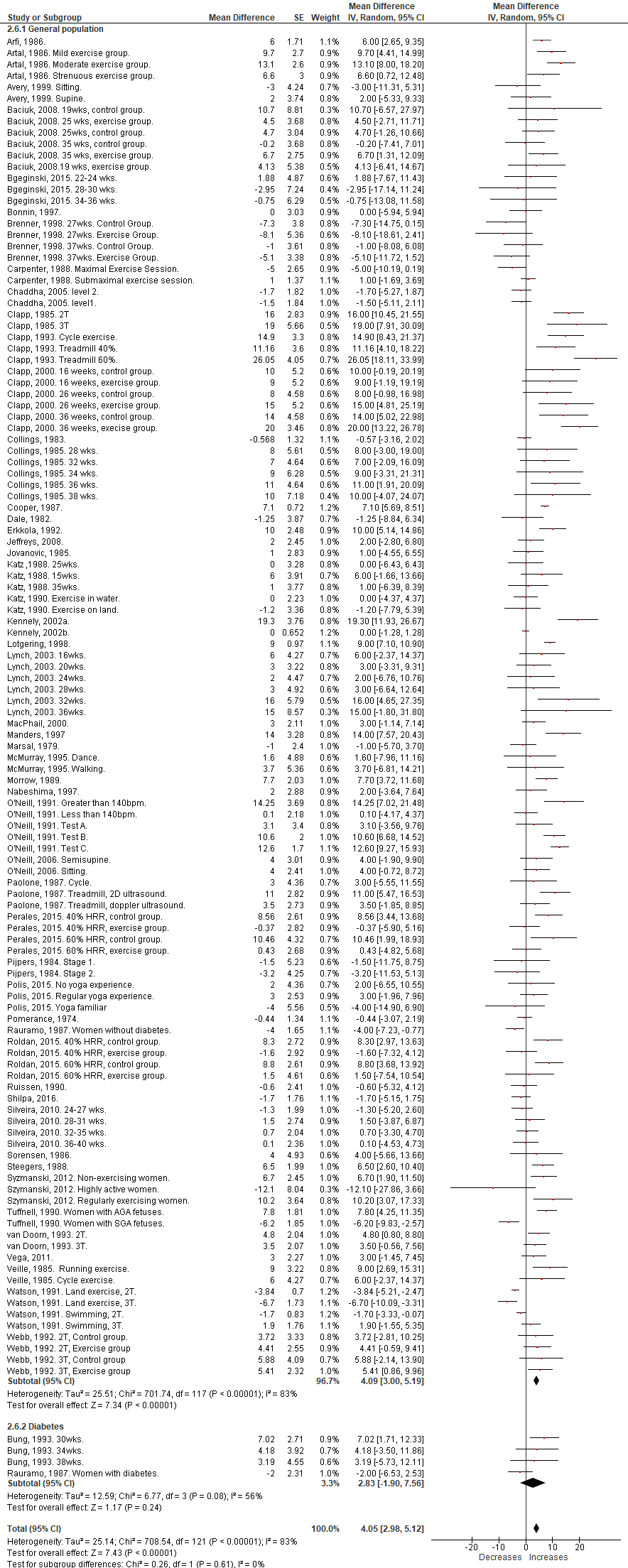


*Online Supplement Figure 7.* Impact of acute prenatal exercise on fetal heart rate (FHR) from pre-to-during exercise. Subgroup analyses were comparing different methods of determining FHR during acute exercise. FHR values are reported in bpm. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; AGA, average for gestational age; SGA, small for gestational age; 2T, second trimester; 3T, third trimester.

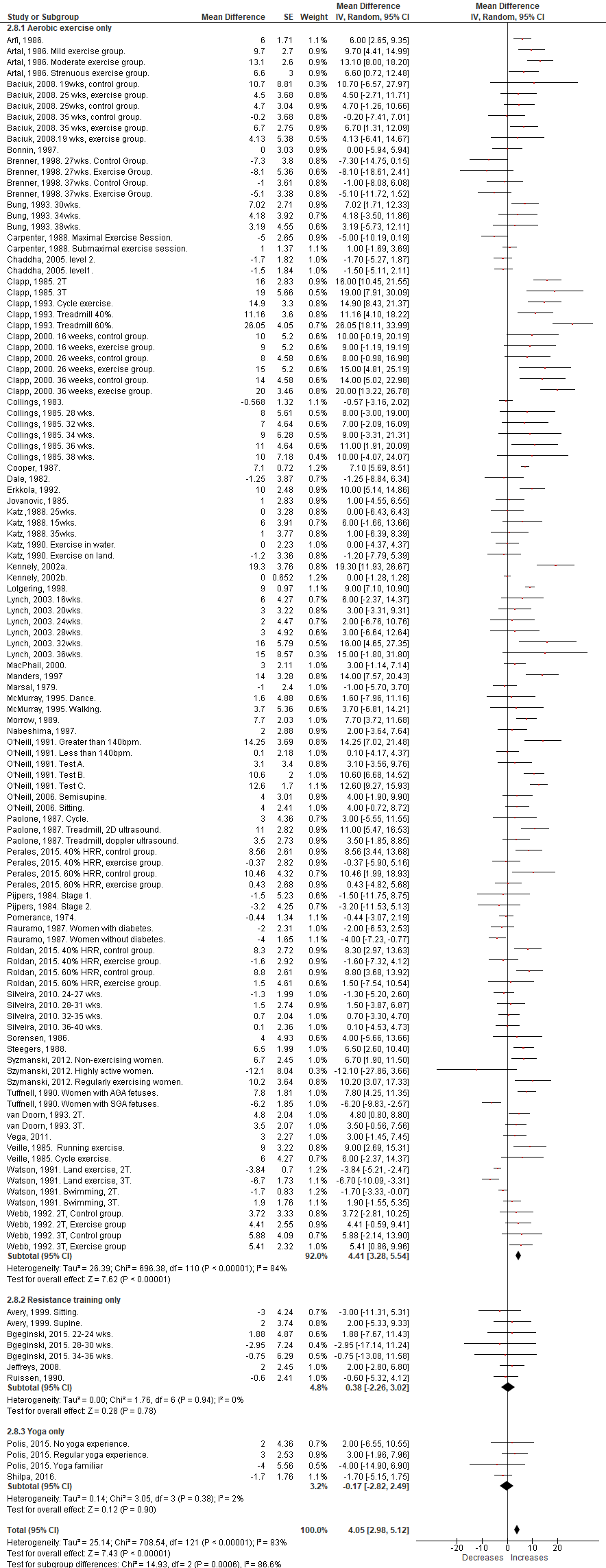
## Fetal heart rate following exercise



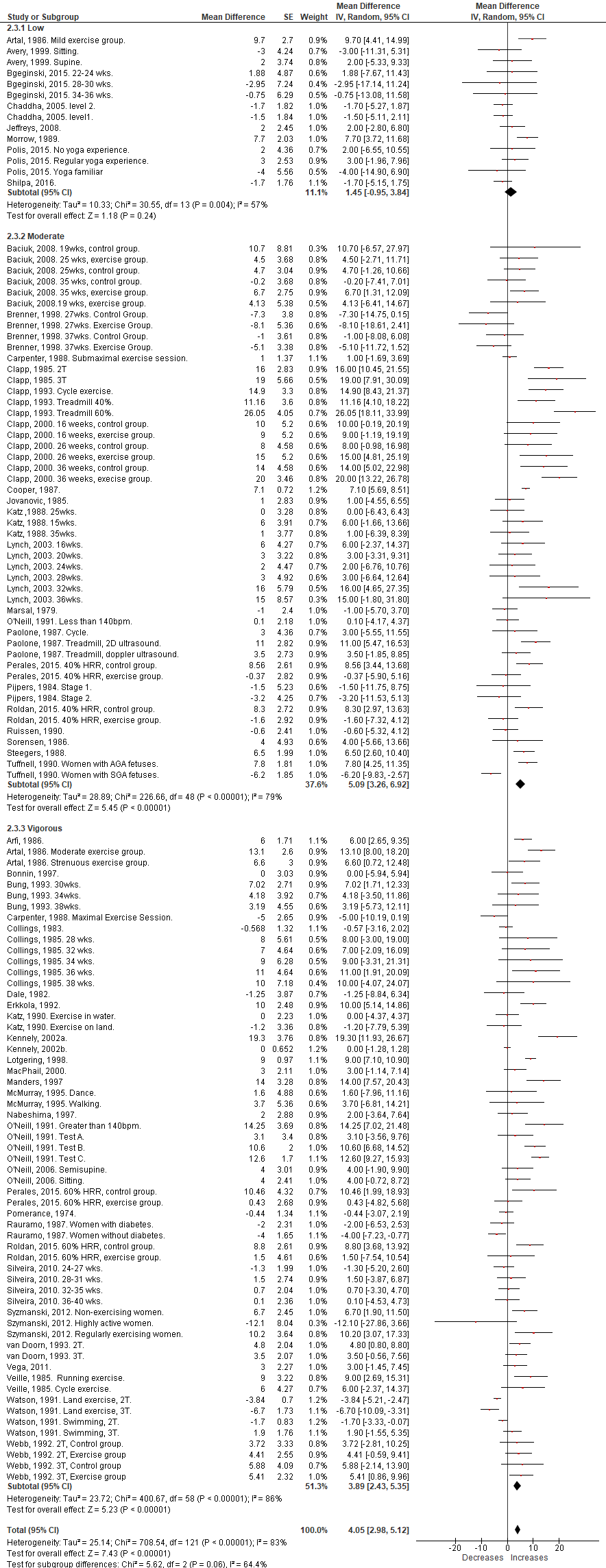
*Online Supplement Figure 8.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing women who were previously active to those who were previously inactive. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.



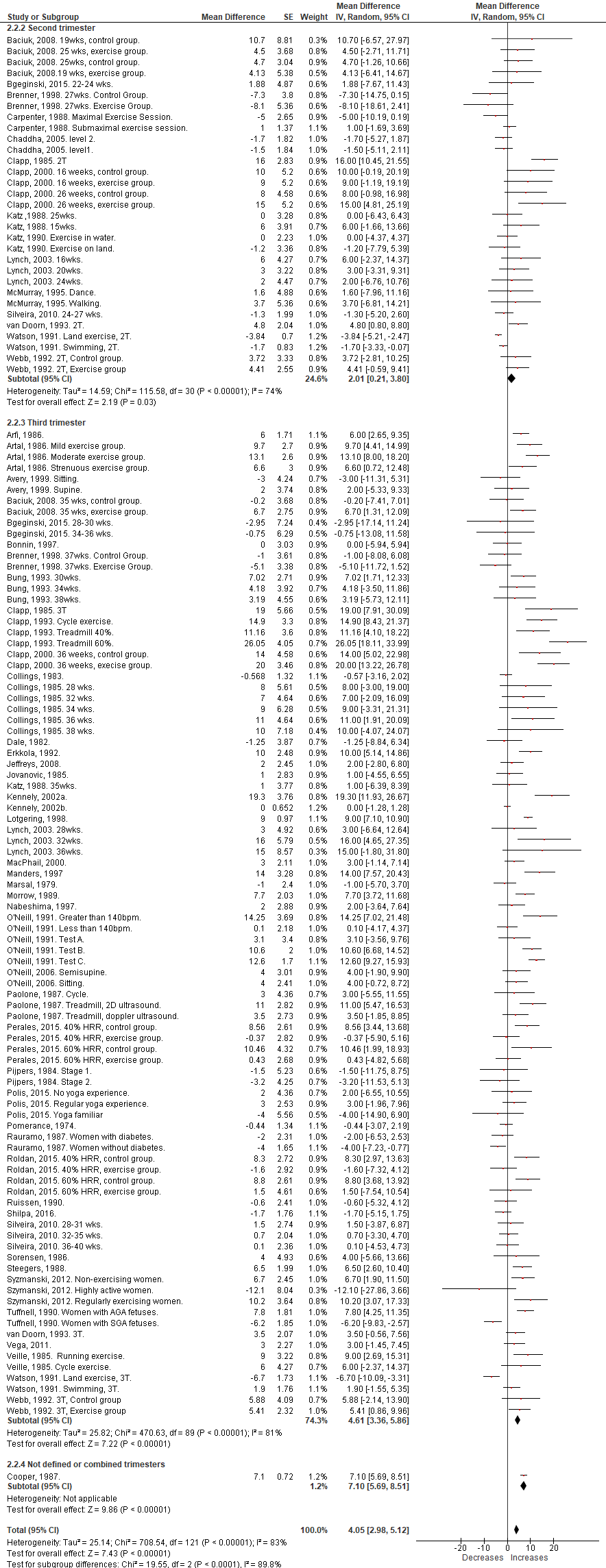
*Online Supplement Figure 9.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing women with diabetes compared to women without diabetes. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.



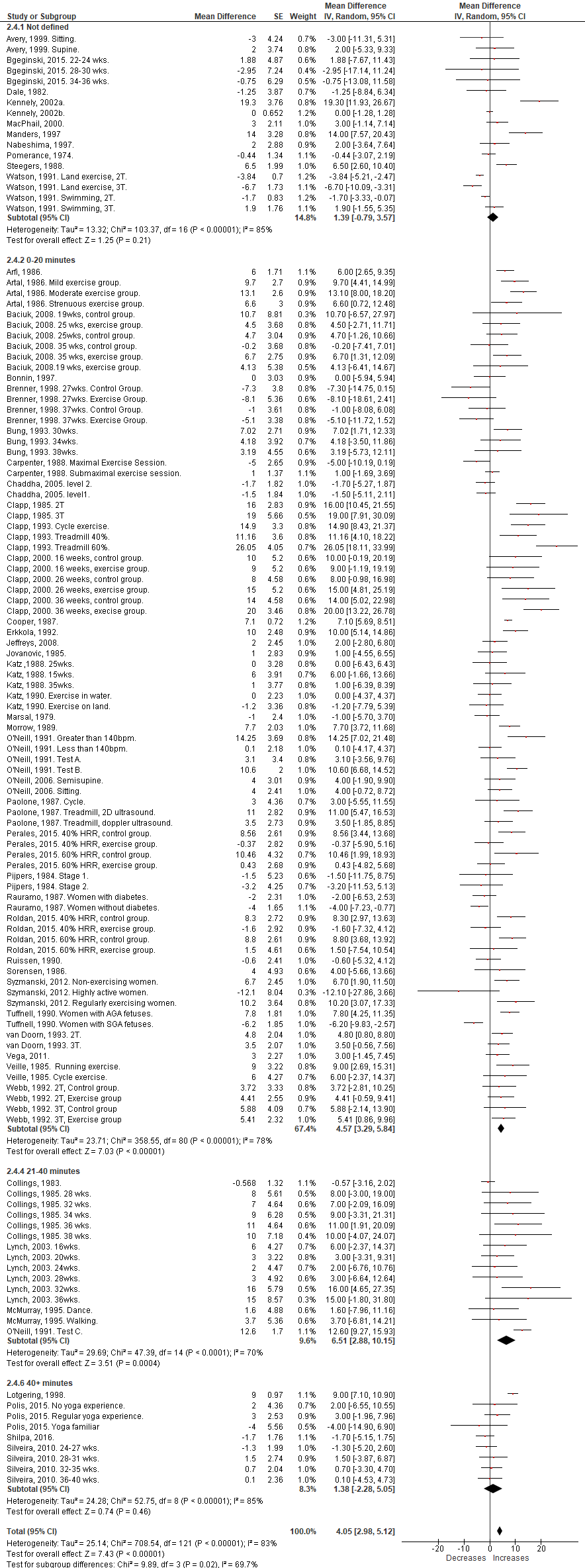
*Online Supplement Figure 10.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing different exercise modalities. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.



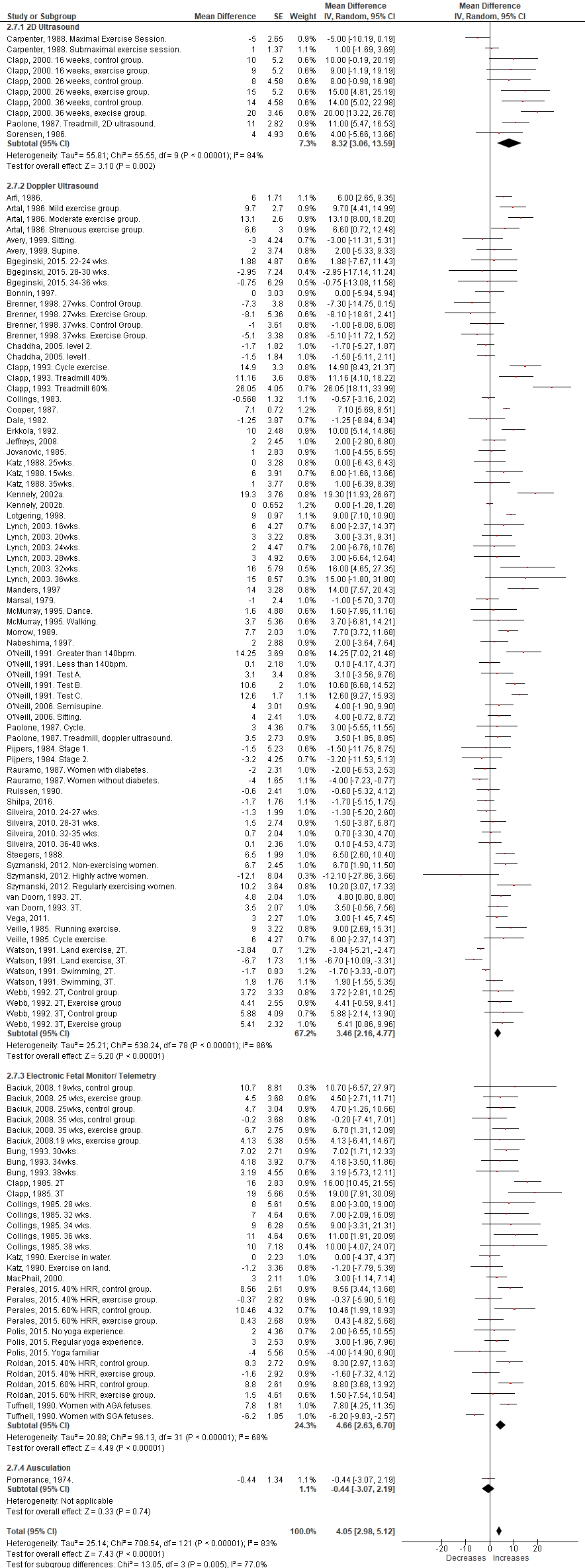
*Online Supplement Figure 11.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing women who were exercising at different intensities. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.



*Online Supplement Figure 12.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing women who were exercising in different trimesters. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.

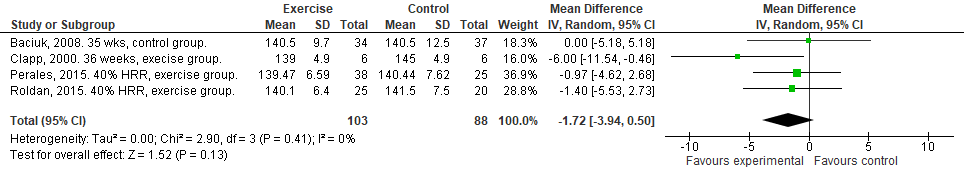


*Online Supplement Figure 13.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing women who were exercising for different durations. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.

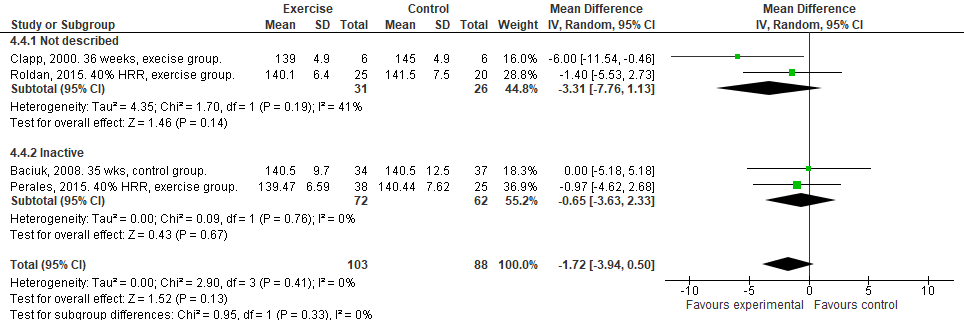


*Online Supplement Figure 14.* Effect of acute prenatal exercise on fetal heart rate (FHR) following exercise. Data reported as a mean difference compared to baseline, resting conditions. Subgroup analysis were comparing different methods for measuring FHR. Analysis conducted using a random effects model. SE, standard error; IV, inverse variance, AGA, average for gestational age; SGA, small for gestational age, 2T, second trimester; 3T, third trimester; EX, exercise group; CTRL, control group; HRR, heart rate reserve.

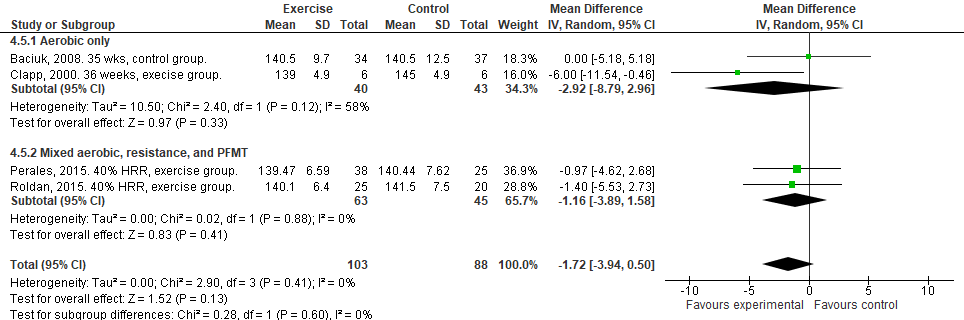
## Fetal heart rate responses to chronic exercise



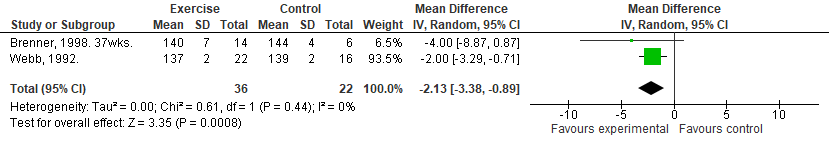
*Online Supplement Figure 15.* Randomized controlled trials examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. All studies were “exercise only” trials. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



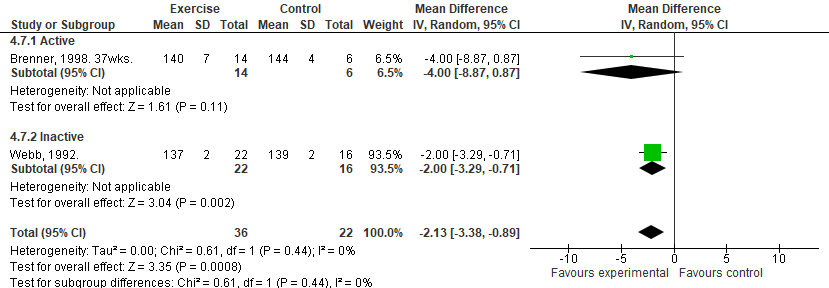
*Online Supplement Figure 16.* Randomized controlled trials examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. Subgroup analysis separating women who were previously inactive. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



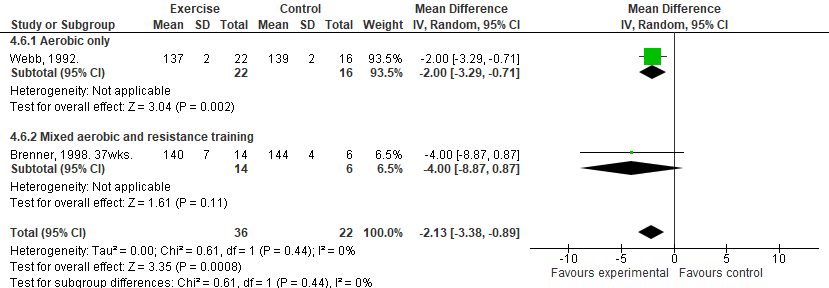
*Online Supplement Figure 17.* Randomized controlled trials examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Subgroup analysis separating studies by type of exercise during intervention. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



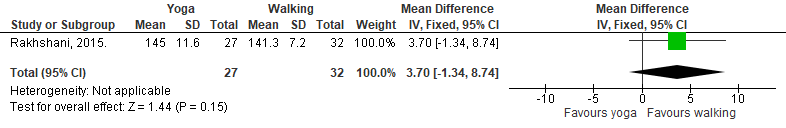
*Online Supplement Figure 18*. Non-randomized exercise interventions examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



