Benefici dell'esercizio fisico prima e durante la gravidanza

- Diabete gestazionale
- Ipertensione
- Incontinenza urinaria
- Trombosi venosa profonda
- Mantenimento dell'eccesso di peso post-gravidanza
- Stati ansiosi e depressivi post-parto

L'esercizio fisico può prevenire:

Clapp, 1995
Artal, 1992
Hall, 1999
Bungum, 2000
Yeo, 2000
Goodwin, 2000
ACSM, 2000

Benefici dell’esercizio fisico durante la gravidanza

- Edemi
- Crampi alle gambe
- Affaticamento
- Dolori alla schiena
- Insonnia
- Nausea
- Vene varicose

L’esercizio fisico può aiutare a prevenire:

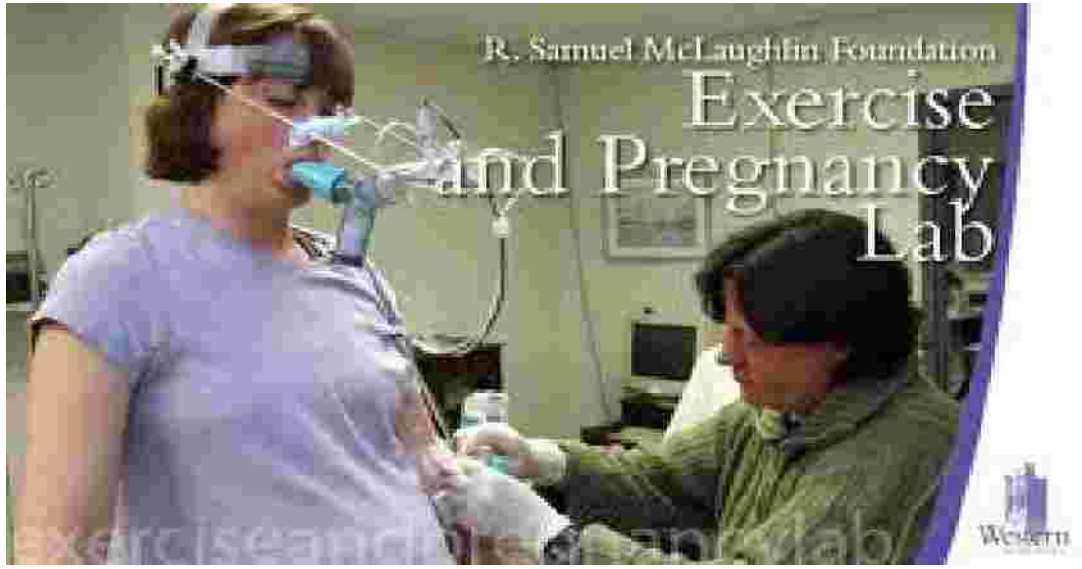
Clapp, 1995
Artal, 1992
Hall, 1999
Bungum, 2000
Yeo, 2000
Goodwin, 2000
ACSM, 2000

Benefici dell'esercizio fisico durante la gravidanza

- Fitness cardiovascolare
- Forza e resistenza muscolare
- Postura corretta
- Autostima
- Senso di benessere

L'esercizio fisico può aiutare a mantenere e migliorare

Clapp, 1995
Artal, 1992
Hall, 1999
Bungum, 2000
Yeo, 2000
Goodwin, 2000
ACSM, 2000



Physiologic responses to acute exercise during pregnancy compared with prepregnancy

Oxygen uptake	Increase
Heart rate	Increase
Stroke volume	Increase
Cardiac output	Increase
Minute ventilation	Increase
VE/VO2	Increase
VE/CO2	Increase
SBP	No change/Decrease
DBP	No change/Decrease

Cardiorespiratory responses to exercise during pregnancy
Absolute O2 uptake is well preserved in women who maintain physical activity
Maximum exercise stress testing is not recommended. If a maximal exercise test is warranted, the test should be performed with physician supervision. Submaximal exercise testing (<75% HRR) may be performed to predict maximum oxygen uptake to develop a more precise exercise prescription
Resting HR is increased due to pregnancy
HR increases at a slower rate in response to increase in exercise intensity
Functional cardiac reserve (HRmax-Resting HR) is decreased during pregnancy because of elevated resting HR
For well-bearing exercise, the energy requirement increases in proportion to maternal weight gain

Effects of exercise on aerobic working capacity in pregnant

The best measure of aerobic working capacity is maximal oxygen uptake (VO_2 max), expressed either in absolute units (L/min) or as a function of body mass (mL/kg/min).

As a general rule, absolute VO_2max (L/min) is well preserved in pregnancy and with advancing gestational age, in women who maintain their customary levels of physical activity, whereas VO_2max as a function of body mass usually declines (proportional to gestational weight gain).

Oxygen uptake at the ventilatory threshold, an indicator of the onset of blood lactate acumulation, is not significantly affected by pregnancy or advancing gestational age

These findings indicate that pregnant women are able to perform submaximal work without accumulating lactic acid in blood and becoming fatigued

Effects of exercise on aerobic working capacity in pregnant

The point of respiratory compensation for metabolic acidosis during graded exercise testing is also unaffected by pregnancy. However, peak blood lactate levels following strenuous exercise testing have been consistently reported to be lower during pregnancy than in the non pregnant state, possibly due to lactate dilution in an expanded maternal blood volume

Effects of pregnancy, postpulated mechanisms, and resulting effects on work performance

Effect of pregnancy	Underlying Cause	Effects on Exercise Response
Increased resting metabolic rate	Fetal energy requirement	Less energy for muscle contraction
Increased resting HR	Reduced resting PNS cardiac modulation	Reduced HRR
Increased maternal body mass	Fetal growth Increased maternal adiposity	Increased energy cost of weight-supported work

Relationship between hormonal changes of pregnancy, anatomical and physiological changes of pregnancy

HORMONAL CHANGES

ANATOMICAL CHANGES	PHYSIOLOGICAL CHANGES
Weight gain ?Joint Laxity Postural Changes	? Sensitivity to CO2 ? Heart Size ? Blood volume

RESPONSES TO EXERCISE

? Energy cost of weight-bearing exercise ? Injury risk for sports requiring physical contact, fast direction changes	Relative anemia Dilution of substances in blood (es. lactate) ? Breathing, ?pH