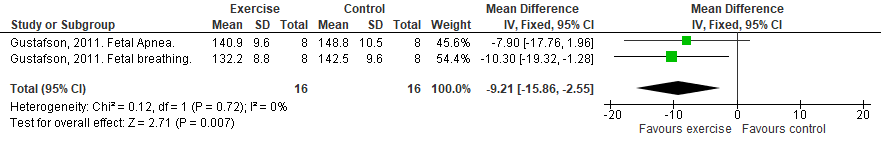
*Online Supplement Figure 19*. Non-randomized exercise interventions examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Subgroup analysis separating women by previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



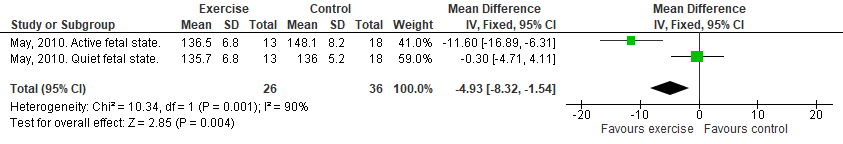
*Online Supplement Figure 20*. Non-randomized exercise interventions examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Subgroup analysis separating studies by type of exercise during intervention. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



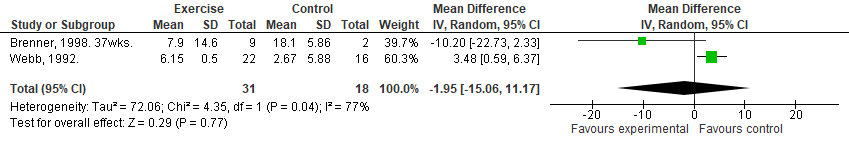
*Online Supplement Figure 21.* Superiority trial examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention comparing women enrolled in a yoga program to a walking program. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



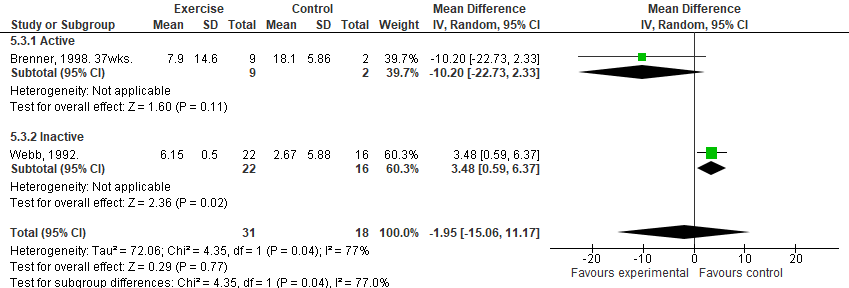
*Online Supplement Figure 22*. Cohort study examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



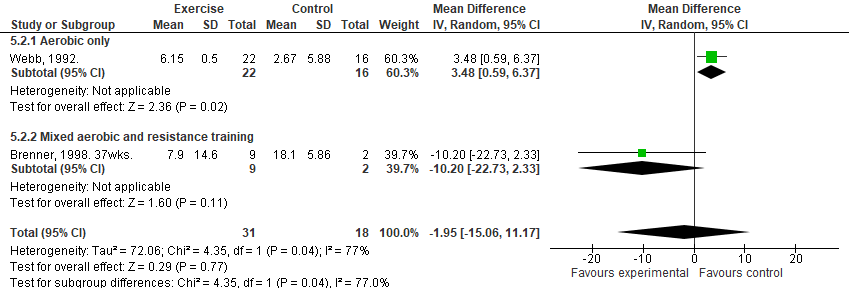
*Online Supplement Figure 23*. Cross-sectional study examining the impact of prenatal exercise on resting fetal heart rate (FHR) post-intervention. FHR was reported in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



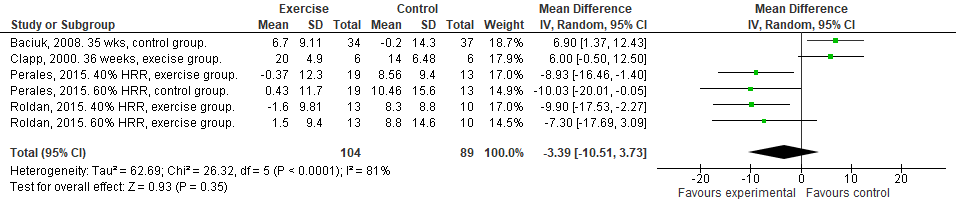
*Online Supplement Figure 24*. Non-randomized exercise interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response during acute exercise post-intervention. FHR response was reported as a change from pre-to-during exercise in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



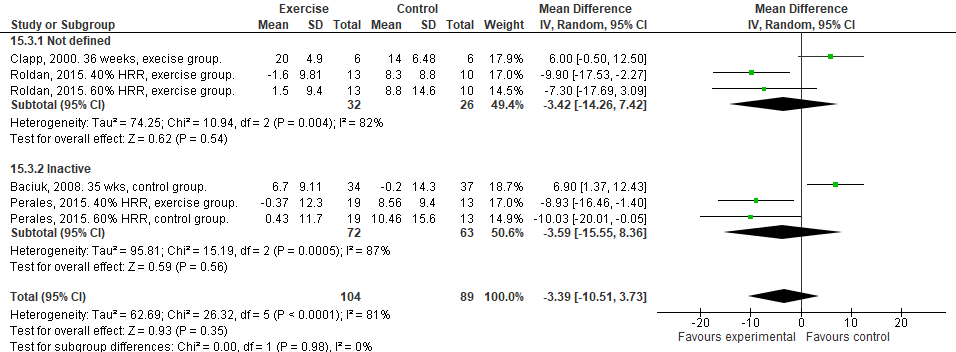
*Online Supplement Figure 25*. Non-randomized exercise interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response during acute exercise post-intervention. FHR response was reported as a change from pre-to-during exercise in beats per minute. Subgroups analysis separating women based on previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



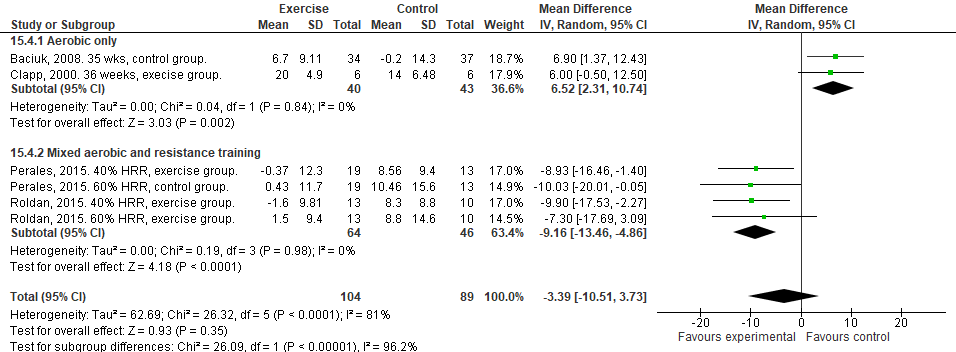
*Online Supplement Figure 26*. Non-randomized exercise interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response during acute exercise post-intervention. FHR response was reported as a change from pre-to-during exercise in beats per minute. Subgroups analysis separating studies by type of exercise during intervention. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.



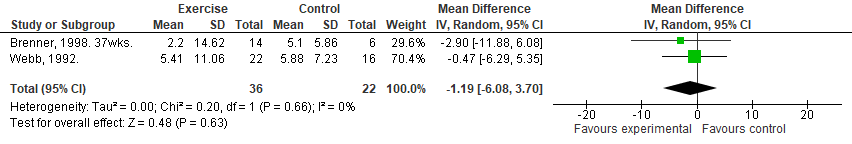
*Online Supplement Figure 27.* Randomized controlled trials examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



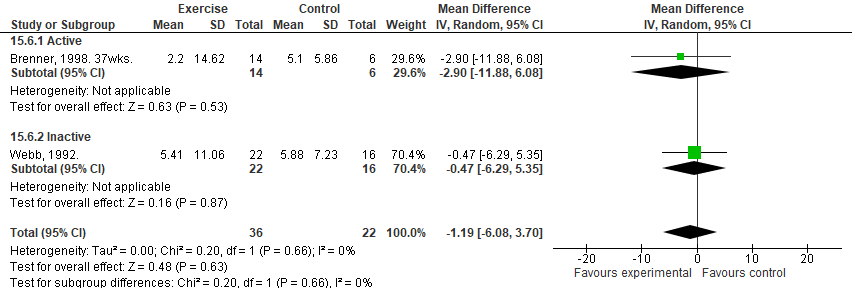
*Online Supplement Figure 28.* Randomized controlled trials examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Subgroup analysis separating women who were previously inactive. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



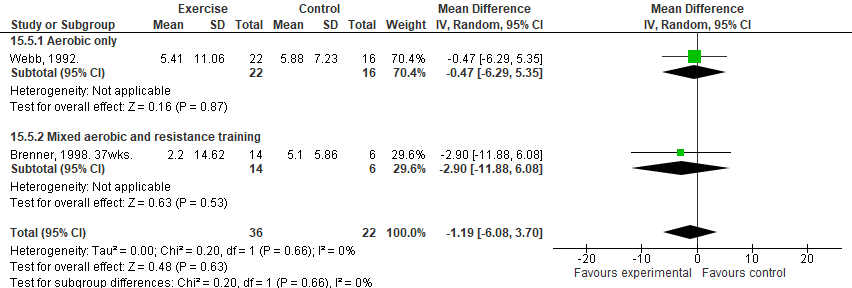
*Online Supplement Figure 29.* Randomized controlled trials examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Subgroup analysis separating studies by type of exercise during intervention. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; HRR, heart rate reserve.



*Online Supplement Figure 30.* Non-randomized interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.

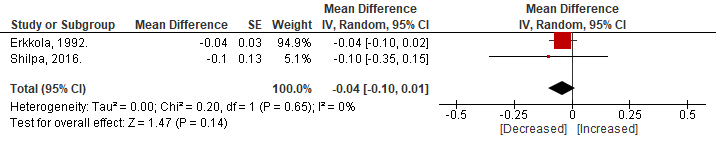


*Online Supplement Figure 31.* Non-randomized interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Subgroup analysis separating women by previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.

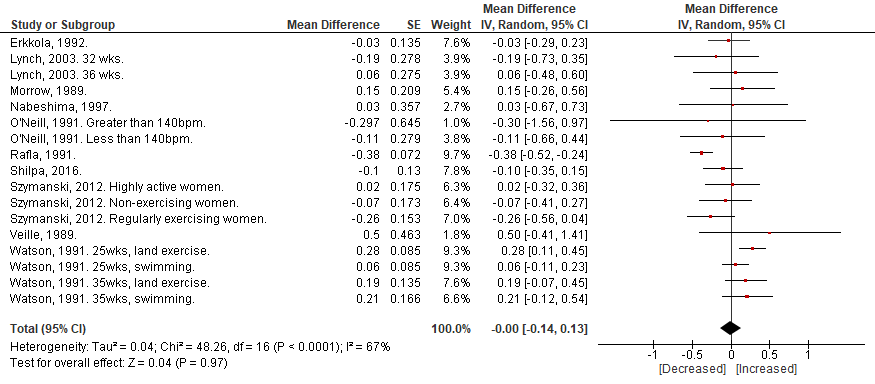


*Online Supplement Figure 32.* Non-randomized interventions examining the impact of prenatal exercise on the fetal heart rate (FHR) response following acute exercise post-intervention. FHR response was reported as a change from pre-to-post exercise in beats per minute. Subgroup analysis separating women by type of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance.

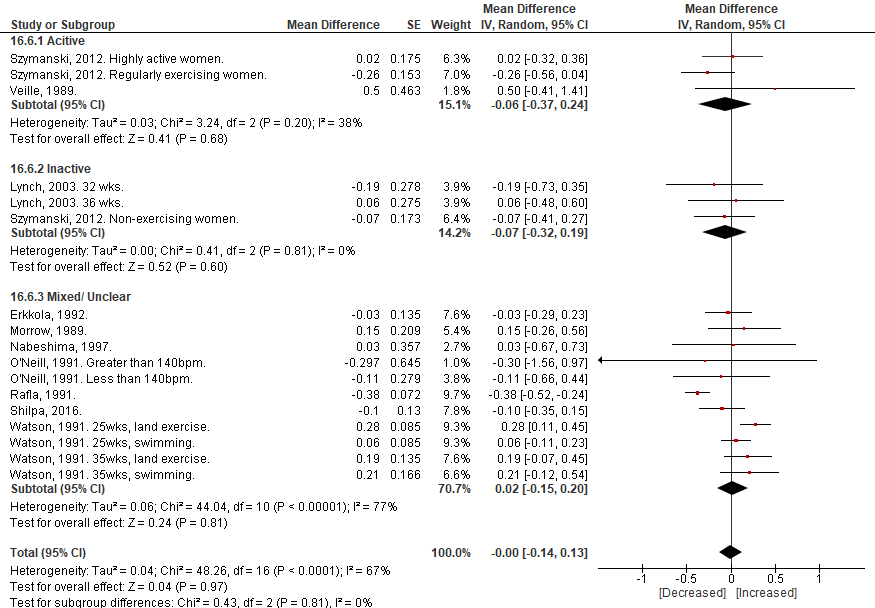
## Umbilical artery during and following acute exercise



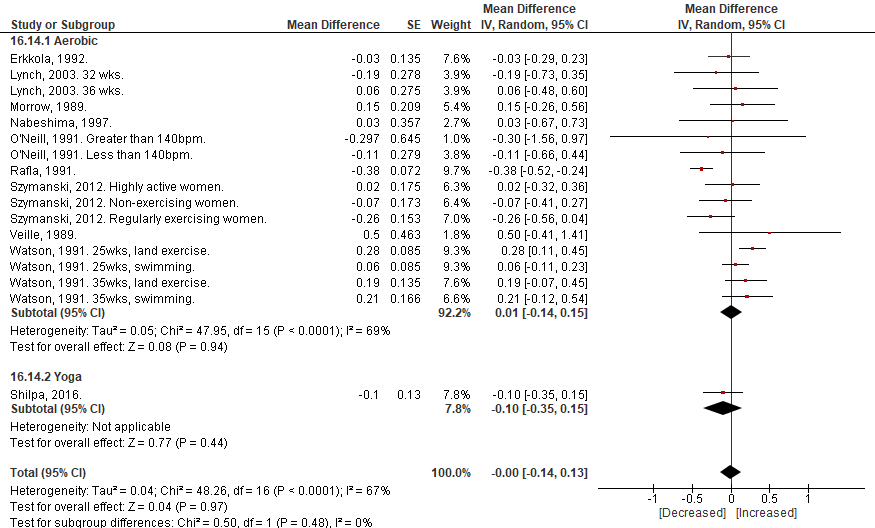
*Online Supplement Figure 33.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-during exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



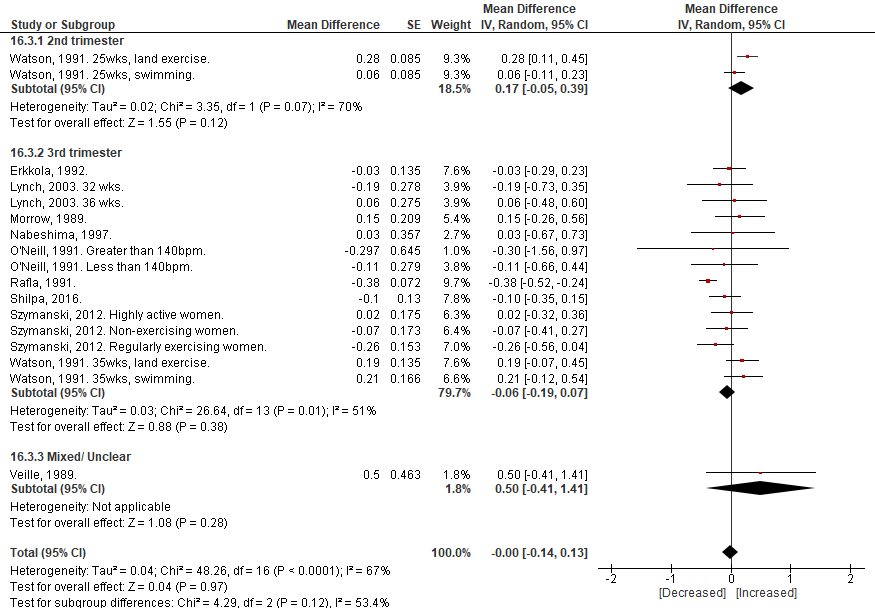
*Online Supplement Figure 34.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



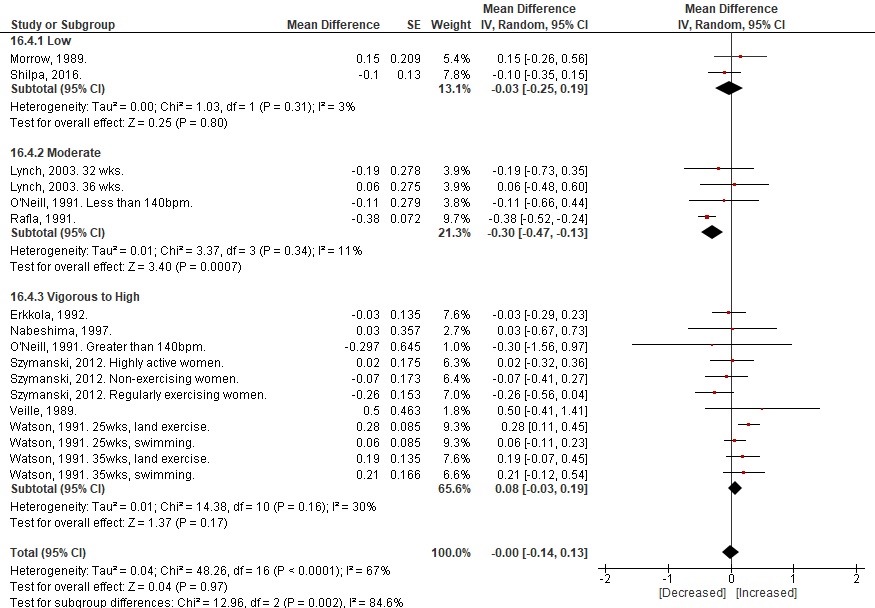
*Online Supplement Figure 35.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by previous physical activity levels. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



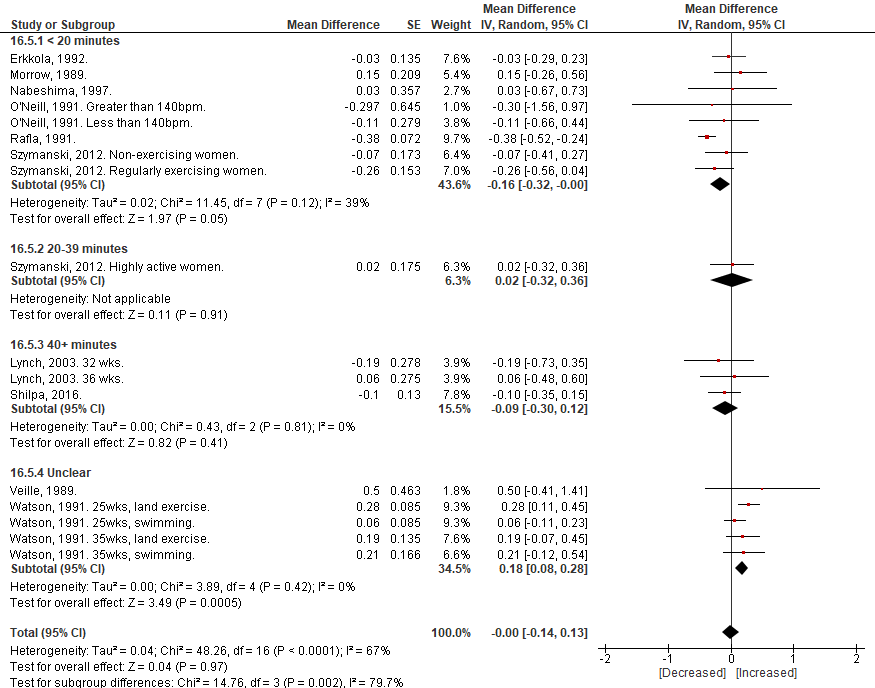
*Online Supplement Figure 36.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by type of exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



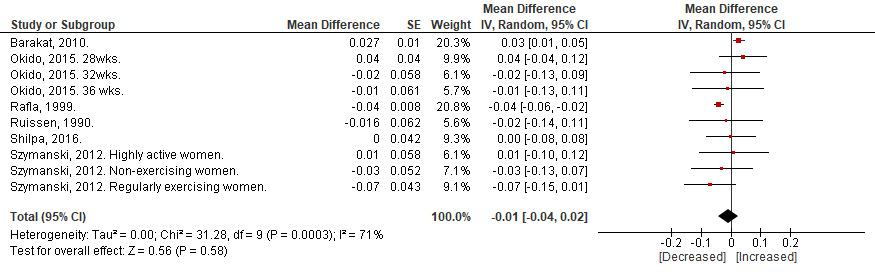
*Online Supplement Figure 37.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by trimester. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



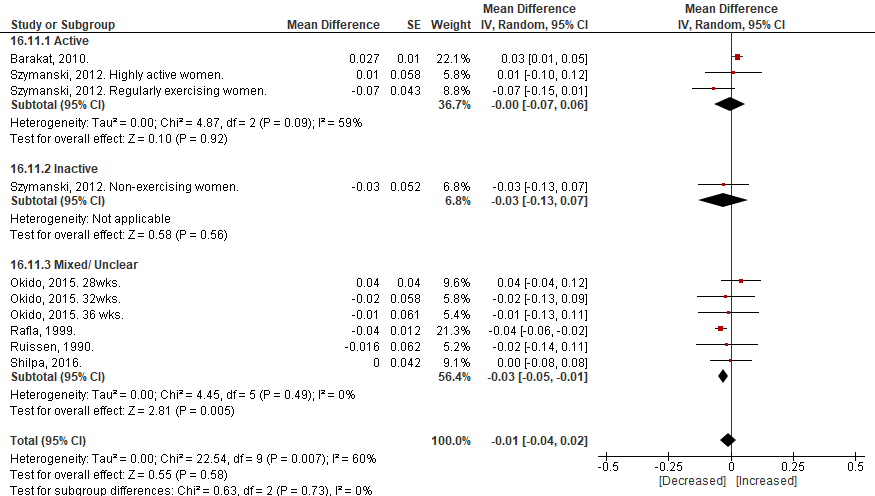
*Online Supplement Figure 38.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by intensity of exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



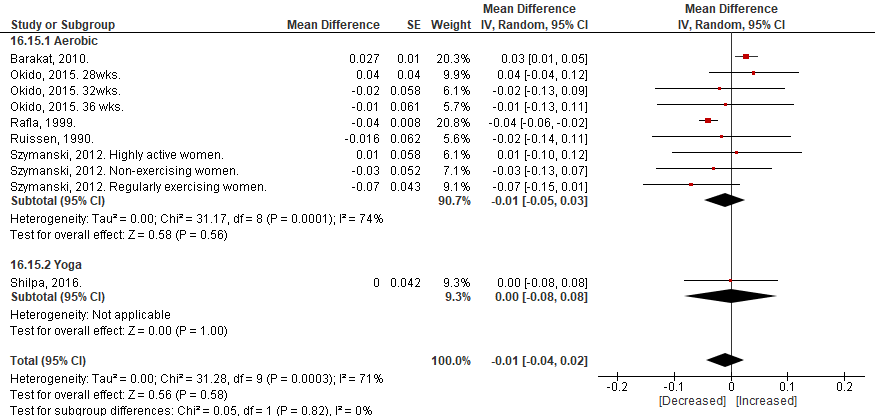
*Online Supplement Figure 39.* Effect of acute prenatal exercise on umbilical artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by duration of exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