Predictors of Change in Physical Activity During and After Pregnancy - Project Viva

Pereira M. *Am J Prev Med 2007*

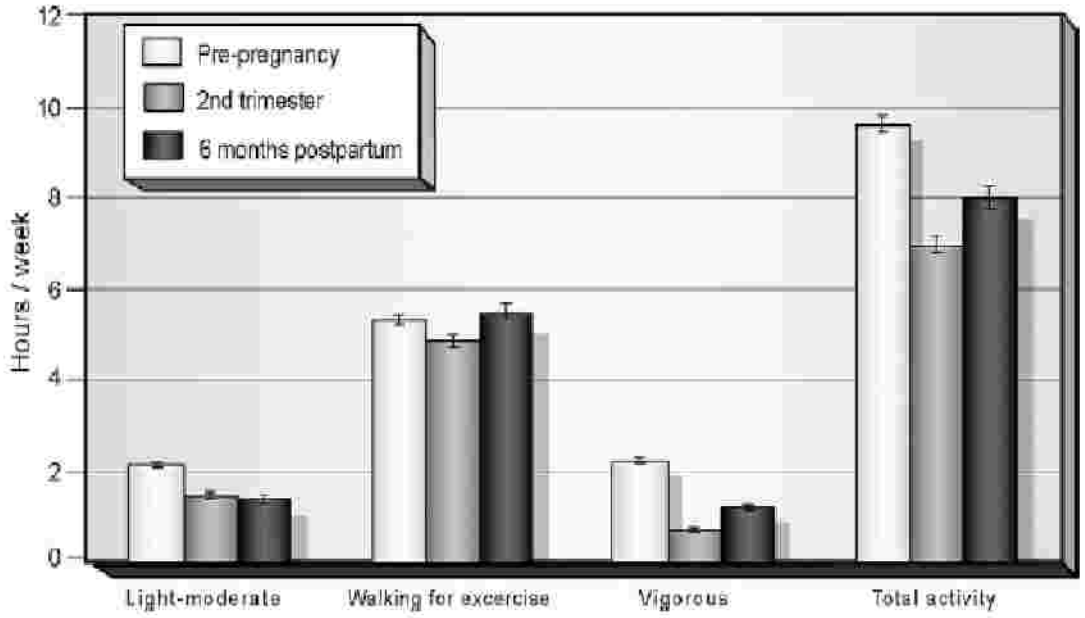


Figure 1. Mean (±SE) self-reported physical activity (hours per week) before, during, and after pregnancy. Data are from participants in Project Viva. (n=1442 prepregnancy; n=1442 second trimester; n=1242; 6 months postpartum).

Women reported decreases in moderate and vigorous physical activity during pregnancy that persisted at 6 months postpartum. Levels of walking did not decline. Children at home, work hours, and lack of chi care were predictors of becoming insufficiently active during or after pregnancy.

Background: Few studies document longitudinal changes in physical activity from prepregnancy to the postpartum period.

Methods: This study estimated change in self-reported leisure-time physical activity in 1442 women before pregnancy, during the second trimester, and at 6 months postpartum. In addition, it also examined predictors of becoming insufficiently active during or after pregnancy.

Results: The mean (SD) age was 32.5 (4.5) years, 34% of the women were overweight or obese prepregnancy (body mass index equal to or greater than 25 kg/m^2), and 76% were white. Before pregnancy, the mean total leisure physical activity was 9.6 hours per week. The reported decrease in total activity between prepregnancy and 6 months postpartum was –1.4 (95% CI=–1.0 to –1.9) hours per week, accounted for by decreases in moderate and vigorous physical activity but not walking. Prevalence of insufficiently active lifestyle (less than 150 minutes per week of total activity) increased from 12.6% before pregnancy to 21.7% during the postpartum period. The OR for becoming insufficiently active during pregnancy was 1.58 (95% CI=1.07–2.32) in women with at least one child compared with no children. Predictors of becoming insufficiently active postpartum included postpartum weight retention (OR=1.31; 95% CI=1.05–1.58 for each 5-kg increment); working longer hours in the first trimester (e.g., OR=5.12; 95% CI=1.96–13.4 for 45+ vs 0 hours); and reporting that lack of child care was a barrier to physical activity (OR=1.73; 95% CI=0.99–3.02).

Conclusions: Women reported decreases in moderate and vigorous physical activity during pregnancy that persisted at 6 months postpartum. Levels of walking did not decline. Children in the home, longer work hours, and lack of child care were predictors of becoming insufficiently active during or after pregnancy.

(Am J Prev Med 2007;32(4):312–319)

Table 2. Multivariable predictors of incidence of sedentary lifestyle from prepregnancy to second trimester of pregnancy (n=1191)[a]