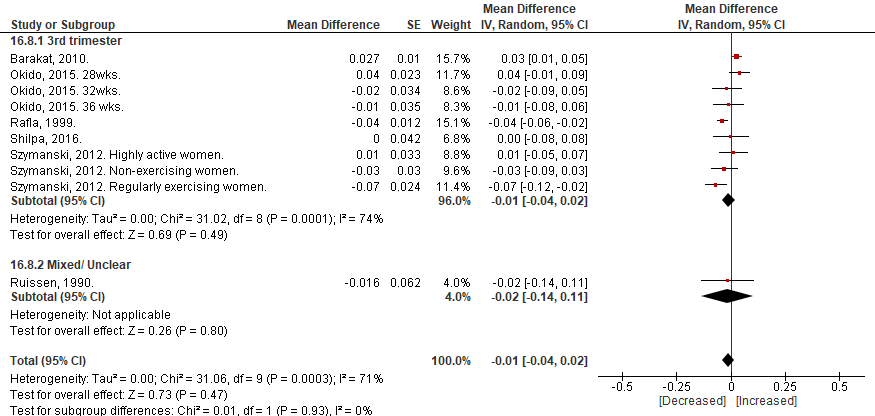
*Online Supplement Figure 40.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



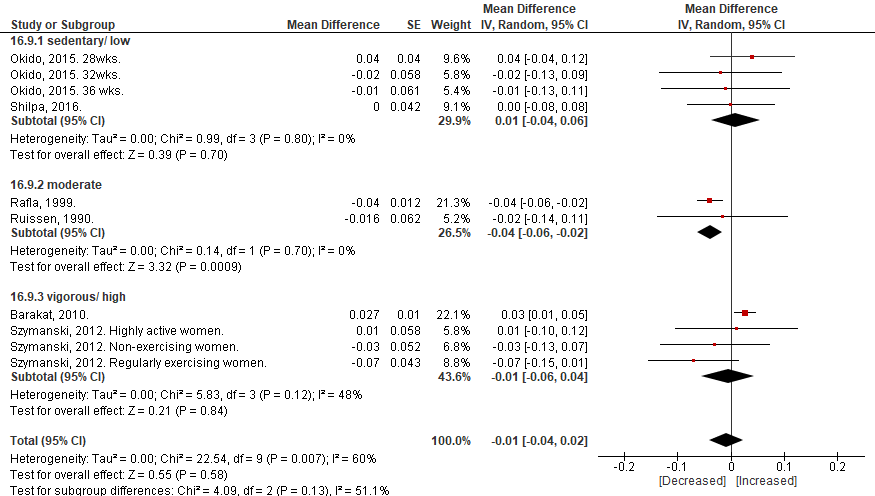
*Online Supplement Figure 41.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by previous physical activity levels. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



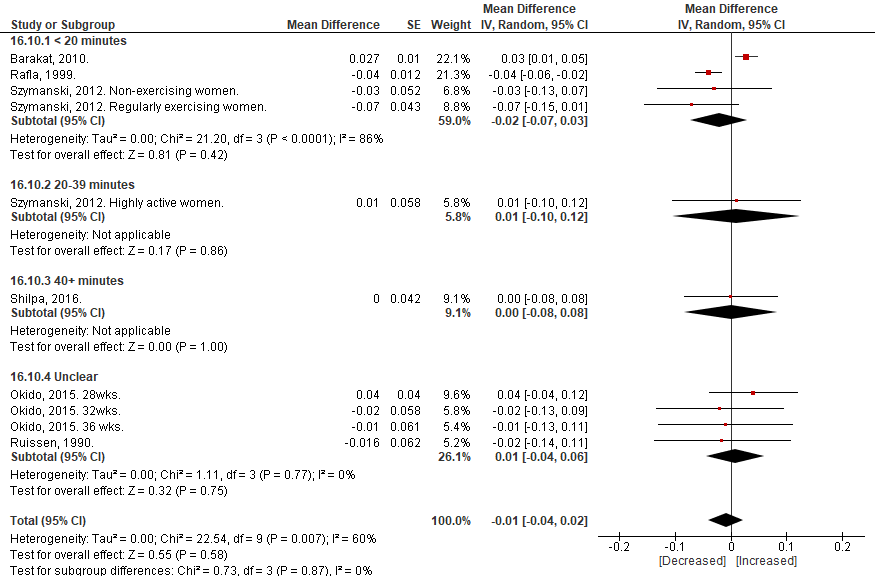
*Online Supplement Figure 42.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by type of exercise. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

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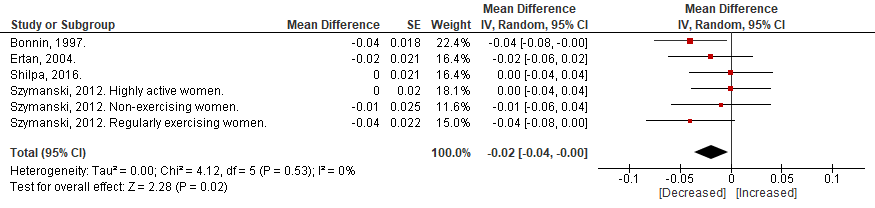
*Online Supplement Figure 43.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by trimester. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



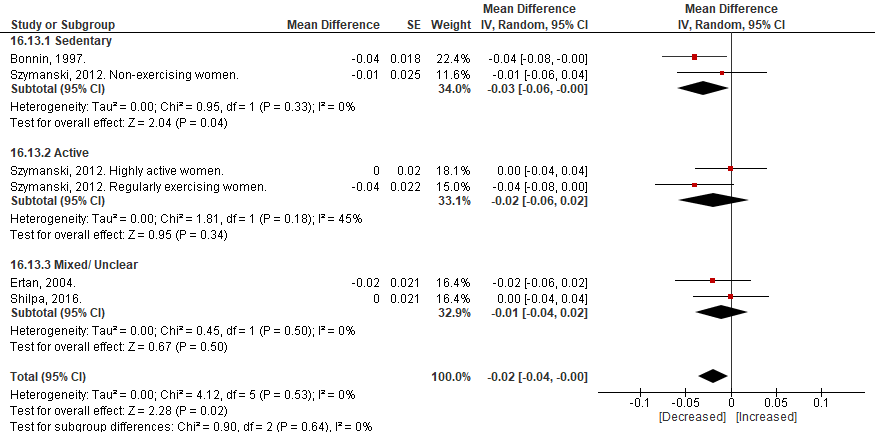
*Online Supplement Figure 44.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by intensity. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



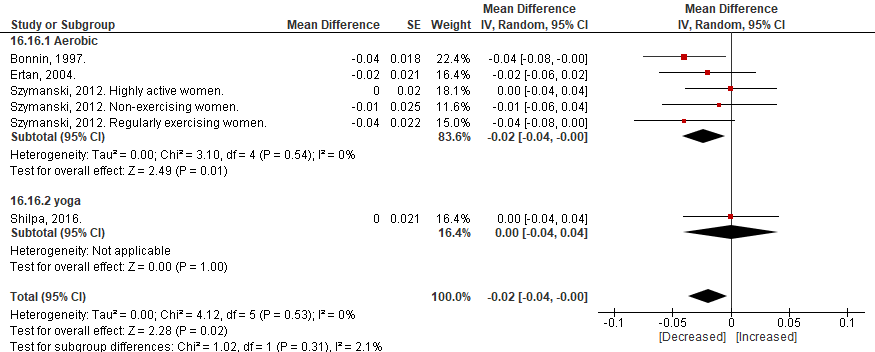
*Online Supplement Figure 45.* Effect of acute prenatal exercise on umbilical artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by duration of exercise. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



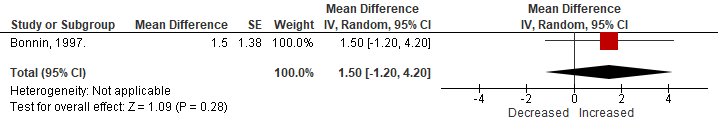
*Online Supplement Figure 46.* Effect of acute prenatal exercise on umbilical artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. RI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



*Online Supplement Figure 47.* Effect of acute prenatal exercise on umbilical artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by previous physical activity levels. RI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.

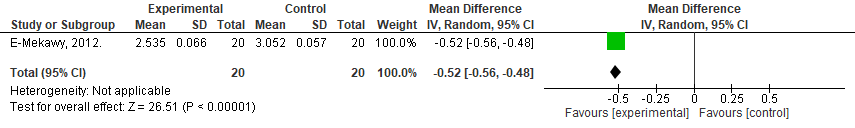


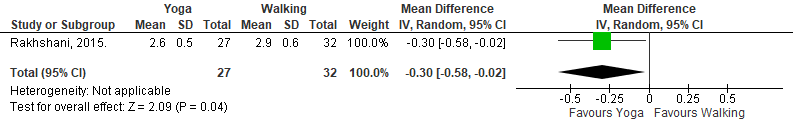
*Online Supplement Figure 48.* Effect of acute prenatal exercise on umbilical artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by types of exercise. RI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



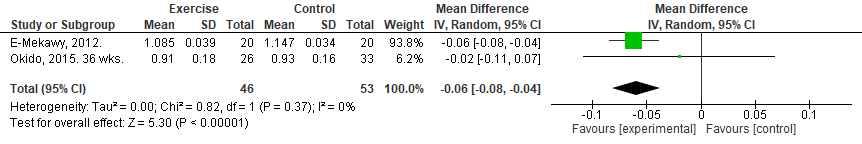
*Online Supplement Figure 49.* Effect of acute prenatal exercise on umbilical artery mean blood velocity (Vmean). Data presented as a mean difference from pre-to-following exercise. Subgroup analysis separating studies by types of exercise. Vmean is expressed in cm/s. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.

## Umbilical artery responses to chronic exercise

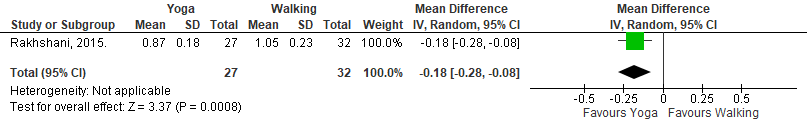
*Online Supplement Figure 50.* Randomized controlled trial reporting on the effect of prenatal exercise intervention compared to control on umbilical artery systolic/diastolic ratio (S/D) at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



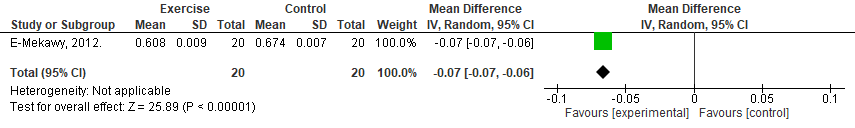
*Online Supplement Figure 51.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared with walking interventions on umbilical artery systolic/diastolic ratio (S/D) at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



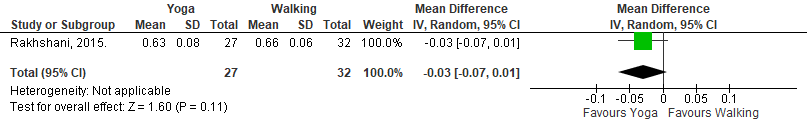
*Online Supplement Figure 52.* Randomized controlled trial reporting on the effect of prenatal exercise intervention compared to control on umbilical artery pulsatility index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



*Online Supplement Figure 53.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared to walking interventions on umbilical artery pulsatility index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

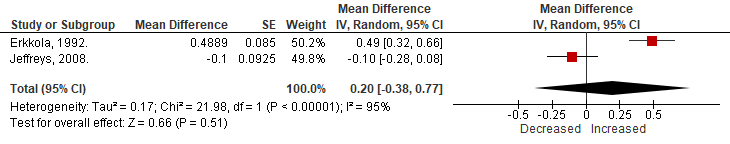


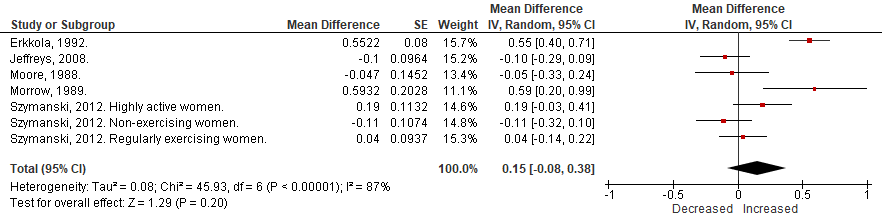
*Online Supplement Figure 54.* Randomized controlled trial reporting on the effect of prenatal exercise intervention compared to control on umbilical artery resistance index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

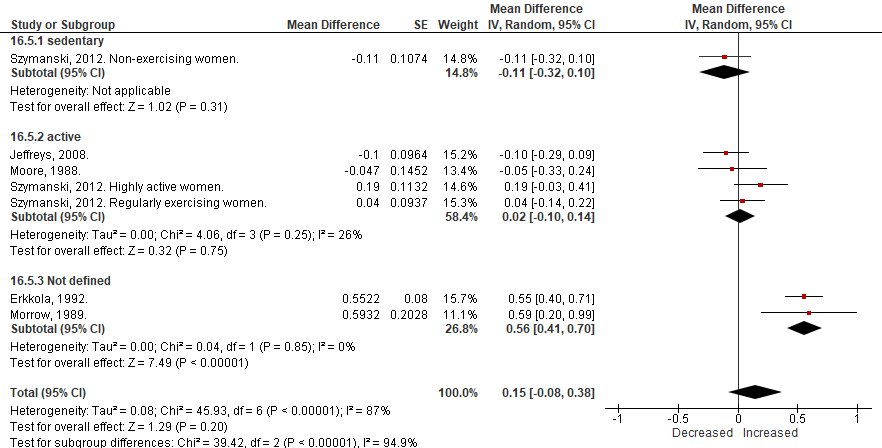


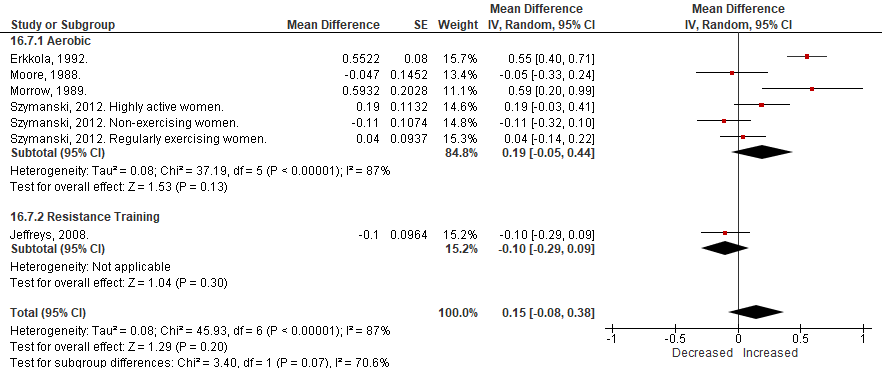
*Online Supplement Figure 55.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared to walking interventions on umbilical artery resistance index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

## Uterine artery during and following acute exercise

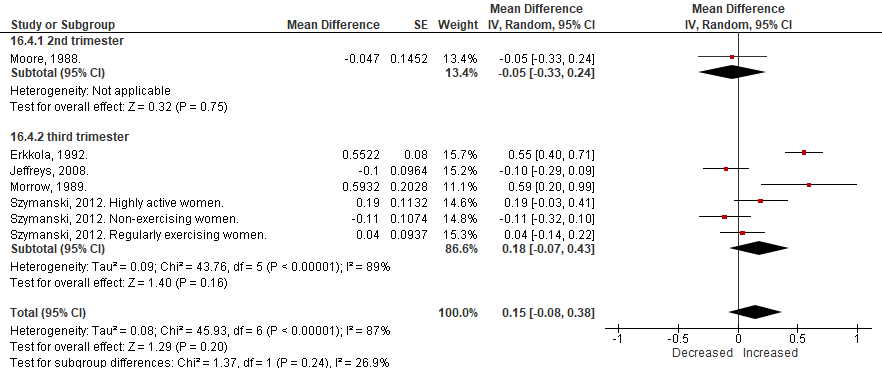
*Online Supplement Figure 56.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-during exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

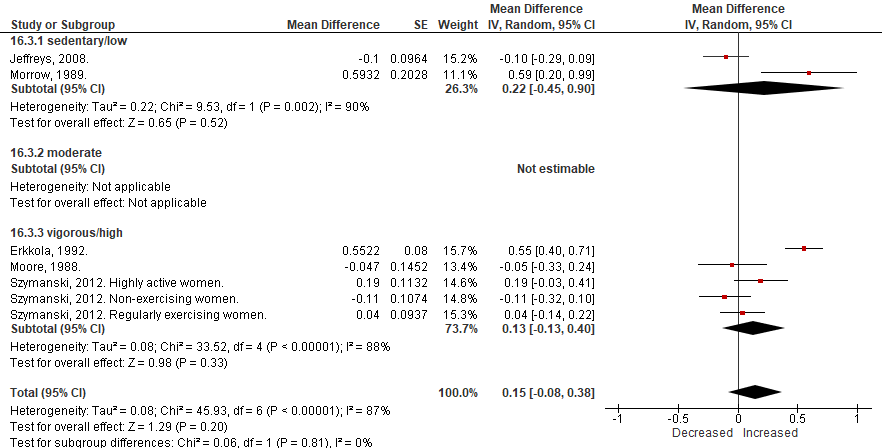
*Online Supplement Figure 57.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

*Online Supplement Figure 58.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Subgroup analysis separating studies by previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

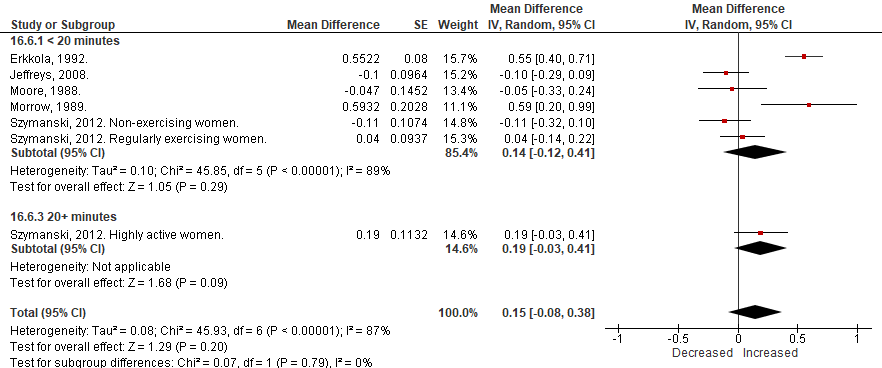
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*Online Supplement Figure 59.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Subgroup analysis separating studies by type of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

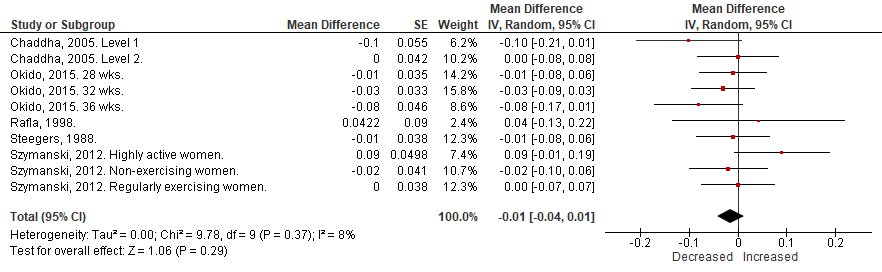
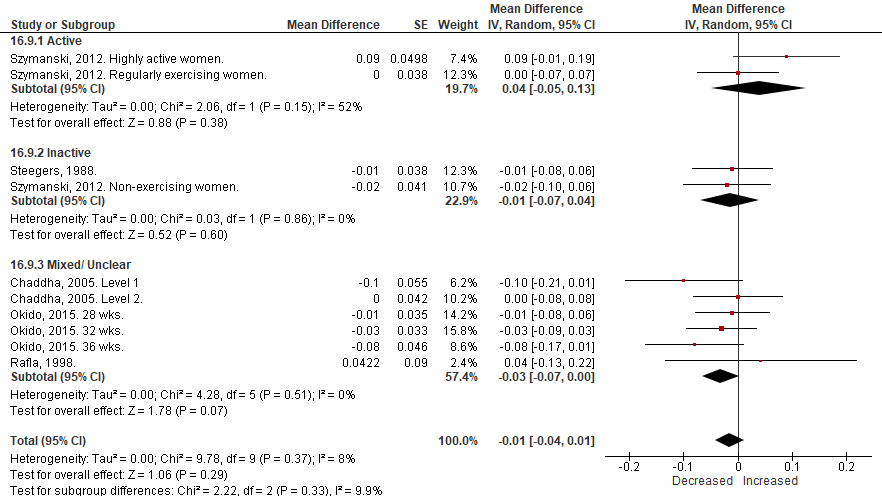
*Online Supplement Figure 60.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Subgroup analysis separating studies by trimester. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

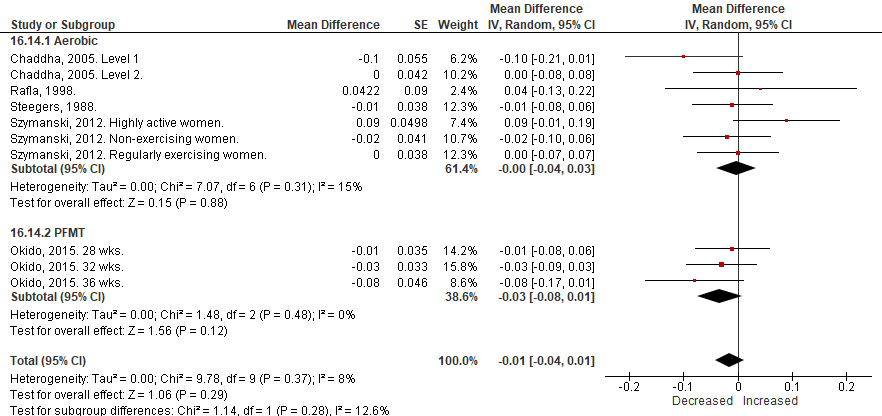
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*Online Supplement Figure 61.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Subgroup analysis separating studies by intensity of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

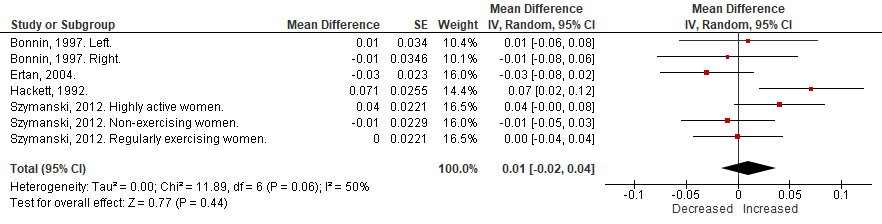
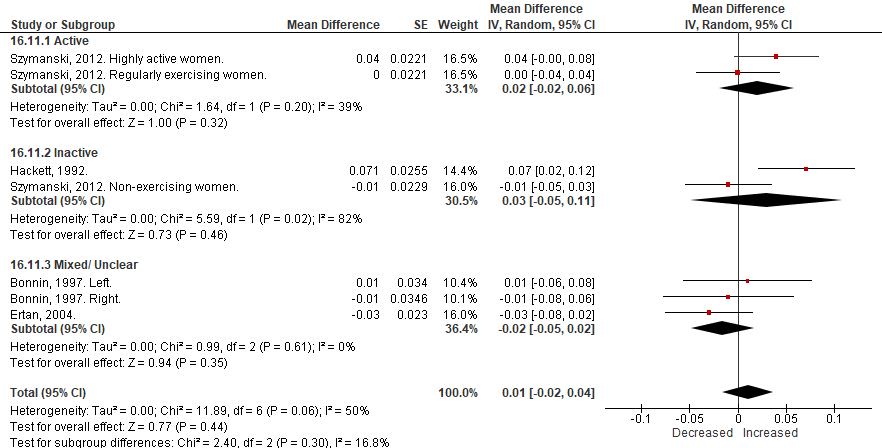
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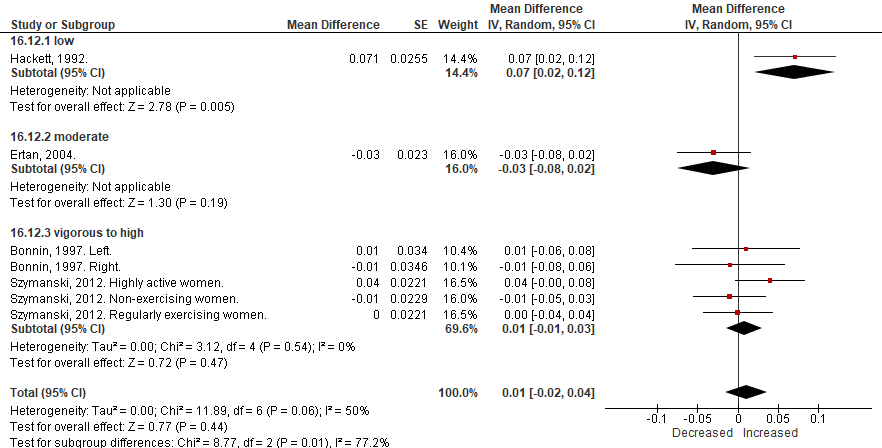
*Online Supplement Figure 62.* Effect of acute prenatal exercise on uterine artery S/D ratio. Data presented as a mean difference from pre-to-following exercise. S/D ratio is expressed in arbitrary units. Subgroup analysis separating studies by duration of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

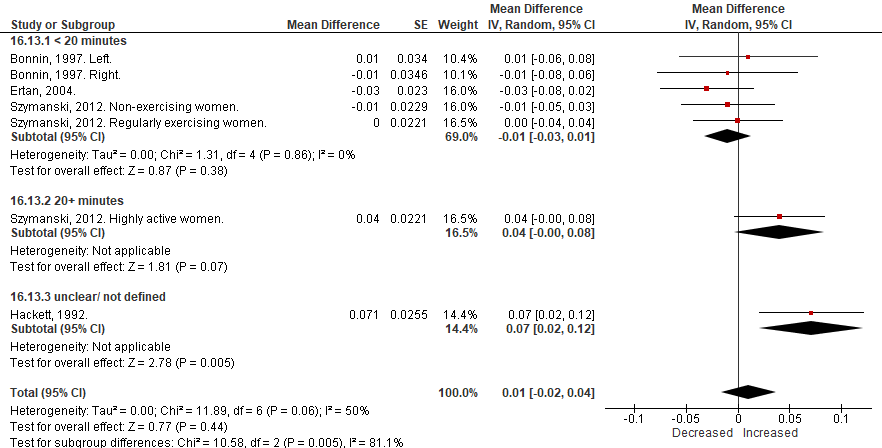
*Online Supplement Figure 63.* Effect of acute prenatal exercise on uterine artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. PI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; UPVI, uteroplacental vessel insufficiency.*Online Supplement Figure 64.* Effect of acute prenatal exercise on uterine artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. PI is expressed in arbitrary units. Subgroup analysis separating studies by previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; UPVI, uteroplacental vessel insufficiency.

**

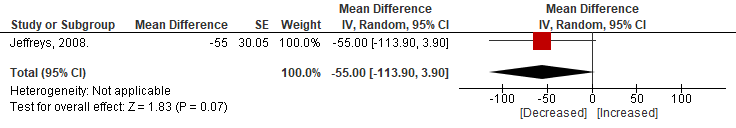
*Online Supplement Figure 65.* Effect of acute prenatal exercise on uterine artery pulsatility index (PI). Data presented as a mean difference from pre-to-following exercise. PI is expressed in arbitrary units. Subgroup analysis separating studies by type of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; PFMT, pelvic floor muscle training; UPVI, uteroplacental vessel insufficiency.

*Online Supplement Figure 66.* Effect of acute prenatal exercise on uterine artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. RI is expressed in arbitrary units. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction. *Online Supplement Figure 67.* Effect of acute prenatal exercise on uterine artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. RI is expressed in arbitrary units. Subgroup analysis separating studies by previous physical activity levels. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.

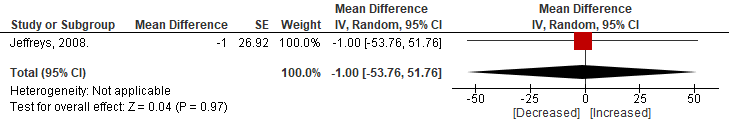
*Online Supplement Figure 68.* Effect of acute prenatal exercise on uterine artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. RI is expressed in arbitrary units. Subgroup analysis separating studies by intensity of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



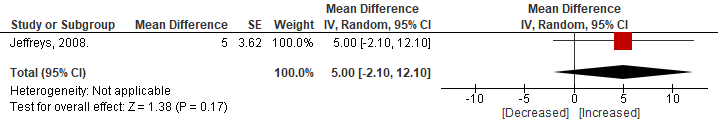
*Online Supplement Figure 69.* Effect of acute prenatal exercise on uterine artery resistance index (RI). Data presented as a mean difference from pre-to-following exercise. RI is expressed in arbitrary units. Subgroup analysis separating studies by duration of exercise. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error; IUGR, intrauterine growth restriction.



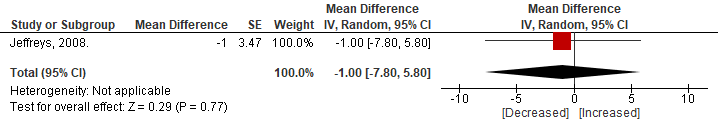
*Online Supplement Figure 70.* Effect of acute prenatal exercise on uterine artery volumetric blood flow. Data presented as a mean difference from pre-to-during exercise. Volumetric blood flow is expressed in ml/min. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



*Online Supplement Figure 71.* Effect of acute prenatal exercise on uterine artery volumetric blood flow. Data presented as a mean difference from pre-to-following exercise. Volumetric blood flow is expressed in ml/min. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

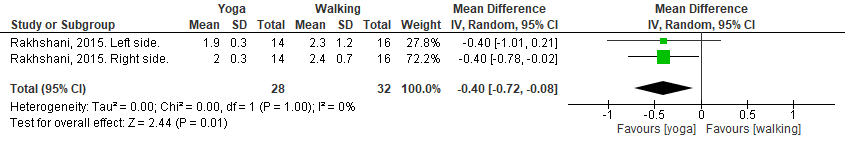


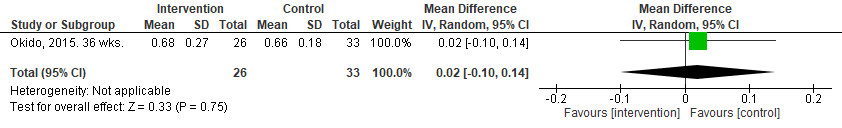
*Online Supplement Figure 72.* Effect of acute prenatal exercise on uterine artery blood velocty. Data presented as a mean difference from pre-to-during exercise. Blood velocity is expressed in cm/s. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

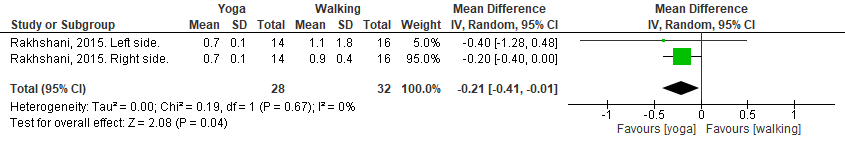


*Online Supplement Figure 73.* Effect of acute prenatal exercise on uterine artery blood velocty. Data presented as a mean difference from pre-to-following exercise. Blood velocity is expressed in cm/s. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

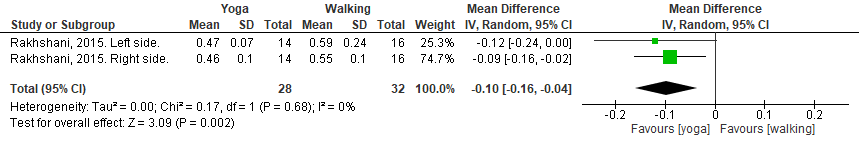
## Uterine artery responses to chronic exercise

*Online Supplement Figure 74.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared with walking interventions on uterine artery systolic/diastolic ratio (S/D) at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

*Online Supplement Figure 75.* Randomized controlled trial reporting on the effect of prenatal exercise intervention compared to control. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



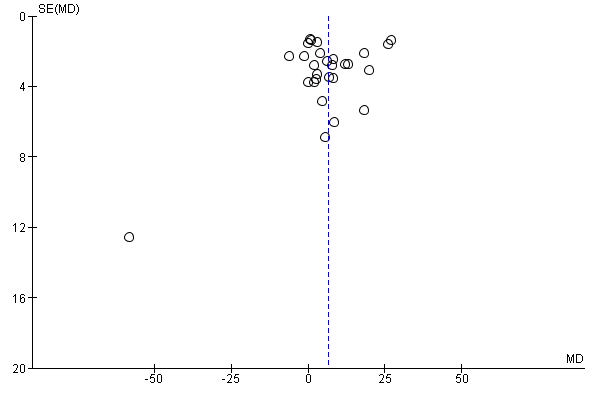
*Online Supplement Figure 76.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared with walking interventions on uterine artery pulsatility index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.



*Online Supplement Figure 77.* Superiority trial (randomized controlled trial) reporting on the effect of prenatal yoga compared with walking interventions on uterine artery resistance index at rest. Analyses conducted with a random effects model. CI, confidence interval; df, degrees of freedom; IV, inverse variance; SE, standard error.

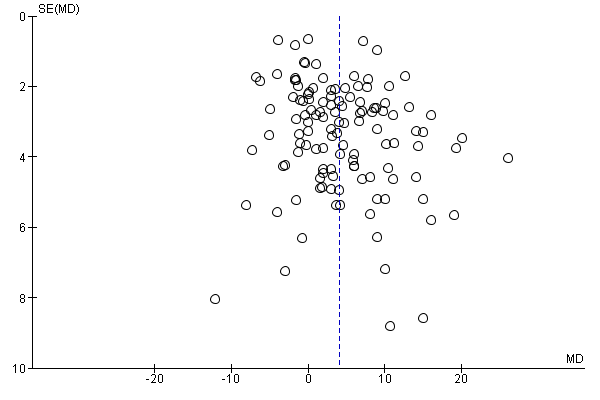
# Supplemental Figures (Funnel Plots)

## Fetal Heart Rate During Exercise



*Online Supplement Figure 78.* Funnel plot of the meta-analysis of published acute prenatal exercise on the fetal heart rate response during exercise. Each plotted point represents the mean difference (pre-during exercise) in FHR for a distinct group within each study. The vertical line represents the average mean difference of 6.35bpm found in the meta-analysis.

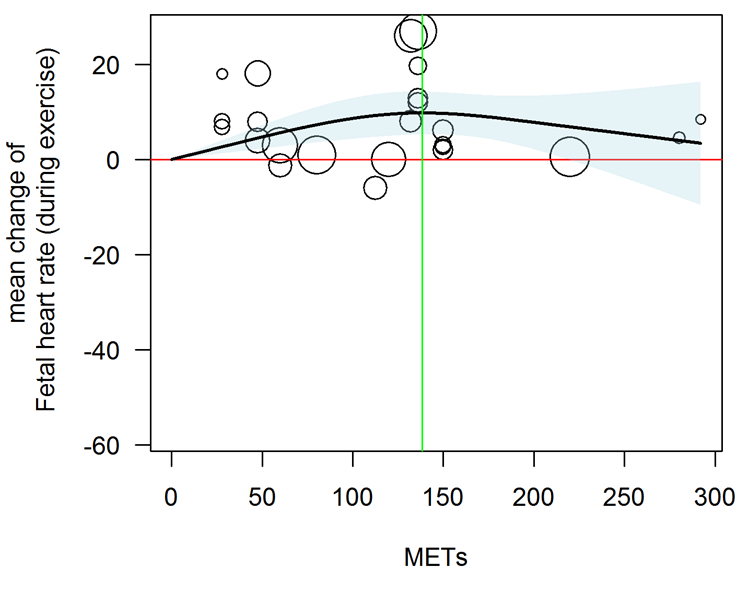
## Fetal Heart Rate Following Exercise



*Online Supplement Figure 79.* Funnel plot of the meta-analysis of published acute prenatal exercise on the fetal heart rate response following exercise. Each plotted point represents the mean difference (pre-following exercise) in FHR for a distinct group within each study. The vertical line represents the average mean difference of 4.05bpm found in the meta-analysis.

# Meta-regressions

## Fetal heart rate (during exercise), Predictor: Volume (MET minutes) per session.



*Online Supplement Figure 80.* Curvilinear (spline) regression of the mean change in fetal heart rate from pre-to-during acute exercise. p <0.001. Black line, line of best fit; red line, mean difference of zero; green line, maximum of non-linear curve; shaded area, 95% confidence intervals. Volume of exercise per session was assessed as MET minutes per session and was determined by multiplying the METs associated with the activity by the duration (minutes) of the activity. Circle size is related to the weight of the study in the regression.

P-values, nonlinear: <0.001. Maximum of nonlinear curve: 9.8 at 138.3 METs

## df AIC BIC AICc logLik LRT pval QE tau^2 R^2  
## Full 3 178.1944 181.7286 179.3944 -86.0972 468.3329 69.4584   
## Reduced 2 180.2508 182.6069 180.8223 -88.1254 4.0564 0.0440 577.1653 82.9822 16.30%

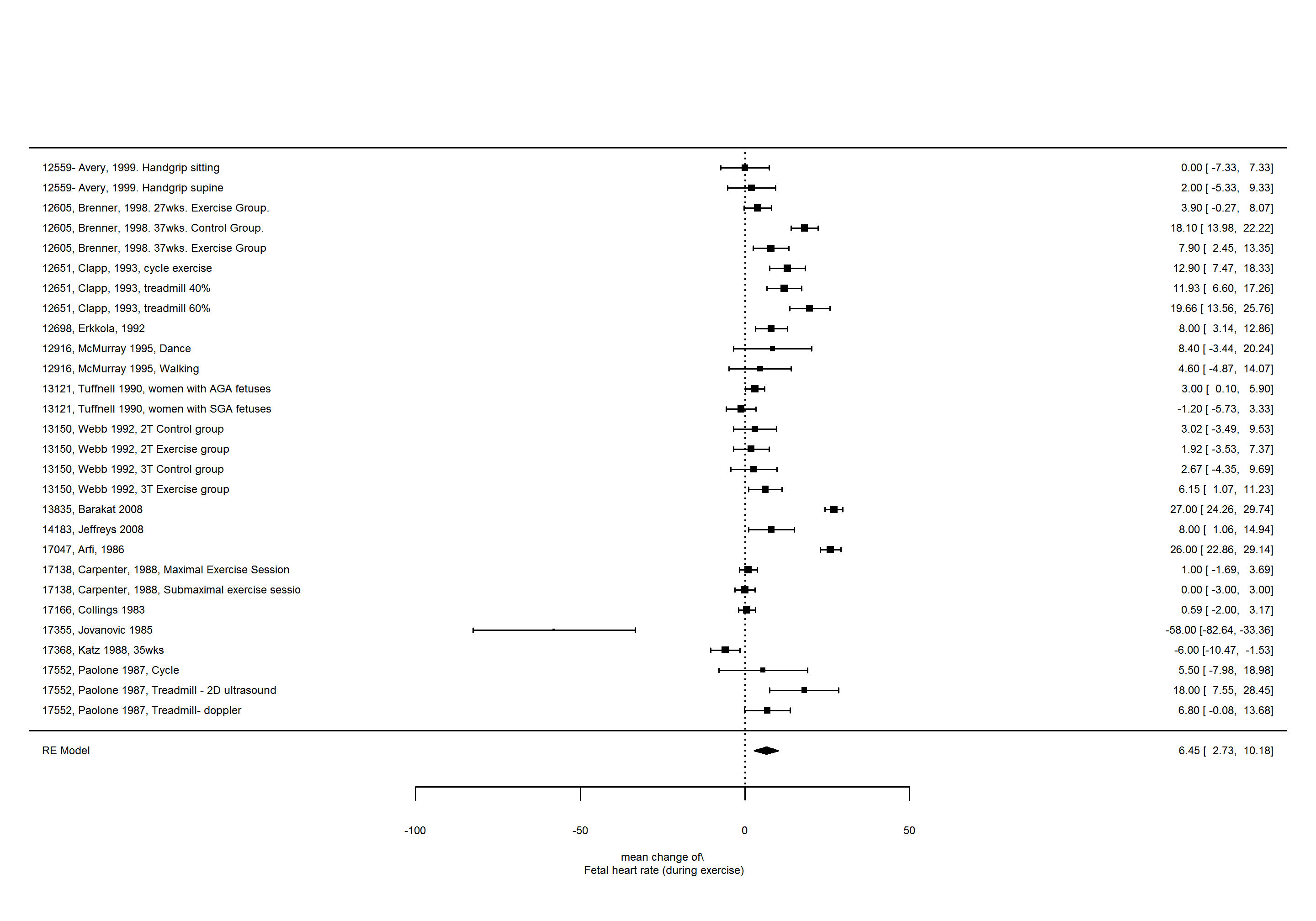
*Data set*

**Date filename:** ../Data/CONVERSION OF SE TO SD FOR NICK - FHR - meta-regressions May 31, 2018.xlsx  
**Sheet:** FHR 1.1 DURING  
**Data file last modified**: 01-Jun-2018 at 08:18

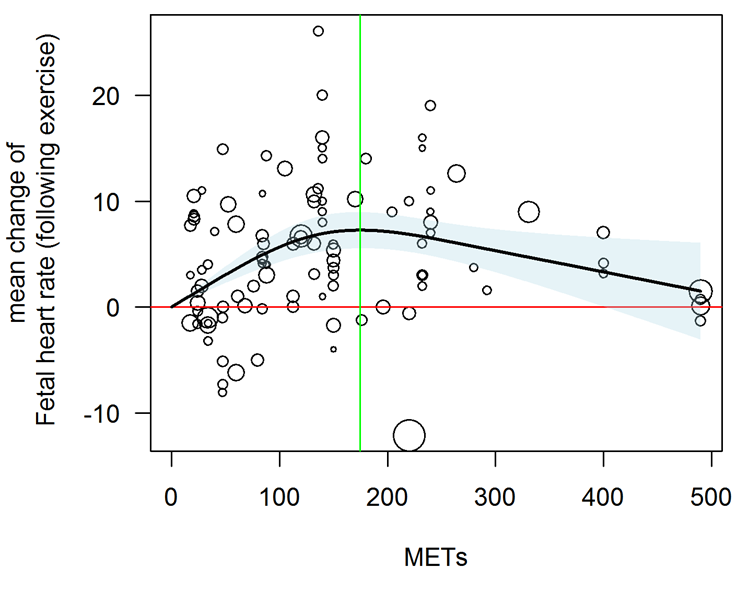
The data set has 28 rows and 9 columns.

*Random effects meta-analysis of mean change of fetal heart rate (during exercise)*

##   
## Random-Effects Model (k = 28; tau^2 estimator: REML)  
##   
## tau^2 (estimated amount of total heterogeneity): 88.8918 (SE = 27.2472)  
## tau (square root of estimated tau^2 value): 9.4282  
## I^2 (total heterogeneity / total variability): 94.20%  
## H^2 (total variability / sampling variability): 17.23  
##   
## Test for Heterogeneity:   
## Q(df = 27) = 555.4115, p-val < .0001  
##   
## Model Results:  
##   
## estimate se zval pval ci.lb ci.ub   
## 6.4520 1.9001 3.3957 0.0007 2.7280 10.1761 \*\*\*  
##   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1



## Fetal heart rate (following exercise), Predictor: Volume (MET minutes) per session.



*Online Supplement Figure 81.* Curvilinear (spline) regression of the mean change in fetal heart rate from pre-to-following acute exercise. p <0.001. Black line, line of best fit; red line, mean difference of zero; green line, maximum of non-linear curve; shaded area, 95% confidence intervals. Volume of exercise per session was assessed as MET minutes per session and was determined by multiplying the METs associated with the activity by the duration (minutes) of the activity. Circle size is related to the weight of the study in the regression.

P-values, nonlinear: <0.001. Maximum of nonlinear curve: 7.2 at 174.6 METs

## df AIC BIC AICc logLik LRT pval QE tau^2 R^2  
## Full 3 667.5133 675.3883 667.7582 -330.7567 798.0272 26.8195   
## Reduced 2 692.1861 697.4361 692.3073 -344.0931 26.6728 <.0001 860.9723 37.1016 27.71%

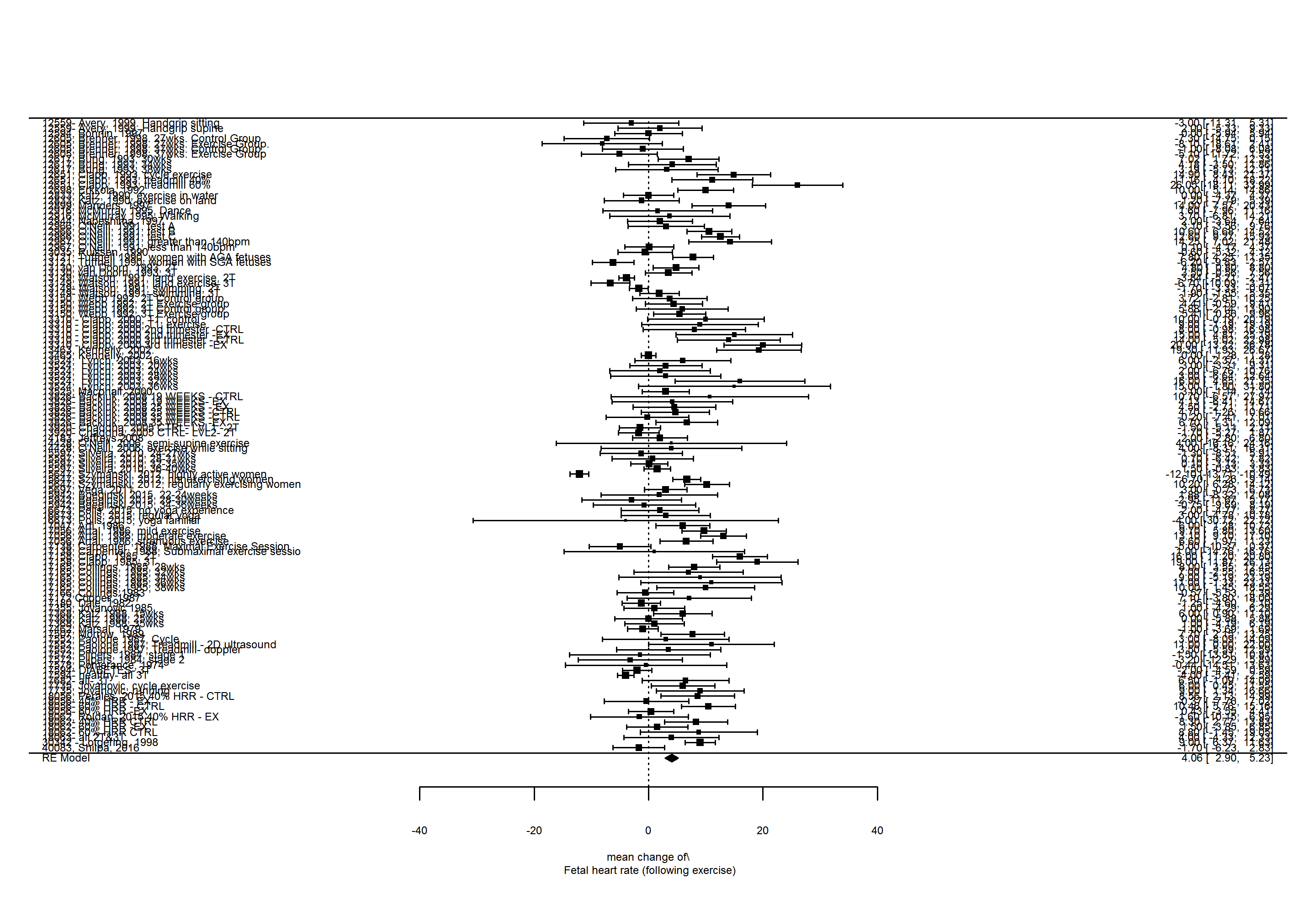
*Data set*

**Date filename:** ../Data/CONVERSION OF SE TO SD FOR NICK - FHR - meta-regressions May 31, 2018.xlsx  
**Sheet:** following  
**Data file last modified**: 01-Jun-2018 at 08:18

The data set has 122 rows and 9 columns.