	n (%)	OR	95% CI	Trend p
Total prepregnancy physical activity				
(1 hour per week)		0.86	0.83–0.90	
Age increment				
(1 year)		1.00	0.96–1.04	
BMI before pregnancy				
(1 kg/m^2)		1.03	0.99–1.06	
Depression (Edinburgh Scale)				
<13	1065 (89.4)	Ref.		
≥13	102 (8.6)	0.77	0.41–1.46	
Missing	24 (2.0)	0.72	0.20–2.58	
Race/ethnicity				
White	929 (78.0)	Ref.		
Asian	56 (4.7)	1.79	0.86–3.74	
Black	104 (8.7)	1.34	0.71–2.51	
Hispanic	62 (5.2)	1.64	0.80–3.35	
Other	40 (3.4)	1.92	0.82–4.50	
Marital status				
Married	1052 (88.3)	Ref.		
Cohabitate	82 (6.9)	1.02	0.51–2.07	
Divorced/separated/widowed	22 (1.9)	1.29	0.36–4.60	
Never married	35 (2.9)	1.31	0.43–4.04	
Education				
≤high school diploma	76 (6.4)	1.56	0.73–3.32	0.14
Some college	236 (19.8)	1.48	0.88–2.48	
BA or BS	460 (38.6)	1.36	0.91–2.05	
Postgraduate degree	419 (35.2)	Ref.		
Annual household income ($U.S.)				
≤40,000	113 (9.5)	1.30	0.68–2.50	0.52
40,001–70,000	268 (22.5)	1.01	0.66–1.56	
Don't know	27 (2.3)	0.99	0.28–3.43	
>70,000	783 (65.7)	Ref.		
Employment in early pregnancy (hours per week)				
0	163 (13.7)	Ref.		0.10
1–24	170 (14.3)	0.71	0.35–1.44	
25–34	107 (9.0)	1.18	0.58–2.40	
35–44	550 (46.2)	1.27	0.73–2.21	
45+	201 (16.9)	1.31	0.66–2.63	
Employment change from early pregnancy to second trimester				
No change	906 (76.1)	Ref.		
Decrease	179 (15.0)	1.17	0.72–1.91	
Increase	106 (8.9)	0.94	0.49–1.81	
Number of children in home before current pregnancy				
0	548 (46.0)	Ref.		0.004
1+	588 (49.4)	1.58	1.07–2.32	
Missing	55 (4.6)	0.22	0.05–0.94	
Nauseated[b]				
Yes	537 (45.1)	1.25	0.86–1.81	
No	654 (54.9)	Ref.		
Vomiting frequency (total during this pregnancy)				
0	621 (52.1)	Ref.		0.03
1–2	189 (15.9)	1.04	0.65–1.68	
3–10	174 (14.6)	0.82	0.50–1.37	
11–20	83 (7.0)	0.59	0.28–1.27	
20+	124 (10.4)	0.55	0.28–1.07	

Table 3. Multivariable predictors of incidence of sedentary lifestyle from prepregnancy to 6 months after pregnancy (n=794)*

	n (%)	OR	95% CI	Trend p
Total prepregnancy physical activity				
(1 hour per week)		0.85	0.81–0.90	
Weight retention 6 months postpartum				
(5 kg)		1.31	1.05–1.58	
Pregnancy weight gain based on IOM Guidelines				
Inadequate	110 (13.9)	1.14	0.59–2.21	
Adequate	291 (36.7)	Ref.		
Excessive	393 (49.5)	0.44	0.27–0.72	
Depression in second trimester				
<13	672 (84.6)	Ref.		
≥13	57 (7.2)	1.06	0.48–2.33	
Missing	65 (8.2)	0.78	0.35–1.74	
Depression 6 months postpartum				
<13	721 (90.8)	Ref.		
≥13	66 (8.3)	1.34	0.64–2.79	
Missing	7 (0.9)	1.43	0.22–9.49	
Age increment				
(1 year)		1.08	1.02–1.14	
BMI before pregnancy				
(1 kg/m^2)		0.99	0.94–1.04	
Race/ethnicity				
White	618 (77.8)	Ref.		
Asian	37 (4.7)	0.97	0.34–2.74	
Black	67 (8.4)	1.25	0.54–2.89	
Hispanic	47 (5.9)	1.57	0.66–3.72	
Other	25 (3.2)	1.35	0.39–4.63	
Marital status				
Married	702 (88.4)	Ref.		
Cohabitate	60 (7.6)	0.97	0.40–2.36	
Divorced/separated/widowed	11 (1.4)	0.37	0.03–4.34	
Never married	21 (2.6)	1.13	0.26–4.95	
Education				
≤high school diploma	35 (4.4)	1.58	0.49–5.07	0.54
Some college	162 (20.4)	1.14	0.61–2.16	
BA or BS	298 (37.5)	0.89	0.53–1.48	
Postgraduate degree	299 (37.7)	Ref.		
Annual household income (annual $U.S.)				
Don't know	14 (1.8)	0.57	0.06–5.21	0.91
≤40,000	81 (10.2)	0.77	0.31–1.91	
40,001–70,000	170 (21.4)	1.24	0.72–2.16	
>$70,000	529 (66.6)	Ref.		
Employment in early pregnancy (hours per week)				
0	110 (13.9)	Ref.		0.002
1–24	109 (13.7)	1.74	0.72–4.24	
25–34	73 (9.2)	2.01	0.72–5.64	
35–44	367 (46.2)	3.25	1.46–7.21	
45+	135 (17.0)	5.12	1.96–13.37	
Employment change from early pregnancy to 6 months postpartum				
No change	334 (42.1)	Ref.		
Decrease	421 (53.0)	0.46	0.28–0.76	
Increase	39 (4.9)	2.01	0.80–5.09	
Number of children in home				
0	366 (46.1)	Ref.		
1+	389 (49.0)	1.30	0.79–2.13	
Missing	39 (4.9)	0.68	0.21–2.23	
Nauseated[b]				
No	404 (50.9)	Ref.		
Yes	390 (49.1)	1.14	0.79–1.81	
Vomiting frequency (total during this pregnancy)				
0	395 (49.8)	Ref.		0.11
1–2	129 (16.3)	0.71	0.38–1.32	

Women's Exercise Beliefs and Behaviors During Their Pregnancy and Postpartum

Danielle Symons Downs, PhD, and Heather A. Hausenblas, PhD

74 women

1) the most common exercise beliefs during pregnancy were that exercise improves mood and physical limitations (e.g., nausea) obstructed exercise participation;

2) the most common exercise beliefs during postpartum were that exercise controls weight gain and a lack of time obstructed exercise participation;

3) women's husband/partner and family members most strongly influenced their pregnancy and postpartum exercise behavior;

Women exercised more before they were pregnant than during pregnancy and postpartum.

Table 1. Exercise Beliefs Reported During Pregnancy and Postpartum

Belief Themes	N	%*
Pregnancy		
Behavioral Beliefs (Advantages)		
Improves overall mood	25	33.8
Increases energy and stamina/endurance	22	29.7
Stay fit (e.g., in shape, keep muscle tone, to walk)	16	21.6
Controls weight	14	18.9
Assist in labor and delivery (e.g., makes delivery easier/faster)	11	14.9
Provides stress reduction/relaxation	6	8.1
Normative Beliefs (Influences)		
Husband or fiancé	27	36.5
Children	13	17.6
Other family members (parents, siblings, grandparents)	11	14.9
Friends	9	12.2
Health care professionals	2	2.7
Gym instructors	2	2.7
Control Beliefs (Obstructing Factors)		
Physical limitations and restrictions (e.g., nausea, vomiting)	42	56.8
Tiredness and fatigue/no energy	20	27.0
Time limits (lacking time)	19	25.7
Gaining weight (too big)	10	13.5
Caring for other children	7	9.5
Fear of harming self/baby	7	9.5
Bad weather	6	8.1
No motivation/feeling lazy	6	8.1
Postpartum		
Behavioral Beliefs (Advantages)		
Controls weight	28	37.8
Stay fit (e.g., in shape, keep muscle tone, to walk)	27	36.5
Improves overall mood	23	31.1
Increases energy and stamina	22	29.7
Decreases physical discomfort (e.g., relieves cramps, soreness, swelling)	3	4.1
Provides stress reduction/relaxation	2	2.7
Normative Beliefs (Influences)		
Husband or fiancé	28	37.8
Other family members (parents, siblings, grandparents)	25	33.8
Children	7	9.5
Friends	9	12.2
Health care professionals	5	6.8
Gym instructor	1	1.4
Control Beliefs (Obstructing Factors)		
Time limits (lacking time)	36	48.6
Physical limitations and restrictions (e.g., nausea, vomiting)	16	21.6
Tiredness and fatigue/no energy	10	13.5
Fear of harming self	8	10.8
No motivation/feel lazy	6	8.1

* May not add up to 100% because some participants reported multiple beliefs.

LA SEDENTARIETA' COME FATTORE DI RISCHIO PRIMA E DURANTE LA GRAVIDANZA

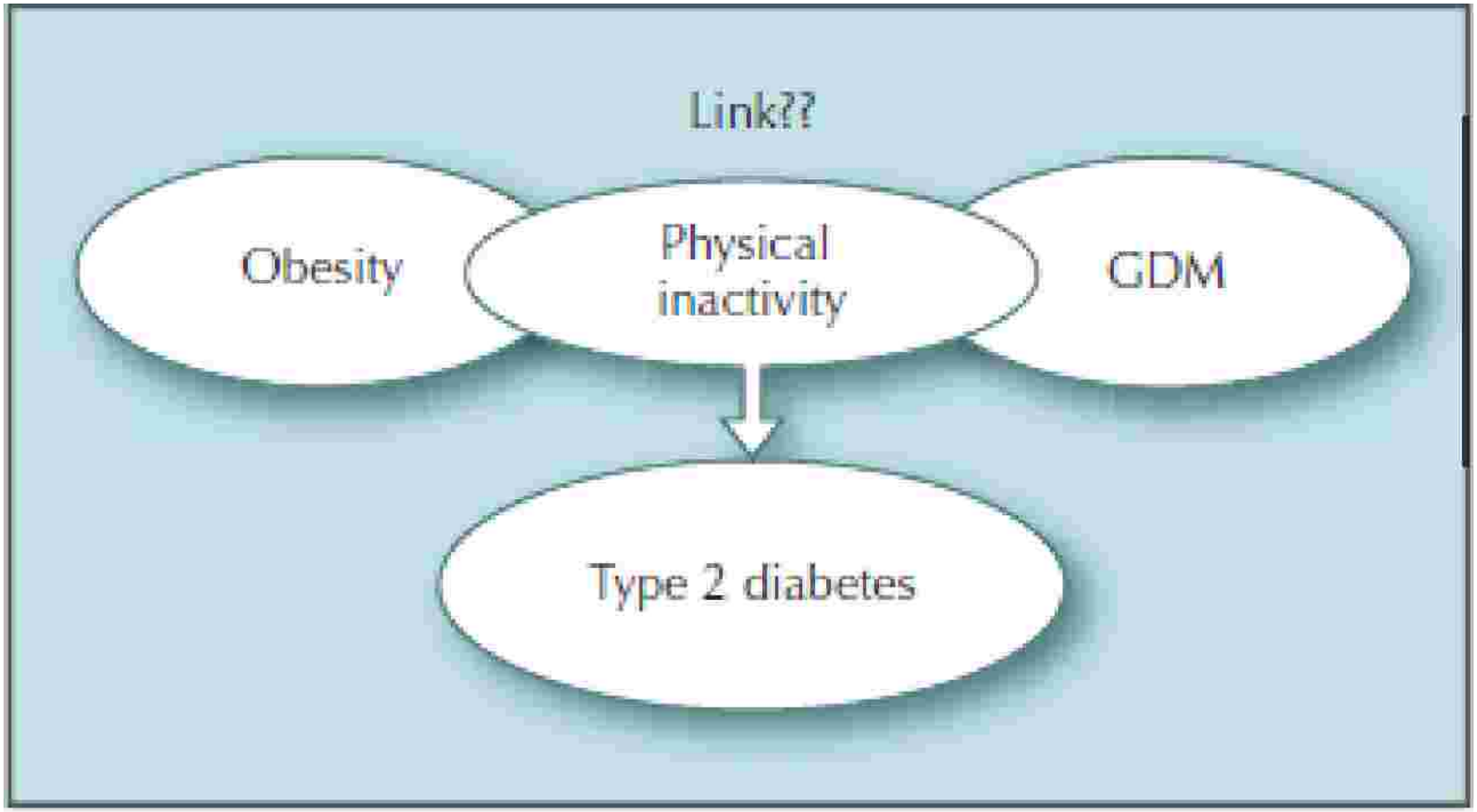
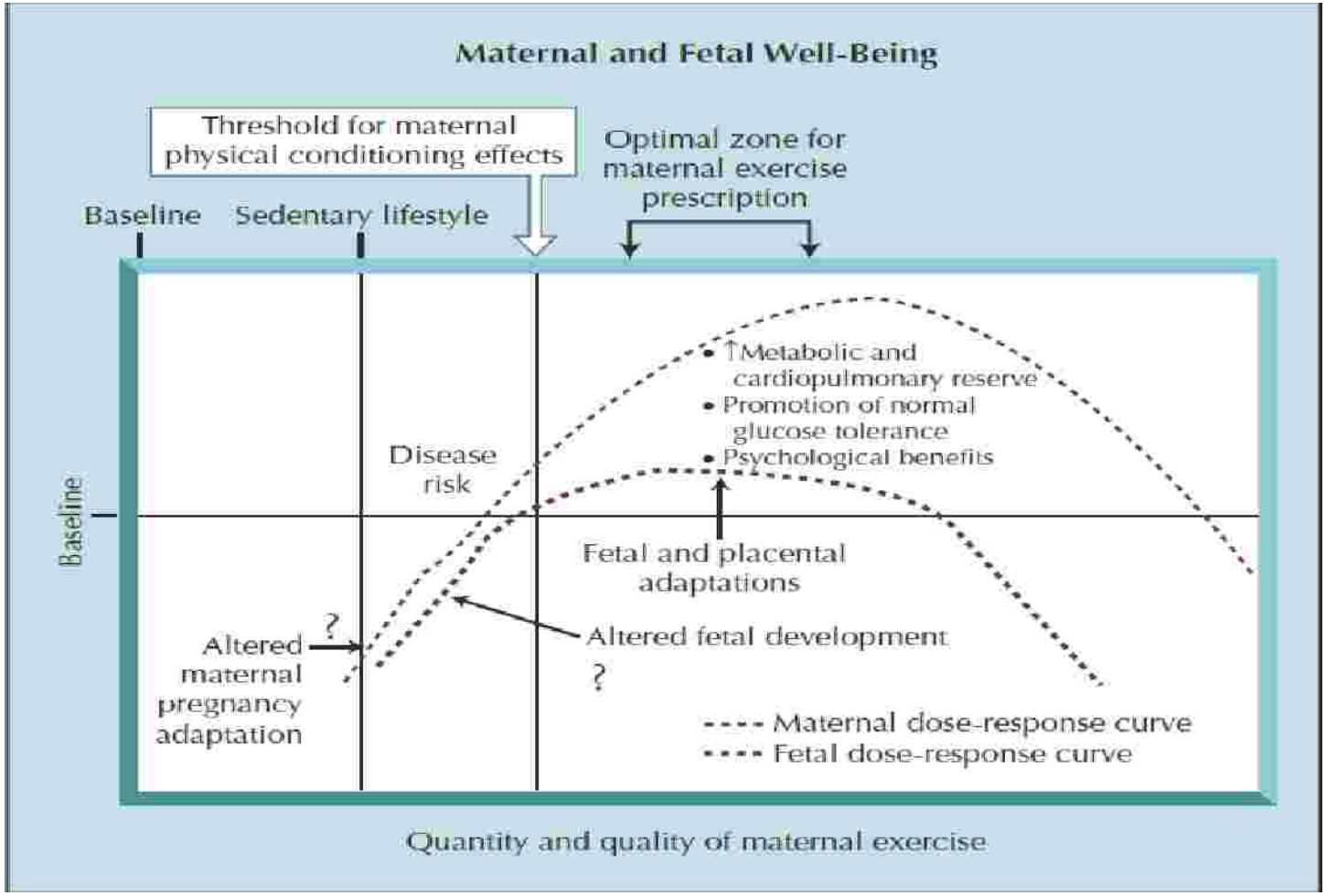