*Random effects meta-analysis of mean change of fetal heart rate (following exercise)*

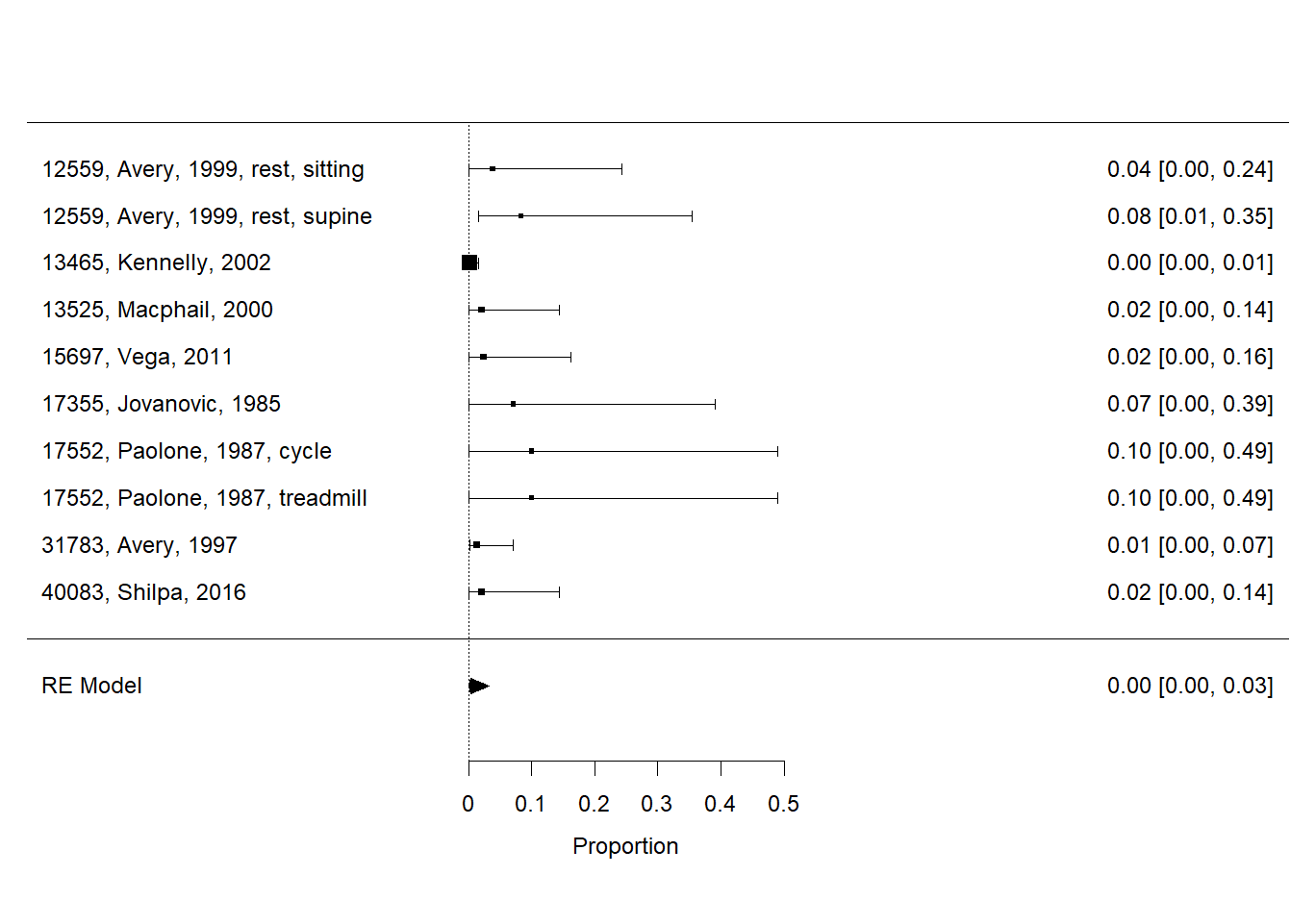
##   
## Random-Effects Model (k = 122; tau^2 estimator: REML)  
##   
## tau^2 (estimated amount of total heterogeneity): 30.8783 (SE = 5.3762)  
## tau (square root of estimated tau^2 value): 5.5568  
## I^2 (total heterogeneity / total variability): 86.12%  
## H^2 (total variability / sampling variability): 7.20  
##   
## Test for Heterogeneity:   
## Q(df = 121) = 1018.9645, p-val < .0001  
##   
## Model Results:  
##   
## estimate se zval pval ci.lb ci.ub   
## 4.0616 0.5940 6.8377 <.0001 2.8974 5.2259 \*\*\*  
##   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1



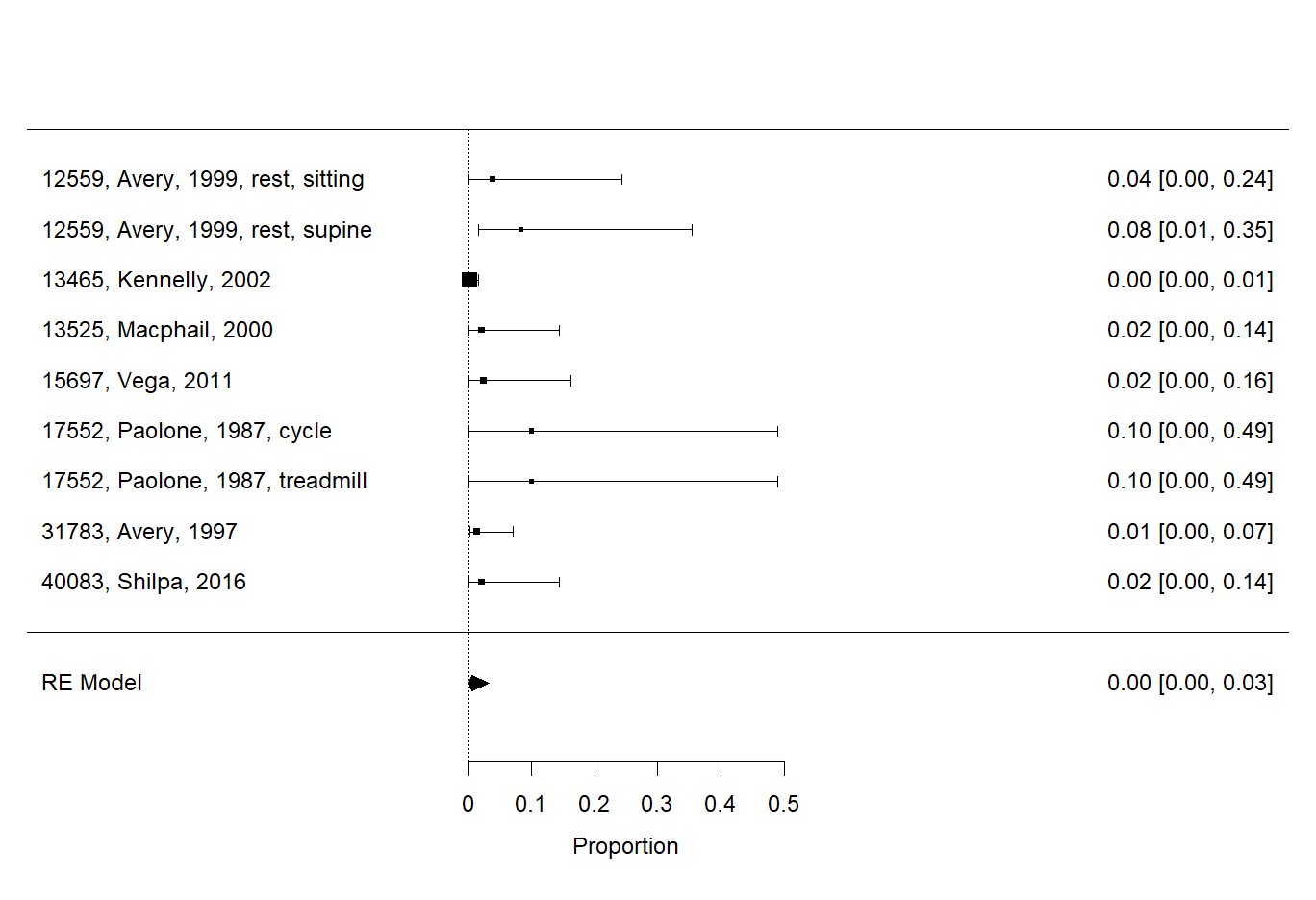
# Proportions/ Incidence

To assess bradycardia and tachycardia in response to acute exercise, the pooled proportion of bradycardia or tachycardia events was obtained through random effects pooling of logit-transformed proportions in R (version 3.4.1) using the rma.glmm function for generalized linear mixed effects models in the metaphor package.92

## Bradycardia occurring during pre-exercise rest

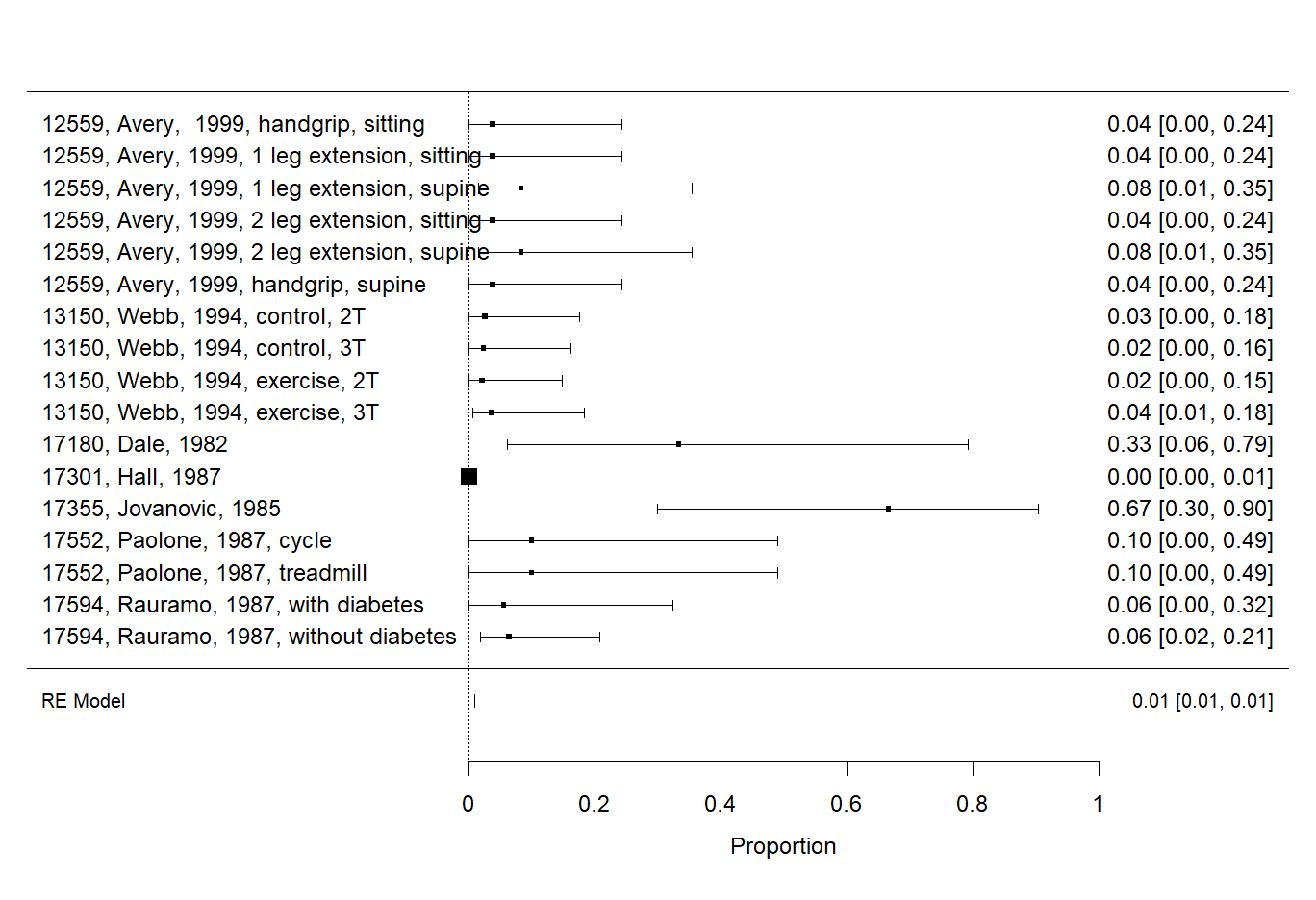


*Online Supplement Figure 82*. Proportion of bradycardia events occurring at rest prior to prenatal exercise. Incidence of bradycardia at rest was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. Data from all studies reporting on bradycardia (author defined). I2= 40%.

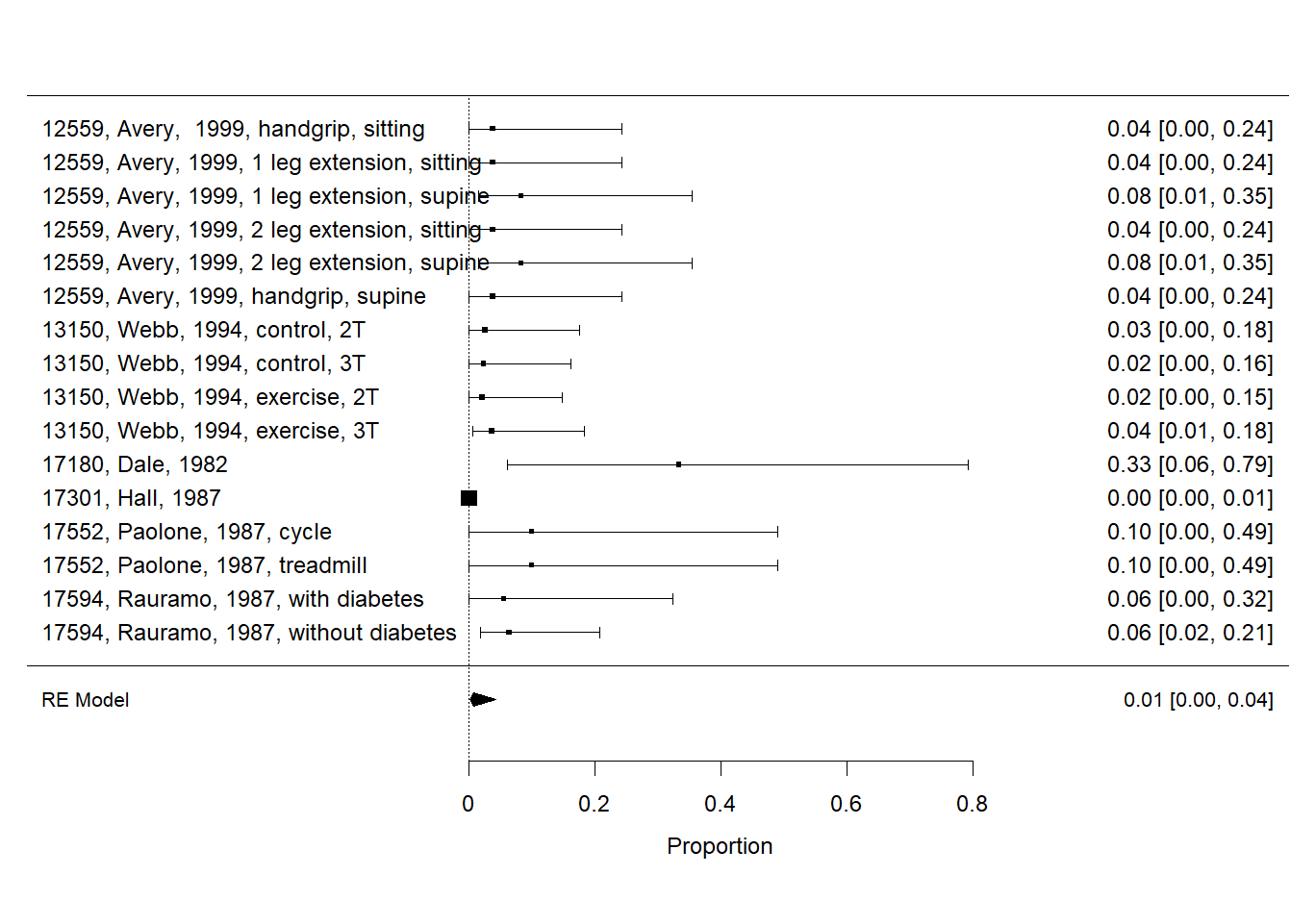


*Online Supplement Figure 83*. Proportion of bradycardia events occurring at rest prior to prenatal exercise. Incidence of bradycardia at rest was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. Sensitivity analysis removing study which may have artifact7 I2= 42%

## Bradycardia occurring during acute exercise sessions

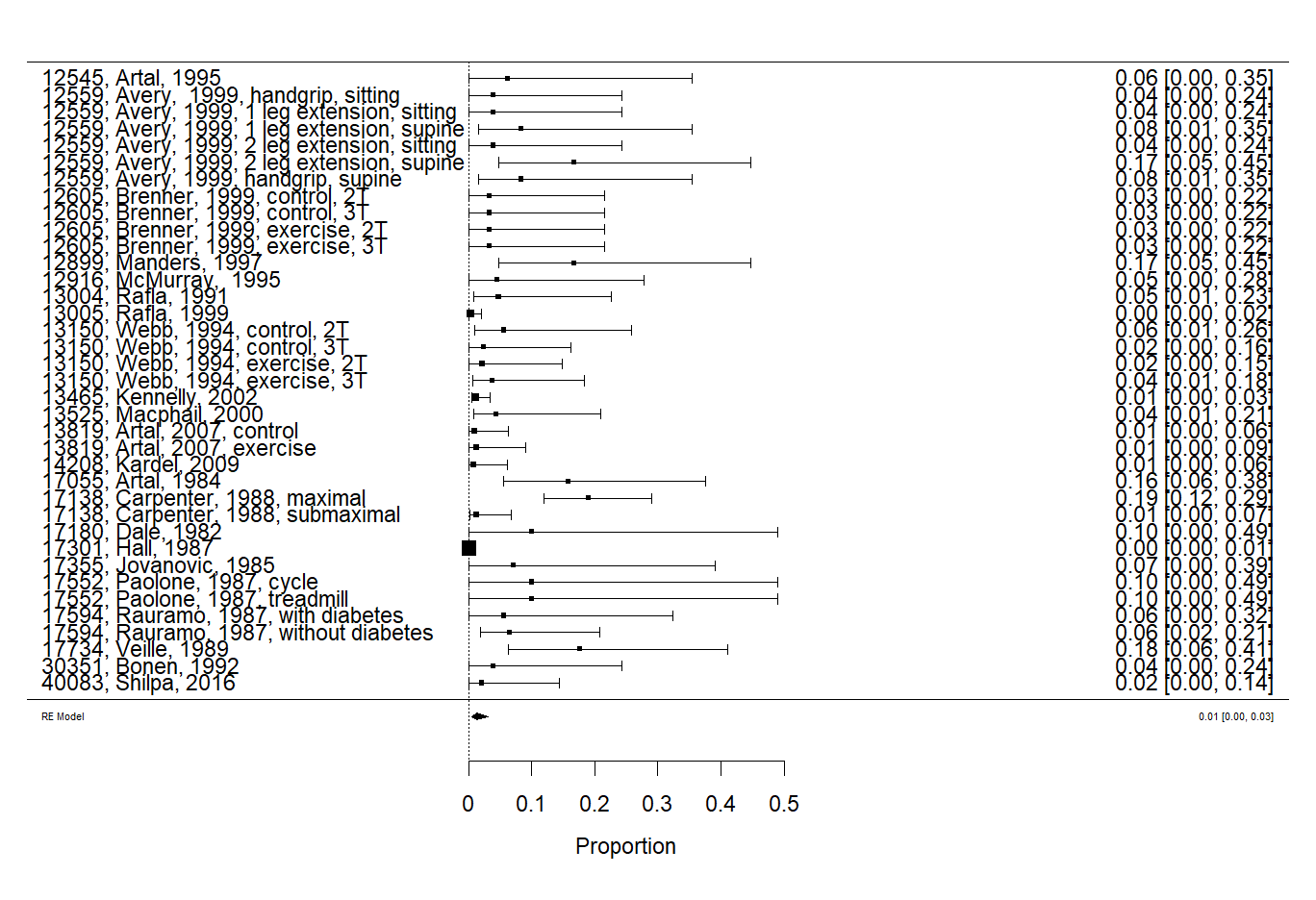


Online Supplement Figure 84. Proportion of bradycardia events occurring during prenatal exercise. Incidence of bradycardia during acute exercise sessions was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. Data from all studies reporting on bradycardia (author defined). I2= 80%

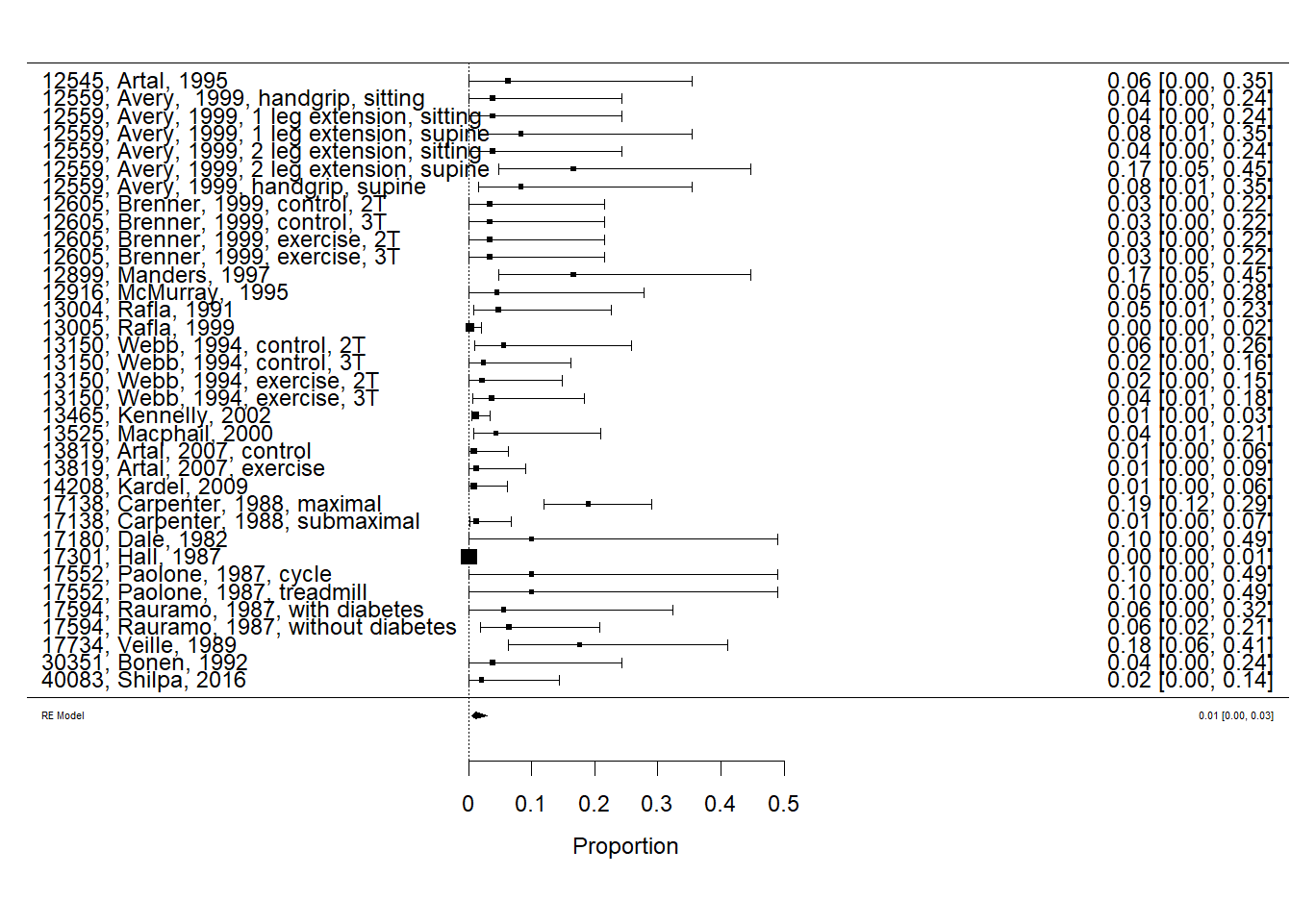


Online Supplement Figure 85. Proportion of bradycardia events occurring during prenatal exercise. Incidence of bradycardia during acute exercise sessions was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. Sensitivity analysis removing study which may have artifact. 7 I2= 67%.