Figure 2. Schematic linking physical inactivity during pregnancy as a risk factor for obesity and GDM, which may then lead to an increased risk for type 2 diabetes later in life. GDM—gestational diabetes mellitus.



Maternal and foetal dose-response curves exist as the quantity and quality of maternal exercise increase from baseline.

QUALE E' LA QUANTITA' E QUALITA' DI ESERCIZIO FISICO IDEALE DA PRESCRIVERE??

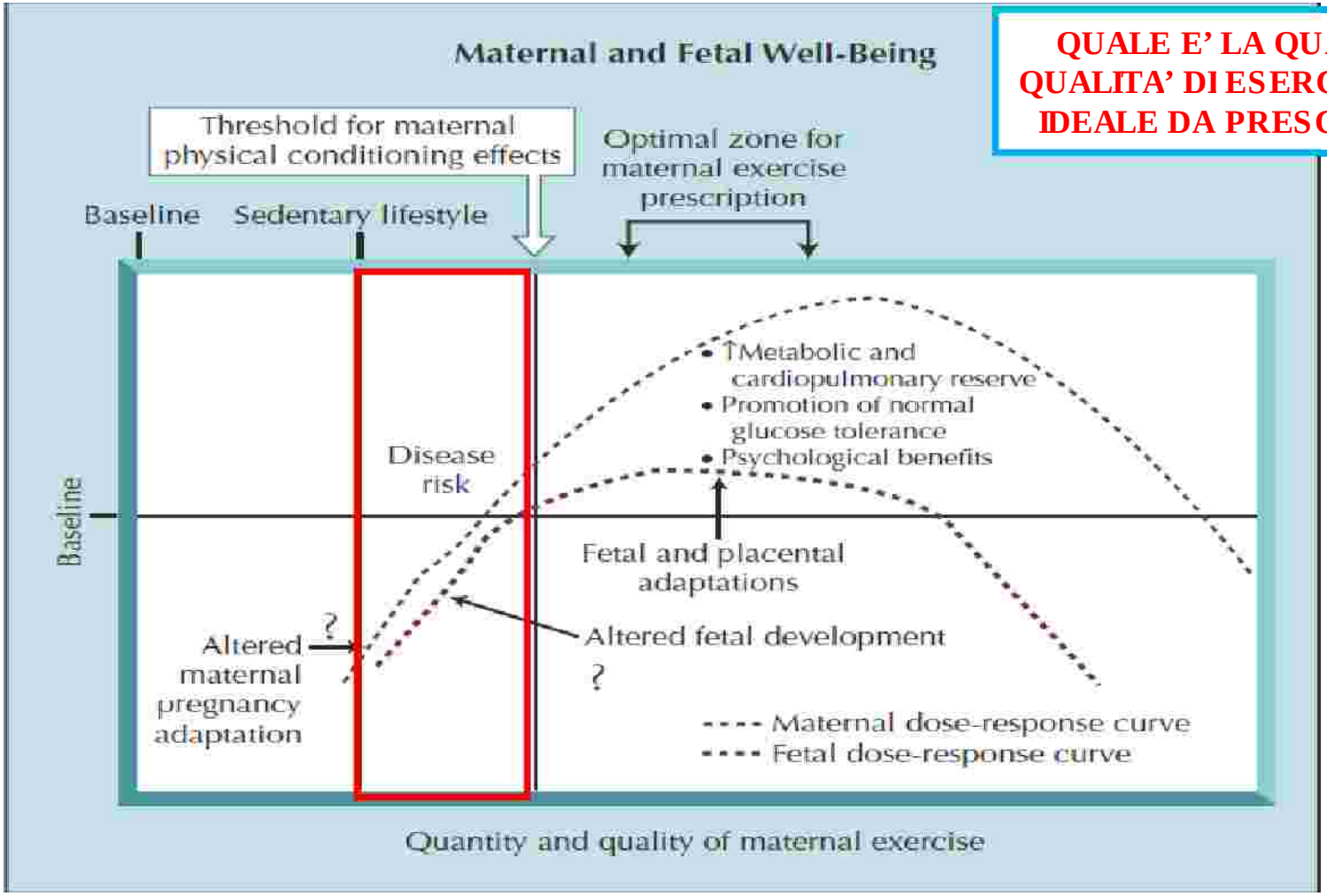
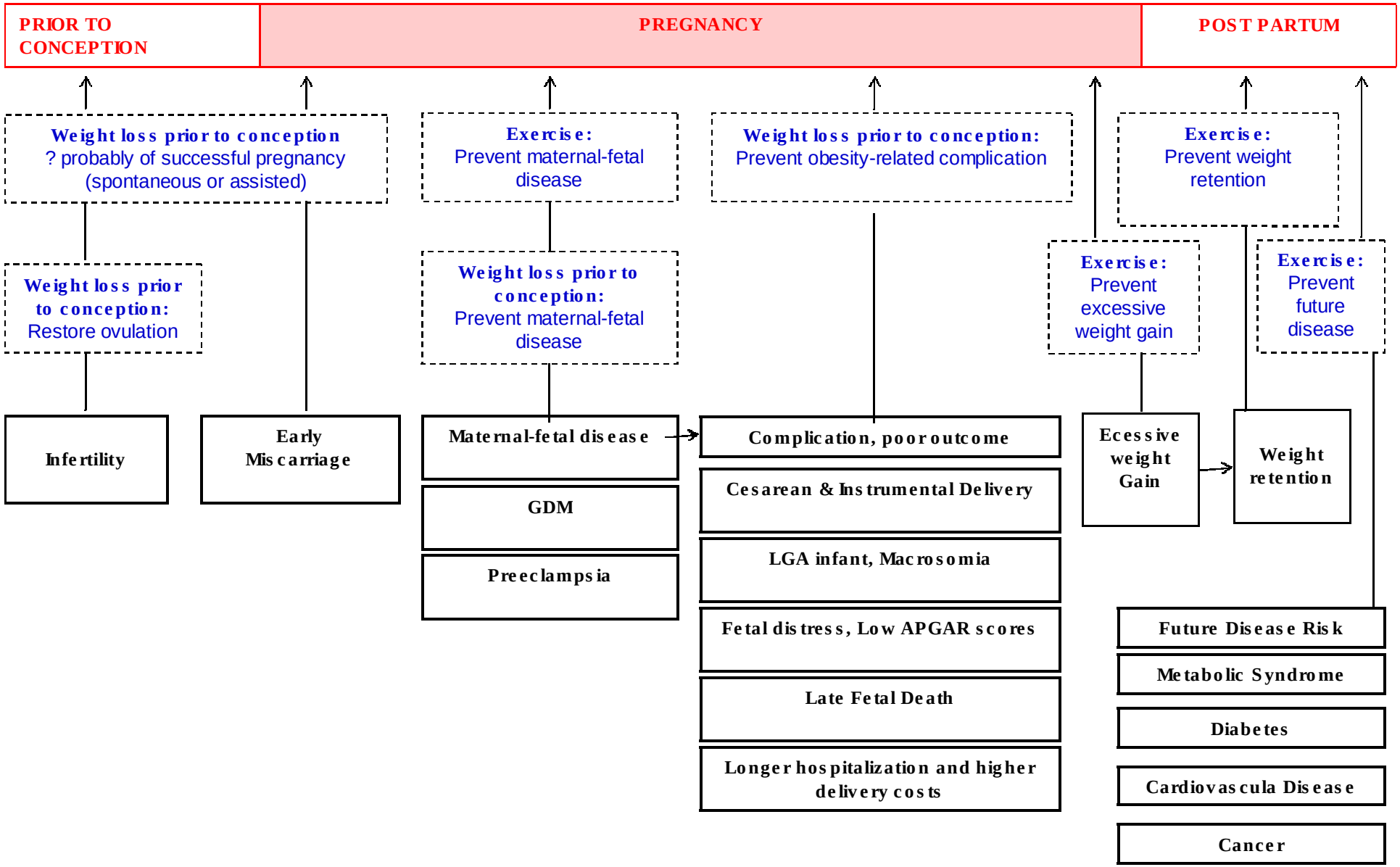


Diagram suggesting that a minimal amount of physical activity must be maintained to achieve health benefits during pregnancy.

A sedentary lifestyle and, thus, physical inactivity may put the mother and fetus at risk for disease through altered maternal pregnancy adaptation. (*Adapted from Wolfe et al.)*

Reproductive risks associated with obesity and benefits of exercise prior to conception, during pregnancy, and post-partum (Weissgerber TL, 2006).

——— Represent reproductive risks associated with obesity, - - - - Represented effects of weight loss before conception and exercise on reproductive risks associated with obesity.