## Bradycardia occurring during post-exercise recovery

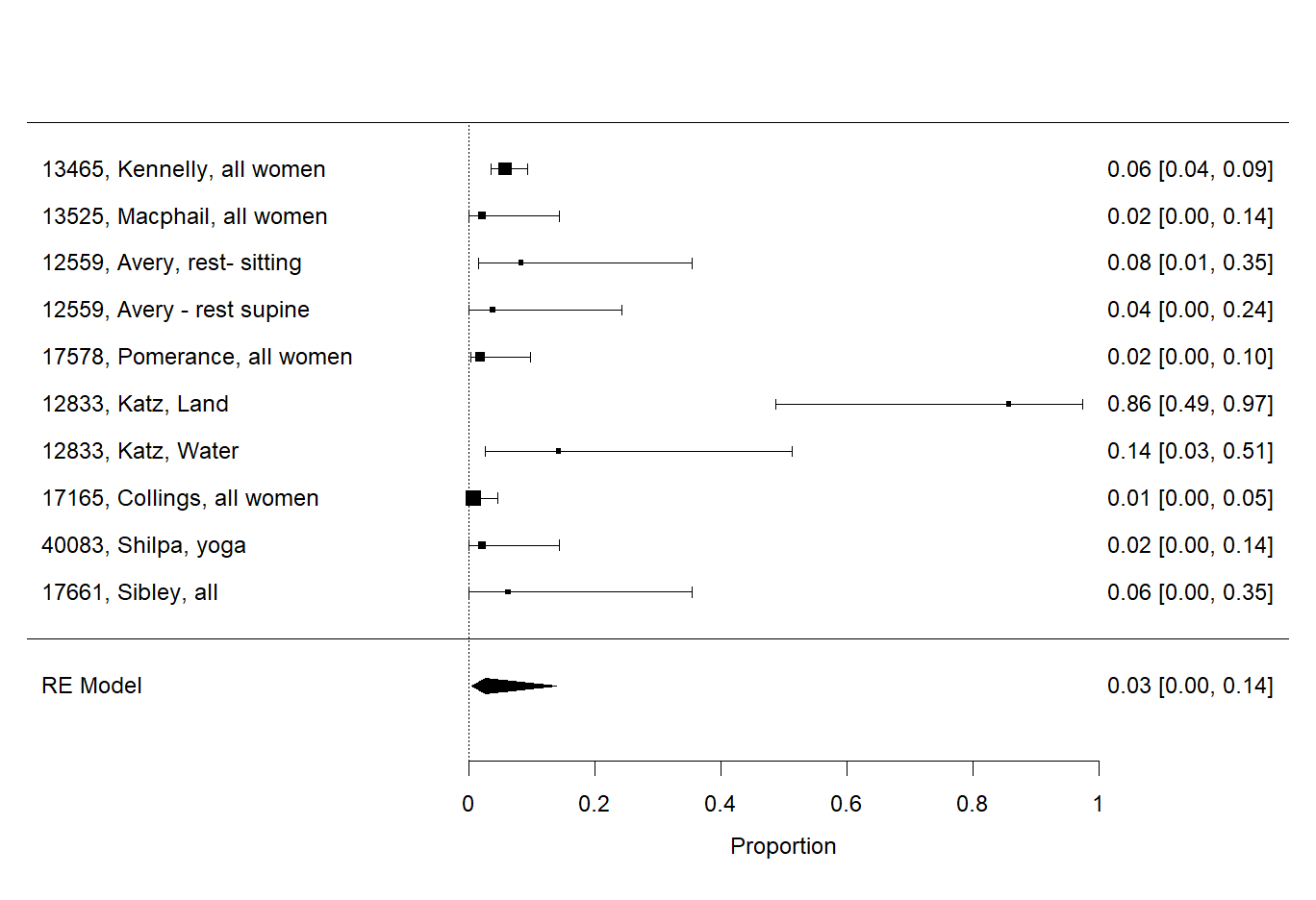


*Online Supplement Figure 86.* Proportion of bradycardia events occurring at rest following acute prenatal exercise. Incidence of bradycardia following exercise was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. I2= 76%



*Online Supplement Figure 87*. Proportion of bradycardia events occurring at rest following acute prenatal exercise. Incidence of bradycardia following exercise was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. Sensitivity analysis removing two studies which may have artifact.7 71 I2= 75%

## Tachycardia occurring during pre-exercise rest.

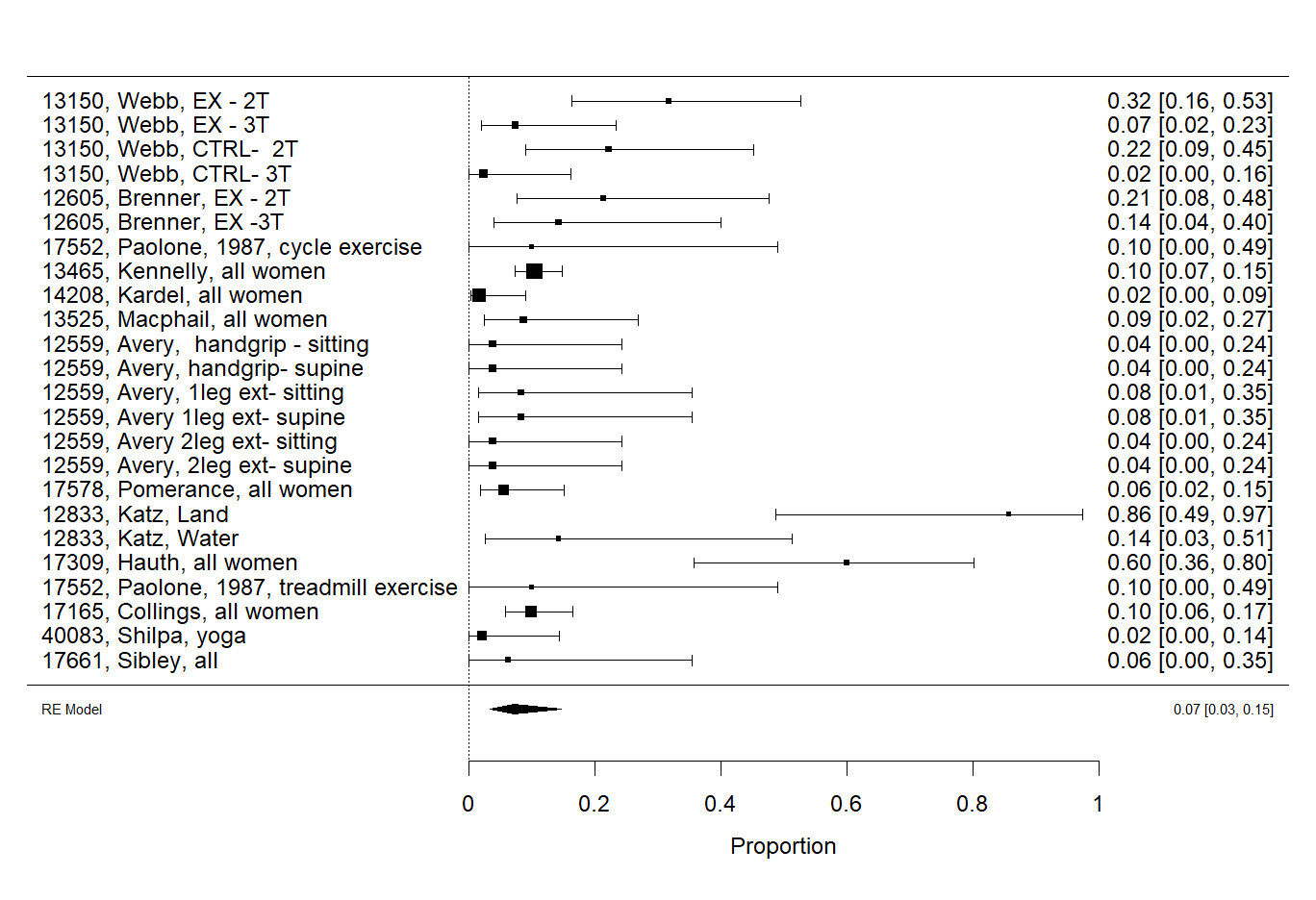


*Online Supplement Figure 88***.** Proportion of tachycardia events occurring at rest prior to prenatal exercise. Incidence of tachycardia at rest was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. I2= 86%

## Tachycardia occurring during acute exercise session.

*Online Supplement Figure 89***.** Proportion of tachycardia events occurring during acute prenatal exercise. Incidence of tachycardia during exercise was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. I2= 72%

## Tachycardia occurring following an acute exercise session



*Online Supplement Figure 90***.** Proportion of tachycardia events occurring at rest following acute prenatal exercise. Incidence of tachycardia following exercise was used and pooled proportion of bradycardia events was obtained through random effects pooling of logit-transformed proportions. I2= 83%

# Search strategies

The following databases were searched on January 6th, 2017:

* Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R)
* Ovid EMBASE
* Ovid All EBM [Evidence-Based Medicine] Reviews: Cochrane Database of Systematic and Cochrane Central Register of Controlled Trials
* Ovid PsycInfo 1806-Present
* EBSCO CINAHL Plus with Full-text, 1937-Present
* EBSCO Sport Discus with Full-text. 1975-Present
* EBSCO ERIC, 1966-Present
* EBSCO Child Development and Adolescent Studies, 1927-Present
* Scopus, 1960-Present
* Web of Science Core Collection (including Emerging Sources Citation Index) , 1900-Present
* Clinicaltrials.gov
* TRIP database

## Maternal Outcomes Strategy

### MEDLINE

1. exp Exercise/ or Athletes/ or exp Exercise Movement Techniques/ or Physical Exertion/ or exp Exercise Therapy/ or exp Sports/ or Motor Activity/ or Sedentary Lifestyle/ or (exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity).ti,kf. or exercise.ab. /freq=2 or physical\* activ\*.ab. /freq=2 or (weight\* adj2 lift\*).ti,kf. or ((muscle or muscular or strength\*) adj2 conditioning).ti,kf.

2. exp Pregnancy Complications/ or Pregnancy Outcome/ or exp Labor, Obstetric/ or exp Delivery, Obstetric/ or exp Extraction, Obstetrical/ or pregnan\*.ti,hw,kf.

3. ((birth or pregnancy or childbirth) adj3 (outcome\* or complication\*)).mp.

4. (((spontaneous or induc\* or onset or length) adj3 (labor or labour)) or c?esarean).mp.

5. (episiotom\* or vaginal delivery or gestational diabetes or pre-eclampsia or preeclampsia or gestosis).mp.

6. (((normal or instrumental or assisted) adj2 (delivery or birth or childbirth)) or (forceps or ventouse or vacuum extraction)).mp.

7. ((mode of delivery or type of delivery) and (pregnan\* or birth or childbirth or obstetric\* or labor or labour)).mp.

8. ((tear\* or ruptur\* or hemorrhage\*) adj2 (placent\* or vagin\* or membran\* or periton\*)).mp.

9. (miscarriage\* or spontaneous abortion\*).mp.

10. or/2-9

11. 1 and 10

12. Pregnancy/ or pregnan\*.ti,hw,kf. or exp Pregnancy Trimesters/ or Peripartum Period/ or Postpartum Period/ or (antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,kf.

13. 1 and 12

14. ((pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\*) adj5 (exercise or physical\* activ\* or strenuous activit\* or physical inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* adj2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or ((muscle or muscular or strength\*) adj2 conditioning))).ab.

15. 13 or 14

16. exp Insulins/ or diabetes mellitus/ or exp diabetes mellitus, type 1/ or exp diabetes mellitus, type 2/ or diabetes, gestational/ or prediabetic state/ or hemoglobin a, glycosylated/ or (insulin or glucose or glyc?emic control or blood sugar or diabet\* or prediabet\* or hba1c or glycosylated h?emoglobin or hyperglyc?emi\* or hypoglyc?emi\* or (weight adj3 (gain\* or change\* or loss or lose or retention)) or bmi or body mass index or body composition or skinfold thickness or ((hip or waist) adj2 ratio) or ((waist or abdominal) adj2 circumference) or overweight or obes\* or adipos\* or underweight or normal weight or healthy weight or hypertension or hypotension or fainting or syncope or lightheaded\* or light headed\* or dizziness or blood pressure or tox?emi\* or eph complex or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or cardio-metabolic or metabolic or heart or cardio\* or cardiac or lipid\* or placental growth factor\* or triglyceride\* or ldl or hdl or lipoprotein or cholesterol).mp.

17. dehydration/ or exp Cardiovascular Diseases/ or (dehydrat\* or heart disease\* or cardiovascular disease\*).mp.

18. adaptation, physiological/ or body temperature regulation/

19. Physical Fitness/ or exp Physical Endurance/ or me.fs. or (safe\* or harm\* or risk\* or fitness or aerobic capacity or oxygen consumption or vo2 max or vo2max or vo2 peak or vo2peak or frequency or intensity or duration or dose response or fitt or zone or (type\* adj2 exercise)).mp.

20. exp Chronic disease/ or exp Osteoporosis/ or exp Urinary Incontinence/ or (chronic disease\* or chronic illness\* or osteoporosis or incontinen\*).mp.

21. exp Back Pain/ or Pelvic Pain/ or Muscle Cramp/ or (Pain/ and exp Hip Joint/) or ((hip or back or pelvic or pelvis) adj3 (pain or discomfort or ache)).mp. or cramp\*.mp.

22. Mental Health/ or exp Mental Disorders/ or Body Image/ or Self Concept/ or (mental health or mental disorder\* or mental illness\* or mental disease\* or depression or depressive or mood or anxiety or well being or wellbeing or wellness or body image or self perception).mp.

23. (postur\* or supine or valsalva or diastasis recti or rectus abdominis or inter rectus distance or interrectus distance).mp.

24. Fatigue/ or (fatigue or exhaustion or injur\* or trauma).mp.

25. or/16-24

26. 15 and 25

27. 11 or 26

28. limit 27 to medline

29. animals/ not (animals/ and humans/)

30. 28 not 29

31. 27 not 28

32. ((rat or rats or mouse or mice or cow or cows or bovine or sheep or ewe\*) not ((rat or rats or mouse or mice or cow or cows or bovine or sheep or ewe\*) and (human\* or women))).ti,ab,kf.

33. 31 not 32

34. 30 or 33

35. remove duplicates from 34

### EMBASE

1. exp \*exercise/ or \*athlete/ or exp \*kinesiotherapy/ or exp \*sport/ or exp \*physical activity/ or \*sedentary lifestyle/ or (exercise or physical\* activ\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity).ti,kw. or exercise.ab. /freq=2 or physical\* activ\*.ab. /freq=2 or (weight\* adj2 lift\*).ti,kw. or ((muscle or muscular or strength\*) adj2 conditioning).ti,kw.

2. exp pregnancy complication/ or pregnancy outcome/ or exp labor/ or exp delivery/ or pregnan\*.ti,kw.

3. ((birth or pregnancy or childbirth) adj3 (outcome\* or complication\*)).mp.

4. (((spontaneous or induc\* or onset or length) adj3 (labor or labour)) or c?esarean).mp.

5. (episiotom\* or vaginal delivery or gestational diabetes or pre-eclampsia or preeclampsia or gestosis).mp.

6. (((normal or instrumental or assisted) adj2 (delivery or birth or childbirth)) or (forceps or ventouse or vacuum extraction)).mp.

7. ((mode of delivery or type of delivery) and (pregnan\* or birth or childbirth or obstetric\* or labor or labour)).mp.

8. ((tear\* or ruptur\* or hemorrhage\*) adj2 (placent\* or vagin\* or membran\* or periton\*)).mp.

9. (miscarriage\* or spontaneous abortion\*).mp.

10. or/2-9

11. 1 and 10

12. Pregnancy/ or pregnan\*.ti,hw,kw. or exp Pregnancy Trimesters/ or Peripartum Period/ or Postpartum Period/ or (antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,kw.

13. 1 and 12

14. ((pregnan\* or maternal or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\*) adj5 (exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* adj2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or fitness or ((muscle or muscular or strength\*) adj2 conditioning))).ab.

15. 13 or 14

16. exp insulin/ or exp diabetes mellitus/ or glycosylated hemoglobin/ or (insulin or glucose or glyc?emic control or blood sugar or diabet\* or prediabet\* or hba1c or glycosylated h?emoglobin or hyperglyc?emi\* or hypoglyc?emi\* or (weight adj3 (gain\* or change\* or loss or lose or retention)) or bmi or body mass index or body composition or skinfold thickness or ((hip or waist) adj2 ratio) or ((waist or abdominal) adj2 circumference) or overweight or obes\* or adipos\* or underweight or normal weight or healthy weight or hypertension or hypotension or fainting or syncope or lightheaded\* or light headed\* or dizziness or blood pressure or tox?emi\* or eph complex or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or cardio-metabolic or metabolic or heart or cardio\* or cardiac or lipid\* or placental growth factor\* or triglyceride\* or ldl or hdl or lipoprotein or cholesterol).mp.

17. dehydration/ or exp cardiovascular disease/ or (dehydrat\* or heart disease\* or cardiovascular disease\*).mp.

18. adaptation/ or exp thermoregulation/ or fitness/ or endurance/ or (safe\* or harm\* or risk\* or fitness or aerobic capacity or oxygen consumption or vo2 max or vo2max or vo2 peak or vo2peak or frequency or intensity or duration or dose response or fitt or zone or (type\* adj2 exercise)).mp.

19. exp backache/ or exp pelvic pain/ or hip pain/ or muscle cramp/ or heat cramp/ or leg cramp/ or ((hip or back or pelvic or pelvis) adj3 (pain or discomfort or ache)).mp. or cramp\*.mp.

20. mental health/ or psychological well being/ or exp mental disease/ or body image/ or self concept/ or (mental health or mental disorder\* or mental illness\* or mental disease\* or depression or depressive or mood or anxiety or well being or wellbeing or wellness or body image or self perception).mp.

21. (postur\* or supine or valsalva or diastasis recti or rectus abdominis or inter rectus distance or interrectus distance).mp.

22. fatigue/ or exhaustion/ or (fatigue or exhaustion or injur\* or trauma or blood loss).mp.

23. chronic disease/ or exp osteoporosis/ or exp urine incontinence/ or (chronic disease\* or chronic illness\* or osteoporosis or incontinen\*).mp.

24. or/16-23

25. 15 and 24

26. 11 or 25

27. exp animal/ not (exp animal/ and human/)

28. 26 not 27

29. remove duplicates from 28

### PsycInfo

1. physical activity/ or exp exercise/ or activity level/ or athletes/ or exp sports/ or ((exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity).ti,ab,id. or ((weight\* adj2 lift\*) or ((muscle or muscular or strength\*) adj2 conditioning))).ti,ab,id.

2. obstetrical complications/ or pregnancy outcomes/ or spontaneous abortion/ or "labor (childbirth)"/ or birth/

3. (pregnan\* or ((birth or pregnancy or childbirth) adj3 (outcome\* or complication\*))).mp.

4. (((spontaneous or induc\* or onset or length) adj3 (labor or labour)) or c?esarean).mp.

5. (episiotom\* or vaginal delivery or gestational diabetes or pre-eclampsia or preeclampsia or gestosis).mp.

6. (((normal or instrumental or assisted) adj2 (delivery or birth or childbirth)) or (forceps or ventouse or vacuum extraction)).mp.

7. ((mode of delivery or type of delivery) and (pregnan\* or birth or childbirth or obstetric\* or labor or labour)).mp.

8. ((tear\* or ruptur\* or hemorrhage\*) adj2 (placent\* or vagin\* or membran\* or periton\*)).mp.

9. (miscarriage\* or spontaneous abortion\*).mp.

10. or/2-9

11. 1 and 10

12. exp pregnancy/ or pregnan\*.ti,hw,id. or (antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,id.

13. 1 and 12

14. ((pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\*) adj5 (exercise or physical\* activ\* or strenuous activit\* or physical inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* adj2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or ((muscle or muscular or strength\*) adj2 conditioning))).ab.

15. 13 or 14

16. insulin/ or diabetes/ or diabetes mellitus/ or (insulin or glucose or glyc?emic control or blood sugar or diabet\* or prediabet\* or hba1c or glycosylated h?emoglobin or hyperglyc?emi\* or hypoglyc?emi\* or (weight adj3 (gain\* or change\* or loss or lose or retention)) or bmi or body mass index or body composition or skinfold thickness or ((hip or waist) adj2 ratio) or ((waist or abdominal) adj2 circumference) or overweight or obes\* or adipos\* or underweight or normal weight or healthy weight or hypertension or hypotension or fainting or syncope or lightheaded\* or light headed\* or dizziness or blood pressure or tox?emi\* or eph complex or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or cardio-metabolic or metabolic or heart or cardio\* or cardiac or lipid\* or placental growth factor\* or triglyceride\* or ldl or hdl or lipoprotein or cholesterol).mp.

17. dehydration/ or exp Cardiovascular Disorders/ or (dehydrat\* or heart disease\* or cardiovascular disease\*).mp.

18. "thermoregulation (body)"/ or physical fitness/ or physical endurance/ or (safe\* or harm\* or risk\* or fitness or aerobic capacity or oxygen consumption or vo2 max or vo2max or vo2 peak or vo2peak or frequency or intensity or duration or dose response or fitt or zone or (type\* adj2 exercise)).mp.

19. back pain/ or ((hip or back or pelvic or pelvis) adj3 (pain or discomfort or ache)).mp. or cramp\*.mp.

20. mental health/ or exp Mental Disorders/ or exp body image/ or self concept/ or (mental health or mental disorder\* or mental illness\* or mental disease\* or depression or depressive or mood or anxiety or well being or wellbeing or wellness or body image or self perception).mp.

21. (postur\* or supine or valsalva or diastasis recti or rectus abdominis or inter rectus distance or interrectus distance).mp.

22. fatigue/ or (fatigue or exhaustion or injur\* or trauma).mp.

23. Physical Fitness/ or exp Physical Endurance/ or (safe\* or harm\* or risk\* or fitness or aerobic capacity or oxygen consumption or vo2 max or vo2max or vo2 peak or vo2peak or frequency or intensity or duration or dose response or fitt or zone or (type\* adj2 exercise)).mp.

24. chronic illness/ or osteoporosis/ or urinary incontinence/ or (chronic disease\* or chronic illness\* or osteoporosis or incontinen\*).mp.

25. or/16-24

26. 15 and 25

27. 11 or 26

28. first posting.ps.

29. (27 not first posting).ps.

30. limit 29 to human

31. 27 and 28

32. 30 or 31

### Cochrane Library

#1 [mh Exercise] or [mh "Exercise Movement Techniques"] or [mh "Physical Exertion"] or [mh "Exercise Therapy"] or [mh "Motor Activity"] or [mh "Sedentary Lifestyle"] or (exercise or "physical\* activ\*" or "strenuous activit\* " or " physical\* inactiv\* " or sedentary or running or plyometric\* or yoga or " tai chi" or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or physical\* active\*):ti,ab,kw (weight\* near/2 lift\*):ti,ab,kw or ((muscle or muscular or strength\*) near/2 conditioning):ti,ab,kw

#2 [mh "Pregnancy Complications"] or [mh "Pregnancy Outcome"] or [mh "Labor, Obstetric"] or [mh "Delivery, Obstetric"] or [mh "Extraction, Obstetrical"] or (pregnan\*) .ti,ab,kw

#3 ((birth or pregnancy or childbirth) near/3 (outcome\* or complication\*)):ti,ab,kw

#4 (((spontaneous or induc\* or onset or length) near/3 (labor or labour)) or (cesarean or caesarean)):ti,ab,kw

#5  (episiotom\* or vaginal delivery or gestational diabetes or pre-eclampsia or preeclampsia or gestosis):ti,ab,kw

#6  (((normal or instrumental or assisted) near/2 (delivery or birth or childbirth)) or (forceps or ventouse or vacuum extraction)):ti,ab,kw

#7 ((mode of delivery or type of delivery) and (pregnan\* or birth or childbirth or obstetric\* or labor or labour)):ti,ab,kw

#8 ((tear\* or ruptur\* or hemorrhage\*) near/2 (placent\* or vagin\* or membran\* or periton\*)):ti,ab,kw

#9 (miscarriage\* or spontaneous abortion\*):ti,ab,kw

#10 #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9

#11 #1 AND #10

#12 [mh Pregnancy] or (pregnan\*):ti,ab,kw or [mh "Pregnancy Trimesters"] or [mh "Peripartum Period"] or [mh "Postpartum Period"] or (antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*):ti,ab,kw

#13 #1 AND #12

#14 ((pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\*) near/5 (exercise or physical\* activ\* or strenuous activit\* or physical inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* near/2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or ((muscle or muscular or strength\*) near/2 conditioning))) .ab.

#15 #13 or #14

#16  [mh Insulins] or [mh "diabetes mellitus"] or [mh "diabetes, gestational"] or [mh "prediabetic state"] or [mh "hemoglobin a, glycosylated"] or (insulin or glucose or "glycemic control" or "blood sugar" or diabet\* or prediabet\* or hba1c or "glycosylated hemoglobin" or "glycosylated haemoglobin" or hyperglycemi\* or hypoglycemi\* or hyperglycaemi\* or hypoglycaemi\* or (weight near/3 (gain\* or change\* or loss or lose or retention)) or bmi or (weight near/3 (gain\* or change\* or loss or lose or retention)) or bmi or "body mass index" or "body composition" or "skinfold thickness" or ((hip or waist) near/2 ratio) or ((waist or abdominal) near/2 circumference) or overweight or obes\* or adipos\* or underweight or "normal weight" or "healthy weight" or hypertension or hypotension or fainting or syncope or lightheaded\* or "light headed\*" or dizziness or "blood pressure" or toxemi\* or "eph complex" or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or "cardio-metabolic" or metabolic or heart or cardio\* or cardiac or lipid\* or "placental growth factor\*" or triglyceride\* or ldl or hdl or lipoprotein or cholesterol):ti,ab,kw

#17 [mh dehydration] or [mh "Cardiovascular Diseases"] or (dehydrat\* or heart disease\* or "cardiovascular disease\*"):ti,ab,kw

#18 [mh "adaptation, physiological"] or [mh "body temperature regulation"]

#19 [mh "Physical Fitness"] or [mh "Physical Endurance"] or (safe\* or harm\* or risk\* or fitness or "aerobic capacity" or "oxygen consumption" or "vo2 max" or vo2max or "vo2 peak" or vo2peak or frequency or intensity or duration or "dose response" or fitt or zone or (type\* near/2 exercise)):ti,ab,kw

#20 [mh "Chronic disease"] or [mh Osteoporosis] or [mh "Urinary Incontinence"] or ("chronic disease\*" or "chronic illness\*" or osteoporosis or incontinen\*):ti,ab,kw

#21 [mh "Back Pain"] or [mh "Pelvic Pain"] or [mh "Muscle Cramp"] or cramp\*:ti,ab,kw or ([mh Pain] and ([mh "Hip Joint"] or ((hip or back or pelvic or pelvis) near/3 (pain or discomfort or ache))):ti,ab,kw)

#22 [mh "Mental Health"] or [mh "Mental Disorders"] or [mh "Body Image"] or [mh "Self Concept"] or ("mental health" or "mental disorder\*" or "mental illness\*" or "mental disease\*" or depression or depressive or mood or anxiety or "well being" or wellbeing or wellness or "body image" or "self perception"):ti,ab,kw

#23 [mh Fatigue] or (fatigue or exhaustion or injur\* or trauma):ti,ab,kw

#24 (postur\* or supine or valsalva or "diastasis recti" or "rectus abdominis" or "inter rectus distance" or "interrectus distance"):ti,ab,kw

#25 #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24

#26 #15 and #25

#27  #11 or #26

### CINAHL

S1 ( (MH "Exercise+") OR (MH "Athletes+") OR (MH "Therapeutic Exercise+") OR (MH "Physical Fitness+") OR (MH "Physical Activity") OR (MH "Physical Endurance+") OR (MH "Exertion+") OR (MH "Sports+") OR (MH "Life Style, Sedentary") OR (MH "Yoga+") OR (MH "Tai Chi") ) OR TI ( exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning )

S2 ((MH "Pregnancy Complications+") OR (MH "Pregnancy Outcomes") OR (MH "Pregnancy Trimesters+") OR (MH "Labor+") OR (MH "Delivery, Obstetric+") OR (MH "Surgery, Obstetrical+")) OR TI pregnan\* OR MW pregnan\*

S3 (birth or pregnancy or childbirth) n3 (outcome\* or complication\*) or (spontaneous or induc\* or onset or length) n3 (labor or labour) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis OR (normal or instrumental or assisted) n2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" OR ( ("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) ) OR (tear\* or ruptur\* or hemorrhage\*) n2 (placent\* or vagin\* or membran\* or periton\*)

S4 S2 OR S3

S5 S1 AND S4

S6 ( (MH "Pregnancy") OR (MH "Pregnancy Trimesters+") ) OR TI ( pregnan\* or trimester\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* ) OR MW ( antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\* )

S7 S1 and S6

S8 (pregnan\* or trimester\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\*) n5 (exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or (weight\* n2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or (muscle or muscular or strength\*) n2 conditioning)

S9 S7 or S8

S10 ((MH "Insulin+") OR (MH "Diabetes Mellitus+") OR (MH "Prediabetic State") OR (MH "Hemoglobin A, Glycosylated") ) OR ( insulin or glucose or "glycemic control" or "glycaemic control" or "blood sugar" or diabet\* or prediabet\* or hba1c or "glycosylated hemoglobin" or "glycosylated haemoglobin" or hyperglycemi\* or hyperglycaemi\* or hypoglycemi\* or hypoglycaemi\* or weight n3 (gain\* or change\* or loss or lose or retention) or bmi or "body mass index" or "body composition" or "skinfold thickness" or (hip or waist) n2 ratio or (waist or abdominal) n2 circumference or overweight or obes\* or adipos\* or underweight or "normal weight" or "healthy weight" or hypertension or hypotension or fainting or syncope or lightheaded\* or "light headed\*" or dizziness or "blood pressure" or toxemi\* or toxaemi\* or "eph complex" or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or "cardio-metabolic" or metabolic or heart or cardio\* or cardiac or lipid\* or "placental growth factor\*" or triglyceride\* or ldl or hdl or lipoprotein or cholesterol )

S11 ((MH "Dehydration") OR (MH "Cardiovascular Diseases+") ) OR ( dehydrat\* or heart disease\* or "cardiovascular disease\*" )

S12 ((MH "Adaptation, Physiological") OR (MH "Body Temperature Regulation+") OR (MH "Physical Fitness+") OR (MH "Physical Endurance+") ) OR MW metabolism OR ( safe\* or harm\* or risk\* or fitness or "aerobic capacity" or "oxygen consumption" or "vo2 max" or vo2max or "vo2 peak" or vo2peak or frequency or intensity or duration or "dose response" or fitt or zone or type\* n2 exercise )

S13 ((MH "Chronic Disease") OR (MH "Urinary Incontinence+") OR (MH "Osteoporosis+") ) OR ( "chronic disease\*" or "chronic illness\*" or osteoporosis or incontinen\* )

S14 ((MH "Back Pain+") OR (MH "Pelvic Pain+") OR (MH "Muscle Cramp") ) OR ( cramp\* or (hip or back or pelvic or pelvis) n3 (pain or discomfort or ache) )

S15 ((MH "Mental Health") OR (MH "Mental Disorders+") OR (MH "Psychological Well-Being") OR (MH "Body Image") OR (MH "Self Concept")) OR ( "mental health" or "mental disorder\*" or "mental illness\*" or "mental disease\*" or depression or depressive or mood or anxiety or "well being" or wellbeing or wellness or "body image" or "self perception" )

S16 (MH "Fatigue") or fatigue or exhaustion or injur\* or trauma

S17 postur\* or supine or valsalva or "diastasis recti" or "rectus abdominis" or "inter rectus distance" or "interrectus distance"

S18 S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17

S19 S9 AND S18

S20 S5 OR S19

### Sport Discus

S1 (birth or pregnancy or childbirth) n3 (outcome\* or complication\*) or (spontaneous or induc\* or onset or length) n3 (labor or labour) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis) OR (normal or instrumental or assisted) n2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" OR ( ("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) ) OR (tear\* or ruptur\* or hemorrhage\*) n2 (placent\* or vagin\* or membran\* or periton\*) OR antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or pregnan\* or trimester\* or obstetric\*

S2 exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning

S3 S1 and S2

[Limited to Academic Journal, Dissertation, Report]

### Child Development & Adolescent Studies

exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning

AND

pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or or trimester\* or obstetric\* or ( (birth or pregnancy or childbirth) n3 (outcome\* or complication\*) or (spontaneous or induc\* or onset or length) n3 (labor or labour) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis OR (normal or instrumental or assisted) n2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" OR ( ("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) ) OR ( (tear\* or ruptur\* or hemorrhage\*) n2 (placent\* or vagin\* or membran\* or periton\*)

[Limitedto Academic Journal]

### ERIC

exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning

AND

pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or or trimester\* or obstetric\* or ( (birth or pregnancy or childbirth) n3 (outcome\* or complication\*) or (spontaneous or induc\* or onset or length) n3 (labor or labour) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis OR (normal or instrumental or assisted) n2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" OR ( ("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) ) OR ( (tear\* or ruptur\* or hemorrhage\*) n2 (placent\* or vagin\* or membran\* or periton\*)

[Limited to Academic Journals]

### Scopus

(((TITLE-ABS-KEY(((birth or pregnancy or childbirth) w/3 (outcome\* or complication\*)) or ((spontaneous or induc\* or onset or length) w/3 (labor or labour)) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis OR ( (normal or instrumental or assisted) w/2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" ) OR (("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) ) OR ( (tear\* or ruptur\* or hemorrhage\*) w/2 (placent\* or vagin\* or membran\* or periton\*)) OR antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or pregnan\* or obstetric\* or trimester\*))) AND (TITLE ( exercise\* OR "physical\* activ\*" OR "strenuous activit\*" OR "physical inactiv\*" OR sedentary OR running OR plyometric\* OR yoga OR "tai chi" OR "weight training" OR "resistance training" OR swim\* OR sport\* OR athlet\* OR walk OR walking OR "muscle strengthening" OR "muscle conditioning" OR "muscular conditioning" OR "weight lifting" OR "lifting weight\*" ))) OR ((TITLE-ABS-KEY((insulin or glucose or "glycemic control" or "glycaemic control" or "blood sugar" or diabet\* or prediabet\* or hba1c or "glycosylated hemoglobin" or "glycosylated haemoglobin" or hyperglycemi\* or hyperglycaemi\* or hypoglycemi\* or hypoglycaemi\* or (weight w/3 (gain\* or change\* or loss or lose or retention)) or bmi or "body mass index" or "body composition" or "skinfold thickness" or ((hip or waist) w/2 ratio) or ((waist or abdominal) w/2 circumference) or overweight or obes\* or adipos\* or underweight or "normal weight" or "healthy weight" or hypertension or hypotension or fainting or syncope or lightheaded\* or "light headed\*" or dizziness or "blood pressure" or toxemi\* or toxaemi\* or "eph complex" or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or "cardio-metabolic" or metabolic or heart or cardio\* or cardiac or lipid\* or "placental growth factor\*" or triglyceride\* or ldl or hdl or lipoprotein or cholesterol or dehydrat\* or heart disease\* or "cardiovascular disease\*" or safe\* or harm\* or risk\* or fitness or "aerobic capacity" or "oxygen consumption" or "vo2 max" or vo2max or "vo2 peak" or vo2peak or frequency or intensity or duration or "dose response" or fitt or zone or (type\* w/2 exercise) or "chronic disease\*" or "chronic illness\*" or osteoporosis or incontinen\* or cramp\* or ((hip or back or pelvic or pelvis) w/3 (pain or discomfort or ache)) or "mental health" or "mental disorder\*" or "mental illness\*" or "mental disease\*" or depression or depressive or mood or anxiety or "well being" or wellbeing or wellness or fatigue or exhaustion or injur\* or trauma or postur\* or supine or valsalva or "diastasis recti" or "rectus abdominis" or "inter rectus distance" or "interrectus distance"))) AND (((TITLE(exercise\* or "physical\* activ\*" or "strenuous activit\*" or "physical inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking OR "muscle strengthening" or "muscle conditioning" or "muscular conditioning" or "weight lifting" or "lifting weight\*") AND TITLE-ABS-KEY(pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\*)) AND (TITLE-ABS-KEY ( pregnan\* OR antenatal OR prenatal OR perinatal OR postnatal OR prepartum OR antepartum OR postpartum OR "pre partum" OR "ante partum" OR "post partum" OR puerper\* ))))) AND NOT (TITLE(rat or rats or mouse or mice or cow or cows or bovine or sheep or ewe\*))

### Web of Science Core Collection (including Emerging Science Citation Index)

#1 TI=(exercise\* or "physical\* activ\*" or "strenuous activit\*" or "physical inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or (muscle\* or muscular or strength) near/2 conditioning or weight\* near/2 lift\*)

#2 TS=(pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*)

#3 #1 AND #2

#4 TS=(insulin or glucose or "glycemic control" or "glycaemic control" or "blood sugar" or diabet\* or prediabet\* or hba1c or "glycosylated hemoglobin" or "glycosylated haemoglobin" or hyperglycemi\* or hyperglycaemi\* or hypoglycemi\* or hypoglycaemi\* or (weight near/3 (gain\* or change\* or loss or lose or retention)) or bmi or "body mass index" or "body composition" or "skinfold thickness" or ((hip or waist) near/2 ratio) or ((waist or abdominal) near2 circumference) or overweight or obes\* or adipos\* or underweight or "normal weight" or "healthy weight" or hypertension or hypotension or fainting or syncope or lightheaded\* or "light headed\*" or dizziness or "blood pressure" or toxemi\* or toxaemi\* or "eph complex" or proteinuria or edema or hemodynamic\* or haemodynamic\* or systolic or diastolic or cardiovascular or cardiometabolic or "cardio-metabolic" or metabolic or heart or cardio\* or cardiac or lipid\* or "placental growth factor\*" or triglyceride\* or ldl or hdl or lipoprotein or cholesterol or dehydrat\* or heart disease\* or "cardiovascular disease\*" or safe\* or harm\* or risk\* or fitness or "aerobic capacity" or "oxygen consumption" or "vo2 max" or vo2max or "vo2 peak" or vo2peak or frequency or intensity or duration or "dose response" or fitt or zone or (type\* near2 exercise) or "chronic disease\*" or "chronic illness\*" or osteoporosis or incontinen\* or cramp\* or ((hip or back or pelvic or pelvis) near/3 (pain or discomfort or ache)) or "mental health" or "mental disorder\*" or "mental illness\*" or "mental disease\*" or depression or depressive or mood or anxiety or "well being" or wellbeing or wellness or fatigue or exhaustion or injur\* or traumaor postur\* or supine or valsalva or "diastasis recti" or "rectus abdominis" or "inter rectus distance" or "interrectus distance")

#5 #3 AND #4

#6 TS=((birth or pregnancy or childbirth) near/3 (outcome\* or complication\*) or (spontaneous or induc\* or onset or length) near/3 (labor or labour) or cesarean or caesarean or episiotom\* or "vaginal delivery" or "gestational diabetes" or "pre-eclampsia" or preeclampsia or gestosis OR (normal or instrumental or assisted) near/2 (delivery or birth or childbirth) or forceps or ventouse or "vacuum extraction" or miscarriage\* or "spontaneous abortion\*" OR ("mode of delivery" or "type of delivery") and (pregnan\* or birth or childbirth or obstetric\* or labor or labour) OR (tear\* or ruptur\* or hemorrhage\*) near/2 (placent\* or vagin\* or membran\* or periton\*))

#7 #1 AND #6

#8 #5 OR #7

#9 TS=(rat or rats or mouse or mice or cow or cows or bovine or sheep or ewe\*)

#10 #9 NOT #8

### Clinicatrials.gov

(exercise OR "physical activity" ) AND (antenatal OR prenatal OR perinatal OR postnatal OR prepartum OR antepartum OR postpartum OR "pre partum" OR fetus OR foetus OR fetal OR foetal)

(exercise OR "physical activity" ) AND ("ante partum" OR "post partum" OR puerper\* OR primigravida OR primiparous OR multiparous OR nulliparous OR multigravida OR trimester OR trimesters OR obstetric)

### Trip Database

title(exercise OR "physical activity" ) AND title(pregnan\* or antenatal OR prenatal OR perinatal OR postnatal OR prepartum OR antepartum OR postpartum OR "pre partum" OR fetus OR foetus OR fetal OR foetal)

## Fetal Outcomes Strategies

### MEDLINE

1. exp Exercise/ or Athletes/ or exp Exercise Movement Techniques/ or exp Exercise Therapy/ or exp Sports/ or Motor Activity/ or Physical Exertion/ or Sedentary Lifestyle/ or (exercise or physical\* activ\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or fitness).ti,kf. or exercise.ab. /freq=2 or (weight\* adj2 lift\*).ti,kf. or ((muscle or muscular or strength\*) adj2 conditioning).ti,kf.

2. Pregnancy/ or exp Pregnancy Complications/ or Pregnancy Outcome/ or exp Pregnancy Trimesters/ or Peripartum Period/ or Postpartum Period/ or pregnan\*.hw. or (pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,kf.

3. 1 and 2

4. ((pregnan\* or maternal or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or puerper\* or pre partum or ante partum or post partum) adj5 (exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* adj2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or fitness or ((muscle or muscular or strength\*) adj2 conditioning))).ab.

5. 3 or 4

6. exp birth weight/ or fetal weight/

7. infant, low birth weight/ or infant, small for gestational age/ or exp infant, very low birth weight/ or infant, postmature/ or exp infant, premature/

8. ((preterm or pre matur\* or prematur\* or post matur\* or postmatur\*) adj2 birth).mp.

9. Fetal Growth Retardation/ or fetal hypoxia/ or fetal macrosomia/

10. exp Fetal Development/ or exp Congenital Abnormalities/ or exp Fetus/ or (f?etus or f?etal).ti,hw,kf.

11. maternal fetal exchange/ or (exp Uterus/ and exp Regional Blood Flow/) or (placenta\* or uteroplacenta\* or ((maternal f?etal or f?etomaternal or transplacental) adj2 (transfusion or exchange))).mp.

12. ((f?etal or f?etus) adj2 (response or matur\*)).mp.

13. ((f?etal or f?etus or neonat\* or newborn or infant) adj3 (growth or develop\* or viability or viable or weight or wellbeing or well being or health or heart rate or heartrate or bradycardia or hypoxi\* or hypoglyc?emi\* or movement or oxygenation)).mp.

14. (((uterine or uterus) adj2 (blood flow or circulat\*)) or ((uterine or umbilical or mid\* cerebral) adj2 doppler)).mp.

15. (intrauterine growth or iugr).mp.

16. ((perinatal or f?etal or f?etus or neonat\* or newborn\* or infant\*) adj3 (mortality or morbidity or death or outcome\* or complication\*)).mp.

17. (still birth or stillbirth).mp.

18. (birth weight or birthweight or macrosomia or gestational age or lga or sga or preterm or (prematur\* adj2 (infant\* or neonat\* or newborn\* or birth or labo?r))).mp.

19. ((neonatal or newborn\* or infant\* or f?etus or f?etal) and (fat\* or abdominal circumference or body composition or bmi or body mass index or waist circumference or skeletal size or height or anthropometric\* or apgar or adipos\* or ph or base excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin?emi\*)).mp.

20. (f?etus or f?etal).mp. and (adaptation, physiological/ or me.fs.)

21. (((birth or delivery) adj3 (trauma or injur\* or defect\*)) or (dystocia or nicu or neonatal intensive care or brachial plexus)).mp.

22. exp Birth Injuries/

23. ((neonat\* or infant\* or newborn\*) and (ponderal index or skinfold or bmi or body mass index)).mp.

24. Cerebral Palsy/ or exp Neural Tube Defects/ or Cleft Palate/ or (cerebral palsy or neural tube defect\* or spina bifida or anencephal\* or encephalocele\* or iniencephal\* or spinal dyraphism or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or cleft palate\* or cleft lip\*).mp.

25. (((development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) adj2 (disorder\* or disab\* or delay\*)) or behavio?r disorder\* or attention deficit or autis\* or asperger\* or child development or developmental milestone\* or neurodevelopment\* or cognitive development or motor development or motor skill\* or psychosocial development or chronic disease\* or chronic illness\* or cardiovascular or cardiometabolic or diabet\* or heart disease\*).mp. or exp Heart Disease/ or exp Mental Disorders Diagnosed in Childhood/

26. Pediatric Obesity/ or ((child\* or p?ediatric) adj2 (obes\* or overweight)).mp.

27. or/6-25

28. 5 and 27

29. (animals/ not (animals/ and humans/)) or ((rat or rats or mouse or mice or cow or cows or bovine or sheep or ewe\*) not ((rat or rats or mouse or mice or cow or cows or bovine or cattle or sheep or ewe\*) and (human\* or women))).ti,ab,kf. or (rat or rats or mouse or mice or cow or cows or bovine or cattle or sheep or ewe\*).ti.

30. 28 not 29

### EMBASE

1. exp \*exercise/ or \*athlete/ or exp \*kinesiotherapy/ or exp \*sport/ or exp \*physical activity/ or \*sedentary lifestyle/ or (exercise or physical\* activ\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or fitness or sport\*).ti,kw. or exercise.ab. /freq=2 or (weight\* adj2 lift\*).ti,kw. or ((muscle or muscular or strength\*) adj2 conditioning).ti,kw.

2. exp pregnancy/ or exp pregnancy complications/ or pregnancy outcome/ or perinatal period/ or puerperium/ or pregnan\*.hw. or (pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,kw.

3. 1 and 2

4. ((pregnan\* or maternal or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\*) adj5 (exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or (weight\* adj2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or fitness or ((muscle or muscular or strength\*) adj2 conditioning))).ab.

5. 3 or 4

6. fetus/ or exp birth weight/ or fetus weight/ or "parameters concerning the fetus, newborn and pregnancy"/ or apgar score/ or fetus heart rate/ or exp fetus maturity/ or fetus mortality/ or fetus outcome/ or fetus risk/ or gestational age/ or live birth/ or exp perinatal morbidity/ or exp perinatal mortality/ or prenatal mortality/ or exp intrauterine growth retardation/ or exp "immature and premature labor"/ or exp fetus growth/ or exp prenatal growth/ or fetus hypoxia/ or macrosomia/ or exp fetus development/ or exp congenital disorder/ or exp fetus disease/ or fetomaternal transfusion/ or exp stillbirth/ or spontaneous abortion/ or birth injury/ or cerebral palsy/ or exp neural tube defect/ or child development/ or postnatal development/ or exp mental development/ or childhood obesity/ or exp body composition/ or anthropometric parameters/ or abdominal circumference/ or hip circumference/ or sagittal abdominal diameter/ or waist circumference/ or waist hip ratio/ or waist to height ratio/ or weight height ratio/

7. placenta insufficiency/

8. 6 or 7

9. (f?etus or f?etal).ti,hw,kw. or ((f?etal or f?etus) adj2 (response or matur\*)).mp.

10. (placenta\* or uteroplacenta\* or ((maternal f?etal or transplacental or f?etomaternal) adj2 (exchange or transfusion))).mp.

11. ((f?etal or f?etus or neonat\* or newborn or infant) adj3 (growth or develop\* or viability or viable or weight or wellbeing or well being or health or heart rate or heartrate or bradycardia or hypoxi\* or hypoglyc?emi\* or movement or oxygenation)).mp.

12. (((uterine or uterus) adj2 (blood flow or circulat\*)) or ((uterine or umbilical or mid\* cerebral) adj2 doppler)).mp.

13. (intrauterine growth or iugr).mp.

14. ((perinatal or f?etal or f?etus or neonat\* or newborn\* or infant\*) adj3 (mortality or death or outcome\* or complication\*)).mp.

15. (still birth or stillbirth).mp.

16. (birth weight or birthweight or macrosomia or gestational age or lga or sga or preterm or (prematur\* adj2 (infant\* or neonat\* or newborn\* or birth or labo?r))).mp.

17. ((neonatal or newborn\* or infant\* or f?etus or f?etal) and (fat\* or abdominal circumference or body composition or bmi or body mass index or waist circumference or skeletal size or height or anthropometric\* or apgar or adipos\* or ph or base excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin?emi\*)).mp.

18. (((birth or delivery) adj3 (trauma or injur\* or defect\*)) or (dystocia or nicu or neonatal intensive care or brachial plexus)).mp.

19. ((neonat\* or infant\* or newborn\*) and (ponderal index or skinfold or bmi or body mass index)).mp.

20. (cerebral palsy or neural tube defect\* or spina bifida or anencephal\* or encephalocele\* or iniencephal\* or spinal dyraphism or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or cleft palate\* or cleft lip\*).mp.

21. (((development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) adj2 (disorder\* or disab\* or delay\* or impair\*)) or behavio?r disorder\* or attention deficit or autis\* or asperger\* or child development or developmental milestone\* or neurodevelopment\* or cognitive development or motor development or motor skill\* or psychosocial development or chronic disease\* or chronic illness\* or cardiovascular or cardiometabolic or diabet\* or heart disease\*).mp. or childhood disease/ or exp infant disease/ or exp "disorders of higher cerebral function"/ or exp heart disease/

22. ((child\* or p?ediatric) adj2 (obes\* or overweight)).mp.

23. or/9-22

24. 8 or 23

25. 5 and 24

26. exp animal/ not (exp animal/ and human/)

27. 25 not 26

### PsycInfo

1. physical activity/ or exp exercise/ or activity level/ or athletes/ or exp sports/ or ((exercise or physical\* activ\* or strenuous activit\* or physical\* inactiv\* or sedentary or running or plyometric\* or yoga or tai chi or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity).ti,ab,id. or ((weight\* adj2 lift\*) or ((muscle or muscular or strength\*) adj2 conditioning))).ti,ab,id.