Risks of obesity during pregnancy

Obese and overweight women who conceive have an increase risk of maternal and fetal complication:

Longer hospitalization

Caesarean section

Higher delivery costs

Increased preeclampsia

Increased GDM

Risk Factors for Childhood Obesity:

- Obese mother/ father
- Born to a mother with GDM
- Higher birth weight predicted increased risk of overweight in adolescence
- Lower birth weight associated with later risk for central obesity
- Family life – overeating & sedentary lifestyle

Influence on early post-natal life

- Infants who were fed breast milk or who were breast fed longer had lower risk of overweight in adolescence
- WHO breast fed at least 6 months Exclusively!!
- Parental feeding patterns
- Parental activity patterns
- Obese mother – obese child

Gestational weight gain

- Prepregnancy BMI and gestational weight gain (GWG) are strong predictors for high birth weight and obesity in infancy and adulthood
- High GWG in the first part of pregnancy is especially associated with obesity in later life
- Interpregnancy weight gain increases the risk of GDM in future pregnancies

Randomized trial of a behavioral intervention to prevent excessive gestational weight gain: the Fit for Delivery Study[1–4]

Suzanne Phelan, Maureen G Phipps, Barbara Abrams, Francine Darroch, Andrew Schaffner, and Rena R Wing

ABSTRACT

Background: Excessive weight gain during pregnancy is a major risk factor for postpartum weight retention and future weight gain and obesity in women, but few adequately powered randomized controlled trials have examined the efficacy of a behavioral weight-control intervention during pregnancy.

Objective: This study examined whether a behavioral intervention during pregnancy could decrease the proportion of women who exceeded the 1990 Institute of Medicine (IOM) recommendations for gestational weight gains and increase the proportion of women who returned to pregravid weights by 6 mo postpartum.

Design: This study was a randomized, assessor-blind, controlled trial. Participants were pregnant (13.5 wk gestation), normal-weight (NW; $n = 201$) and overweight or obese (OW/OB; $n = 200$) women whose average age was 28.8 y. Participants were randomly assigned within the 1990 IOM weight category (NW compared with OW/OB) to standard care ($n = 200$) or to a behavioral intervention to prevent excessive gestational weight gain ($n = 201$). The intervention included one face-to-face visit; weekly mailed materials that promoted an appropriate weight gain, healthy eating, and exercise; individual graphs of weight gain; and telephone-based feedback. The retention at the 6-mo postpartum assessment was 82%.

Results: Intent-to-treat analyses showed that the intervention, compared with standard care, decreased the percentage of NW women who exceeded IOM recommendations (40.2% compared with 52.1%; $P = 0.003$) and increased the percentages of NW and OW/OB women who returned to their pregravid weights or below by 6 mo postpartum (30.7% compared with 18.7%; $P = 0.005$).

Conclusion: A low-intensity behavioral intervention during pregnancy reduced excessive gestational weight gains in NW women and prevented postpartum weight retention in NW and OW/OB women. This trial was registered at clinicaltrials.gov as NCT01117961. *Am J Clin Nutr* doi: 10.3945/ajcn.110.005306.

TABLE 2
Weight changes during pregnancy by treatment group and BMI category[1]

A low-intensity behavioral intervention during pregnancy reduced excessive gestational weight gains in NW women and prevented postpartum weight retention in NW and OW/OB women

	NW		OW/OB	
	Standard care (n = 94)	Intervention (n = 92)	Standard care (n = 90)	Intervention (n = 87)
Total weight gain, pregravid to delivery (kg)[2]	16.2 ± 4.6[3]	15.3 ± 4.4	15.1 ± 7.5	14.7 ± 6.9
Exceeded IOM recommendations (%)[4]	52.1	40.2	61.1	66.7
Gain (kg)[2]	19.7 ± 3.1	19.5 ± 3.3	19.6 ± 5.5	18.2 ± 4.8
Within IOM recommendations (%)[4]	35.1	45.7	24.4	20.7
Gain (kg)[2]	13.6 ± 1.3	13.5 ± 1.5	10.1 ± 1.9	10.2 ± 2.5
Below IOM recommendations (%)[4]	12.8	14.1	13.3	12.6
Gain (kg)[2]	9.1 ± 1.5	9.4 ± 1.3	4.0 ± 3.3	3.4 ± 3.9
Clinic visits at which subjects exceeded IOM recommendations (%)	35.1	26.0	63.0	58.0
Exceeded IOM recommendations at some point during pregnancy (%)[5]	55.3	51.1	68.9	72.4
Subjects who exceeded IOM recommendations during pregnancy but were within recommendations at delivery (%)	3.2	10.9	7.8	5.7
6 mo postpartum[6]				
Weight loss since delivery (kg)[7]	12.6 ± 4.7	12.7 ± 4.0	10.4 ± 5.9	11.3 ± 5.5
Net weight retention (kg)[7]	3.3 ± 3.5	2.1 ± 4.7	4.3 ± 6.2	3.7 ± 5.9
Subjects at or below prepregnancy weight (%)[8]	20.7	35.6	16.7	25.6

[1] IOM, Institute of Medicine; NW, normal weight; OW/OB, overweight or obese. All models were adjusted for clinic, total weeks of gestation at delivery, race, age, and parity.

[2] On the basis of analyses of completers: n = 91 NW standard care, n = 89 NW intervention, n = 83 OW/OB standard care, and n = 80 NW intervention. Repeated-measures analysis showed no significant effects of treatment group on continuous measures of weight changes during pregnancy.

[3] Mean ± SD (all such values).

[4] Intent-to-treat analyses showed a significant interaction between treatment group and BMI category for excessive total gestational weight gain compared with all other weight-gain categories [odds ratio (OR): 0.38; 95% CI: 0.15, 0.97; P = 0.04].

[5] Multiple logistic regression intent-to-treat analysis indicated a significant main effect for BMI category (OR: 0.20; 95% CI: 0.10, 0.43; P = 0.0001).

[6] Six-month postpartum analysis excluded participants who became pregnant (n = 5).

[7] On the basis of analyses of completers: n = 81 NW standard care, n = 72 NW intervention, n = 68 OW/OB standard care, and n = 70 OW/OB intervention. Repeated-measures analysis showed no significant effects of treatment group on continuous measures of weight changes postpartum.

[8] Intent-to-treat analyses showed that the intervention increased percentages of NW and OW/OB women who achieved their preconception weights or below at 6 mo postpartum (OR: 2.1; 95% CI: 1.3, 3.5; P = 0.005); there was no significant weight × treatment group interaction (P = 0.71).