2. exp pregnancy/ or obstetrical complications/ or pregnancy outcomes/ or pregnan\*.ti,hw,id. or (antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*).ti,ab,id.

3. 1 and 2

4. prenatal development/ or birth weight/ or prenatal exposure/ or premature birth/ or fetus/ or amniotic fluid/ or (blood flow/ and uterus/)

5. (f?etus or f?etal or ((preterm or pre matur\* or prematur\* or post matur\* or postmatur\*) adj2 birth)).mp.

6. (placenta\* or uteroplacenta\* or ((maternal f?etal or f?etomaternal or transplacental) adj2 (transfusion or exchange))).mp.

7. ((neonat\* or newborn or infant) adj3 (growth or develop\* or viability or viable or weight or wellbeing or well being or health or heart rate or heartrate or bradycardia or hypoxi\* or hypoglyc?emi\* or movement or oxygenation)).mp.

8. (((uterine or uterus) adj2 (blood flow or circulat\*)) or ((uterine or umbilical or mid\* cerebral) adj2 doppler)).mp.

9. (intrauterine growth or iugr).mp.

10. ((perinatal or f?etal or f?etus or neonat\* or newborn\* or infant\*) adj3 (mortality or morbidity or death or outcome\* or complication\*)).mp.

11. (still birth or stillbirth).mp.

12. (birth weight or birthweight or macrosomia or gestational age or lga or sga or preterm or (prematur\* adj2 (infant\* or neonat\* or newborn\* or birth or labo?r))).mp.

13. ((neonatal or newborn\* or infant\* or f?etus or f?etal) and (fat\* or abdominal circumference or body composition or bmi or body mass index or waist circumference or skeletal size or height or anthropometric\* or apgar or adipos\* or ph or base excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin?emi\*)).mp.

14. (((birth or delivery) adj3 (trauma or injur\* or defect\*)) or (dystocia or nicu or neonatal intensive care or brachial plexus)).mp.

15. birth injuries/ or birth trauma/

16. ((neonat\* or infant\* or newborn\*) and (ponderal index or skinfold or bmi or body mass index)).mp.

17. exp congenital disorders/ or cerebral palsy/ or cleft palata/ or (cerebral palsy or neural tube defect\* or spina bifida or anencephal\* or encephalocele\* or iniencephal\* or spinal dyraphism or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or cleft palate\* or cleft lip\*).mp.

18. exp developmental disabilities/ or exp communication disorders/ or exp delayed development/ or exp intellectual development disorder/ or exp learning disorders/ or exp nervous system disorders/ or exp pervasive developmental disorders/

19. (((development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) adj2 (disorder\* or disab\* or delay\*)) or behavio?r disorder\* or attention deficit or autis\* or asperger\* or child development or developmental milestone\* or neurodevelopment\* or cognitive development or motor development or motor skill\* or psychosocial development or chronic disease\* or chronic illness\* or cardiovascular or cardiometabolic or diabet\* or heart disease\*).mp. or health disorders/

20. ((child\* or p?ediatric) adj2 (obes\* or overweight)).mp.

21. or/4-20

22. 3 and 21

23. first posting.ps.

24. 22 not 23

25. limit 24 to human

26. 22 not 24

27. 25 or 26

### Cochrane Library

#1 [mh Exercise] or [mh "Exercise Movement Techniques"] or [mh "Physical Exertion"] or [mh "Exercise Therapy"] or [mh "Motor Activity"] or [mh "Sedentary Lifestyle"] or (exercise or "physical\* activ\*" or "strenuous activit\* " or " physical\* inactiv\* " or sedentary or running or plyometric\* or yoga or " tai chi" or weight training or resistance training or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or aerobic capacity or physical\* active\*):ti,ab,kw (weight\* near/2 lift\*):ti,ab,kw or ((muscle or muscular or strength\*) near/2 conditioning):ti,ab,kw

#2  [mh Pregnancy] or [mh "Pregnancy Complications"] or [mh "Pregnancy Outcome"] or [mh "Pregnancy Trimesters"] or [mh "Peripartum Period"] or [mh "Postpartum Period"] or (pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*):ti,kw

#3   #1 AND #2

#4   ((pregnan\* or maternal or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or puerper\* or "pre partum" or "ante partum" or "post partum") near/5 (exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or (weight\* near/2 lift\*) or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or ((muscle or muscular or strength\*) near/2 conditioning))):ab

#5  #3 or #4

#6  [mh "birth weight"] or [mh "fetal weight"]

#7  [mh "infant, low birth weight"] or [mh "infant, small for gestational age"] or [mh "infant, very low birth weight"] or [mh "infant, postmature"] or [mh "infant, premature"]

#8  ((preterm or pre matur\* or prematur\* or post matur\* or postmatur\*) near/2 birth):ti,ab,kw

#9  [mh "Fetal Growth Retardation"] or [mh "fetal hypoxia"] or [mh "fetal macrosomia"]

#10  [mh "Fetal Development"] or [mh "Congenital Abnormalities"] or [mh "Fetus"] or (fetus or fetal):ti,kw

#11  [mh "maternal fetal exchange"] or ([mh "Uterus"] and [mh "Regional Blood Flow"]) or (placenta\* or uteroplacenta\* or (("maternal feta"l or fetomaternal or transplacental) near/2 (transfusion or exchange))):ti,ab,kw

#12  ((fetal or fetus) near/2 (response or matur\*)):ti,ab,kw

#13  ((fetal or fetus or neonat\* or newborn or infant) near/3 (growth or develop\* or viability or viable or weight or wellbeing or "well being" or health or "heart rate" or heartrate or bradycardia or hypoxi\* or hypoglycemi\* or movement or oxygenation)):ti,ab,kw

#14  (((uterine or uterus) near/2 (blood flow or circulat\*)) or ((uterine or umbilical or mid\* cerebral) near/2 doppler)):ti,ab,kw

#15  (intrauterine growth or iugr):ti,ab,kw

#16  ((perinatal or fetal or fetus or neonat\* or newborn\* or infant\*) near/3 (mortality or morbidity or death or outcome\* or complication\*)):ti,ab,kw

#17  ("still birth" or stillbirth):ti,ab,kw

#18  ("birth weight" or birthweight or macrosomia or "gestational age" or lga or sga or preterm or (prematur\* near/2 (infant\* or neonat\* or newborn\* or birth or labor))):ti,ab,kw

#19  ((neonatal or newborn\* or infant\* or fetus or fetal) and (fat\* or "abdominal circumference" or "body composition" or bmi or "body mass index" or "waist circumference" or "skeletal size" or height or anthropometric\* or apgar or adipos\* or ph or "base excess" or metabolic or acidosis or insulin or diabet\* or hyperbilirubinemi\*)):ti,ab,kw

#20  (fetus or fetal):ti,ab,kw and [mh "adaptation, physiological"]

#21  (((birth or delivery) near/3 (trauma or injur\* or defect\*)) or (dystocia or nicu or "neonatal intensive care" or "brachial plexus")):ti,ab,kw

#22  [mh "Birth Injuries"]

#23  ((neonat\* or infant\* or newborn\*) and ("ponderal index" or skinfold or bmi or "body mass index")):ti,ab,kw

#24  [mh "Cerebral Palsy"] or [mh "Neural Tube Defects"] or [mh "Cleft Palate"] or ("cerebral palsy" or "neural tube defect\*" or "spina bifida" or anencephal\* or encephalocele\* or iniencephal\* or spinal dyraphism or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or "cleft palate\*" or "cleft lip\*"):ti,ab,kw

#25  (((development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) near/2 (disorder\* or disab\* or delay\*)) or "behavior disorder\*" or "attention deficit" or autis\* or asperger\* or "child development" or "developmental milestone\*" or neurodevelopment\* or "cognitive development" or "motor development" or "motor skill\*" or "psychosocial development" or "chronic disease\*" or "chronic illness\*" or cardiovascular or cardiometabolic or diabet\* or "heart disease\*"):ti,ab,kw or [mh "Heart Disease"] or [mh "Mental Disorders Diagnosed in Childhood"]

#26  [mh "Pediatric Obesity"] or ((child\* or pediatric) near/2 (obes\* or overweight)):ti,ab,kw

#27  #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26

#28  #5 AND #27

### CINAHL

S1 ( (MH "Exercise+") OR (MH "Athletes+") OR (MH "Therapeutic Exercise+") OR (MH "Physical Fitness+") OR (MH "Physical Activity") OR (MH "Physical Endurance+") OR (MH "Exertion+") OR (MH "Sports+") OR (MH "Life Style, Sedentary") OR (MH "Yoga+") OR (MH "Tai Chi") ) OR TI ( exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning )

S2 ( (MH "Pregnancy") OR (MH "Pregnancy Complications+") OR (MH "Pregnancy Outcomes") OR (MH "Pregnancy Trimesters+") OR (MH "Postnatal Period") OR (MH "Puerperium") ) OR MW pregnan\* OR TI ( pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\* )

S3 S1 AND S2

S4 AB ((pregnan\* or maternal or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or puerper\* or "pre partum" or "ante partum" or "post partum") n5 (exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or weight\* n2 lift\* or "lift\* weight\*" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or (muscle or muscular or strength\*) n2 conditioning)

S5 S3 OR S4

S6 (MH "Birth Weight") OR (MH "Infant, Very Low Birth Weight") OR (MH "Infant, Low Birth Weight+") OR (MH "Fetal Weight") OR (MH "Infant, Small for Gestational Age") OR (MH "Infant, Premature") OR (MH "Infant, Premature, Diseases+") OR (MH "Fetal Growth Retardation") OR (MH "Fetal Anoxia") OR (MH "Fetal Macrosomia") OR (MH "Infant, Postmature") OR (MH "Infant, Large for Gestational Age") OR (MH "Fetus+") OR (MH "Maternal-Fetal Exchange") OR (MH "Perinatal Death") OR (MH "Birth Injuries+") OR (MH "Cerebral Palsy") OR (MH "Neural Tube Defects+") OR (MH "Cleft Palate") OR (MH "Heart Diseases+") OR (MH "Mental Disorders Diagnosed in Childhood+") OR (MH "Pediatric Obesity")

S7 (MH "Uterus+") AND (MH "Blood Circulation+")

S8 ( TI (f#etus or f#etal) or MW (f#etus OR f#etal OR ( placenta\* or uteroplacenta\* or ("maternal f#etal" or f#etomaternal or transplacental) w2 (transfusion or exchange) or (f#etal or f#etus) w2 (response or matur\*) )

S9 ( (f#etal or f#etus or neonat\* or newborn or infant) n3 (growth or develop\* or viability or viable or weight or wellbeing or "well being" or health or "heart rate" or heartrate or bradycardia or hypoxi\* or hypoglyc#emi\* or movement or oxygenation) ) OR ( (uterine or uterus) n2 ("blood flow" or circulat\*) or (uterine or umbilical or mid\* cerebral) n2 doppler ) OR ( "intrauterine growth" or iugr )

S10 ( (perinatal or f#etal or f#etus or neonat\* or newborn\* or infant\*) n3 (mortality or morbidity or death or outcome\* or complication\*) ) OR ( "still birth" or stillbirth or (preterm or "pre matur\*" or prematur\* or "post matur\*" or postmatur\*) w2 (birth or childbirth or labo#r or infant\* or newborn\* or neonat\*) ) OR ( "birth weight" or birthweight or macrosomia or "gestational age" or lga or sga )

S11 ( (perinatal or f#etal or f#etus or neonat\* or newborn\* or infant\*) n3 (mortality or morbidity or death or outcome\* or complication\*) ) OR ( "still birth" or stillbirth or (preterm or pre matur\* or prematur\* or post matur\* or postmatur\*) w2 (birth or childbirth or labo#r or infant\* or newborn\* or neonat\*) ) OR ( "birth weight" or birthweight or macrosomia or gestational age or lga or sga ) OR ( (neonatal or newborn\* or infant\* or fetus or fetal or foetus or foetal) and (fat\* or "abdominal circumference" or "body composition" or bmi or "body mass index" or "waist circumference" or "skeletal size" or height or anthropometric\* or apgar or adipos\* or ph or base n2 excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin#emi\*) )

S12 ( (MH "Adaptation, Physiological") OR MM metabolism ) AND ( f#etus or f#etal )

S13 ( (birth or delivery) n3 (trauma or injur\* or defect\*) or dystocia or nicu or "neonatal intensive care" or "brachial plexus" ) OR ( (neonat\* or infant\* or newborn\*) and (ponderal index or skinfold or bmi or body mass index) ) OR ( "cerebral palsy" or "neural tube defect\*" or "spina bifida" or anencephal\* or encephalocele\* or iniencephal\* or "spinal dyraphism" or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or "cleft palate\*" or "cleft lip\*" )

S14 ( (development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) n2 (disorder\* or disab\* or delay\*) ) OR ( "behavio#r disorder\*" or "attention deficit" or autis\* or asperger\* or "child development" or "developmental milestone\*" or neurodevelopment\* or "cognitive development" or "motor development" or "motor skill\*" or "psychosocial development" or "chronic disease\*" or "chronic illness\*" or cardiovascular or cardiometabolic or diabet\* or "heart disease\*" ) OR ( (child\* or p#ediatric) n2 (obes\* or overweight) )

S15 S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14

S16 S5 AND S15

### Sport Discus/Child Development & Adolescent Studies/ERIC

S1 exercise or "physical\* activ\*" or "strenuous activit\*" or "physical\* inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or mvpa or ltpa or stretching or "aerobic capacity" or fitness or weight\* n2 lift\* or (muscle or muscular or strength\*) n2 conditioning

S2 pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*

S3 S1 and S2

S4 ( f#etus or f#etal or ( placenta\* or uteroplacenta\* or ("maternal f#etal" or f#etomaternal or transplacental) w2 (transfusion or exchange) or (f#etal or f#etus) w2 (response or matur\*) ) ) OR ( (f#etal or f#etus or neonat\* or newborn or infant) n3 (growth or develop\* or viability or viable or weight or wellbeing or "well being" or health or heart rate or heartrate or bradycardia or hypoxi\* or hypoglyc#emi\* or movement or oxygenation) ) OR ( (uterine or uterus) n2 ("blood flow" or "blood circulat\*") or (uterine or umbilical or mid\* cerebral) n2 doppler or "intrauterine growth" or iugr )

S5 ( (perinatal or f#etal or f#etus or neonat\* or newborn\* or infant\*) n3 (mortality or morbidity or death or outcome\* or complication\*) ) OR ( "still birth" or stillbirth or (preterm or "pre matur\*" or prematur\* or "post matur\*" or postmatur\*) w2 (birth or childbirth or labo#r or infant\* or newborn\* or neonat\*) ) OR ( “birth weight" or birthweight or macrosomia or "gestational age" or lga or sga ) OR ( (neonatal or newborn\* or infant\* or f#etus or f#etal) and (fat\* or "abdominal circumference" or "body composition" or bmi or "body mass index" or "waist circumference" or "skeletal size" or height or anthropometric\* or apgar or adipos\* or ph or base n2 excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin#emi\*) )

S6 ( birth or delivery) n3 (trauma or injur\* or defect\*) or dystocia or nicu or "neonatal intensive care" or "brachial plexus" ) OR ( (neonat\* or infant\* or newborn\*) and ("ponderal index" or skinfold or bmi or body mass index) ) OR ( "cerebral palsy" or "neural tube defect\*" or "spina bifida" or anencephal\* or encephalocele\* or iniencephal\* or "spinal dyraphism" or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or "cleft palate\*" or "cleft lip\*" )

S7 ( (development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) n2 (disorder\* or disab\* or delay\*) ) OR ( "behavio#r disorder\*" or "attention deficit" or autis\* or asperger\* or "child development" or "developmental milestone\*" or neurodevelopment\* or "cognitive development" or "motor development" or "motor skill\*" or "psychosocial development" or "chronic disease\*" or "chronic illness\*" or cardiovascular or cardiometabolic or diabet\* or "heart disease\*" ) OR ( (child\* or p#ediatric) n2 (obes\* or overweight) )

S8 S4 OR S5 OR S6 OR S7

S9 S3 AND S8

### Scopus

((TITLE-ABS-KEY( fetus or fetal or foetus or foetal or "intrauterine growth" or iugr) OR TITLE-ABS-KEY((placenta\* or uteroplacenta\* or "maternal fetal" or "maternal foetal" or fetomaternal or foetomaternal or transplacental) w/2 transfusion)) or (TITLE-ABS-KEY((fetal or foetal or fetus or foetus) w/2 (response or matur\*))) or (TITLE-ABS-KEY ( ( ( uterine OR uterus ) W/2 ( "blood flow" OR circulat\* ) ) OR ( ( uterine OR umbilical OR "mid\* cerebral" ) W/2 doppler ) OR "intrauterine growth" OR iugr )) or (TITLE-ABS-KEY((fetal or foetal or fetus or foetus or neonat\* or newborn or infant) and (growth or develop\* or viability or viable or weight or wellbeing or "well being" or health or heart rate or heartrate or bradycardia or hypoxi\* or hypoglycemi\* or hypoglycaemi\* or movement or oxygenation))) or (TITLE-ABS-KEY("still birth" or stillbirth or ((preterm or "pre matur\*" or prematur\* or "post matur\*" or postmatur\*) w/2 (birth or childbirth or labor or labour or infant\* or newborn\* or neonat\*))) OR TITLE-ABS-KEY(( "birth weight" or birthweight or macrosomia or "gestational age" or lga or sga ) ) OR TITLE-ABS-KEY(((neonatal or newborn\* or infant\* or fetus or fetal or foetus or foetal) and (fat\* or "abdominal circumference" or "body composition" or bmi or "body mass index" or "waist circumference" or "skeletal size" or height or anthropometric\* or apgar or adipos\* or ph or "base excess" or metabolic or acidosis or insulin or diabet\* or hyperbilirubinemi\* or hyperbilirubinaemi\*)))) or (TITLE-ABS-KEY((perinatal or fetal or fetus or foetal or foetus or neonat\* or newborn\* or infant\*) W/3 (mortality or morbidity or death or outcome\* or complication\*) )) or (TITLE-ABS-KEY((( birth or delivery) w/3 (trauma or injur\* or defect\*)) or dystocia or nicu or "neonatal intensive care" or "brachial plexus" ) OR TITLE-ABS-KEY(( (neonat\* or infant\* or newborn\*) and ("ponderal index" or skinfold or bmi or body mass index) ) ) OR TITLE-ABS-KEY("cerebral palsy" or "neural tube defect\*" or "spina bifida" or anencephal\* or encephalocele\* or iniencephal\* or "spinal dyraphism" or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or "cleft palate\*" or "cleft lip" )) or (TITLE-ABS-KEY(( (development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) w/2 (disorder\* or disab\* or delay\*) )) OR TITLE-ABS-KEY("behavior disorder\*" or "behaviour disorder\*" or "attention deficit" or autis\* or asperger\* or "child development" or "developmental milestone\*" or neurodevelopment\* or "cognitive development" or "motor development" or "motor skill\*" or "psychosocial development" or "chronic disease\*" or cardiovascular or cardiometabolic or diabet\* or "heart disease\*") OR TITLE-ABS-KEY(( (child\* or pediatric or paediatric) w/2 (obes\* or overweight) )))) and ((TITLE( exercise\* OR "physical\* activ\*" OR "strenuous activit\*" OR "physical inactiv\*" OR sedentary OR running OR plyometric\* OR yoga OR "tai chi" OR "weight training" OR "resistance training" OR swim\* OR sport\* OR athlet\* OR walk OR walking OR "muscle strengthening" OR "muscle conditioning" OR "muscular conditioning" OR "weight lifting" OR "lifting weight\*" )) AND (TITLE-ABS-KEY ( pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or "pre partum" or "ante partum" or "post partum" or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*))) AND NOT TITLE-ABS-KEY(rat or rats or mouse or mice or cow or cows or bovine or cattle or sheep or ewe\*)

### Web of Science Core Collection (including Emerging Sources Citation Index)

#1 TI=(exercise\* or "physical\* activ\*" or "strenuous activit\*" or "physical inactiv\*" or sedentary or running or plyometric\* or yoga or "tai chi" or "weight training" or "resistance training" or swim\* or sport\* or athlet\* or walk or walking or (muscle\* or muscular or strength) near/2 conditioning or weight\* near/2 lift\*)

#2 TS=(pregnan\* or antenatal or prenatal or perinatal or postnatal or prepartum or antepartum or postpartum or pre partum or ante partum or post partum or puerper\* or primigravid\* or primiparous or multiparous or nulliparous or multigravid\* or trimester\* or obstetric\*)

#3 #1 AND #2

#4 TI=(f$etus or f$etal) or TS=(placenta\* or uteroplacenta\* or ("maternal f$etal" or f$etomaternal or transplacental) near/2 (transfusion or exchange) or (f$etal or f$etus) near/2 (response or matur\*) )

#5 TS=((f$etal or f$etus or neonat\* or newborn or infant) near/3 (growth or develop\* or viability or viable or weight or wellbeing or "well being" or health or "heart rate" or heartrate or bradycardia or hypoxi\* or hypoglyc$emi\* or movement or oxygenation) OR (uterine or uterus) near/2 ("blood flow" or "circulat\*") or ((uterine or umbilical or "mid\* cerebral") near/2 doppler) OR "intrauterine growth" or iugr )

#6 TS=( (perinatal or f$etal or f$etus or neonat\* or newborn\* or infant\*) near/3 (mortality or morbidity or death or outcome\* or complication\*) OR "still birth" or stillbirth OR "birth weight" or birthweight or macrosomia or "gestational age" or lga or sga )

#7 TS=( (perinatal or f$etal or f$etus or neonat\* or newborn\* or infant\*) near/3 (mortality or morbidity or death or outcome\* or complication\*) OR "still birth" or stillbirth or (preterm or "pre matur\*" or prematur\* or "post matur\*" or postmatur\*) near/2 (birth or childbirth or labo$r or infant\* or newborn\* or neonat\*) OR "birth weight" or birthweight or macrosomia or gestational age or lga or sga OR (neonatal or newborn\* or infant\* or f$etus or f$etal) and (fat\* or "abdominal circumference" or "body composition" or bmi or "body mass index" or "waist circumference" or "skeletal size" or height or anthropometric\* or apgar or adipos\* or ph or base near/2 excess or metabolic or acidosis or insulin or diabet\* or hyperbilirubin$emi\*))

#8 TS=((birth or delivery) near/3 (trauma or injur\* or defect\*) or dystocia or nicu or "neonatal intensive care" or "brachial plexus" OR ( (neonat\* or infant\* or newborn\*) and (ponderal index or skinfold or bmi or body mass index) ) OR "cerebral palsy" or "neural tube defect\*" or "spina bifida" or anencephal\* or encephalocele\* or iniencephal\* or "spinal dyraphism" or diastematomyel\* or lipomingocele\* or lipmyelomeningocele\* or meningomyelocele\* or "cleft palate\*" or "cleft lip\*" )

#9 TS=( (development\* or learning or intellectual\* or cognitive\* or language or communication or speech or motor) near/2 (disorder\* or disab\* or delay\*) OR "behavio$r disorder\*" or "attention deficit" or autis\* or asperger\* or "child development" or "developmental milestone\*" or neurodevelopment\* or "cognitive development" or "motor development" or "motor skill\*" or "psychosocial development" or "chronic disease\*" or "chronic illness\*" or cardiovascular or cardiometabolic or diabet\* or "heart disease\*" OR (child\* or p$ediatric) near/2 (obes\* or overweight) )

#10 #9 OR #8 OR #7 OR #6 OR #5 OR #4

#11 #3 AND #10

#12 TS=(rat or rats or mouse or mice or cow or cows or bovine or cattle or sheep or ewe\*)

#13 #11 NOT #12

### Clinicatrials.gov

(exercise OR "physical activity" ) AND (antenatal OR prenatal OR perinatal OR postnatal OR prepartum OR antepartum OR postpartum OR "pre partum" OR fetus OR foetus OR fetal OR foetal)

(exercise OR "physical activity" ) AND ("ante partum" OR "post partum" OR puerper\* OR primigravida OR primiparous OR multiparous OR nulliparous OR multigravida OR trimester OR trimesters OR obstetric)

### Trip Database

title(exercise OR "physical activity" ) AND title(pregnan\* or antenatal OR prenatal OR perinatal OR postnatal OR prepartum OR antepartum OR postpartum OR "pre partum" OR fetus OR foetus OR fetal OR foetal)

# Exclusion list with reasons

|  |
| --- |
| No outcome of interest |
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