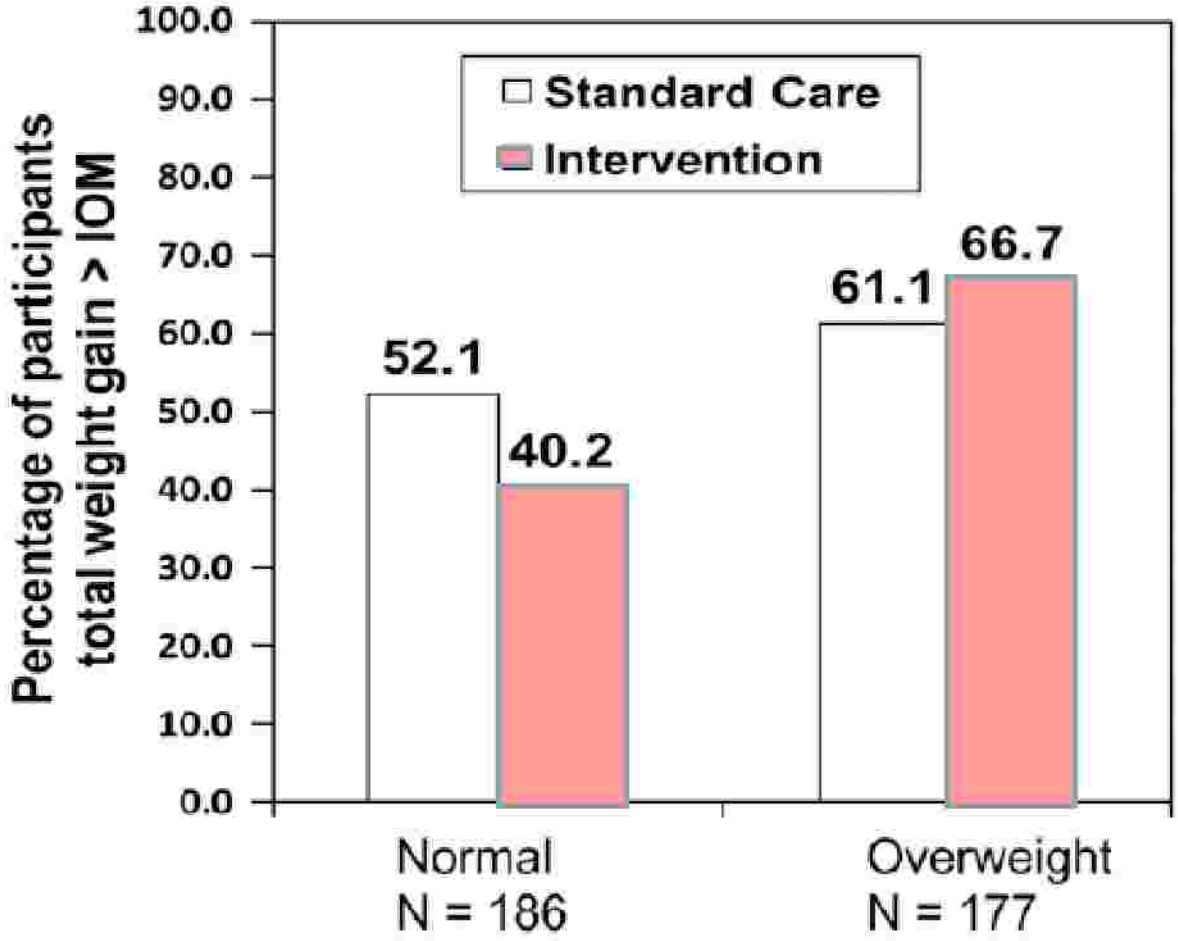


FIGURE 2. Percentages of women whose total weight gain exceeded 1990 Institute of Medicine (IOM) recommendations. On the basis of multiple logistic regression analysis, the overall BMI category by treatment interaction odds ratio (OR) was 0.38 (95% CI: 0.15, 0.97), $P = 0.04$; the OR for the treatment effect in normal-weight women was 0.38 (95% CI: 0.20, 0.87), $P = 0.003$; no significant treatment effect in overweight women was observed, $P = 0.33$.

The LiP (Lifestyle in Pregnancy) Study

A randomized controlled trial of lifestyle intervention in 360 obese pregnant women

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PER OVESEN, DMSC[3]
HENNING BECK-NIELSEN, DMSC[2]
JAN S. JØRGENSEN, PHD[1]

Table 2—*GWG, obstetric, and neonatal outcomes*

Variable	Intervention $n = 150$	Control $n = 154$	P
GA 35			
GWG (kg)	7.0 (4.7–10.6)	8.6 (5.7–11.5)	0.014
≤5 kg	41 (28.5)	30 (20.3)	0.102
≤9 kg	93 (64.6)	79 (53.4)	0.058
Blood pressure (mmHg)			
Systolic	122 (117–130)	124 (116–129)	0.693
Diastolic	82 (77–88)	83 (78–89)	0.263
VO_{2max} (mL/kg/min)*	23 (19–27)	22 (19–24.5)	0.049
Obstetric outcomes			
Cesarean section			
All	40 (26.7)	39 (25.3)	0.790
Emergency	22 (14.7)	28 (18.2)	0.408
Planned	18 (12)	11 (7.1)	0.149
GDM	9 (6.0)	8 (5.2)	0.760
Preeclampsia/PIH	23 (15.4)	28 (18.2)	0.506
Neonatal outcomes			
Birth weight (g)	3,742 (3,464–4,070)	3,593 (3,335–3,930)	0.039
GA (days)	283 (273–290)	283 (274–289)	0.952
LGA	23 (15.4)	18 (11.7)	0.340
Birth weight >4,000 g	40 (32)	39 (25.3)	0.070
Admission to NICU	21 (14.0)	22 (14.3)	0.943

Data are given as median (interquartile range) or number (%). For the GWG variables, the total number is <304 due to missing values: $n = 144$ in the intervention group and $n = 148$ in the control group. For the physical fitness score, the number is $n = 90$ in the intervention group and $n = 76$ in the control group. Differences between groups were analyzed with the χ^2 test for categoric variables. The Student t test was used for continuous variables with normal distribution; otherwise, the Mann-Whitney U test was used. *As an indicator of physical fitness.

CONCLUSIONS

- Lifestyle intervention in pregnancy resulted in limited GWG in obese pregnant women. Overall obstetric outcomes were similar in the two groups.
- Lifestyle intervention resulted in a higher adherence to the Institute of Medicine weight gain recommendations;
- However, a significant number of women still exceeded the upper threshold.

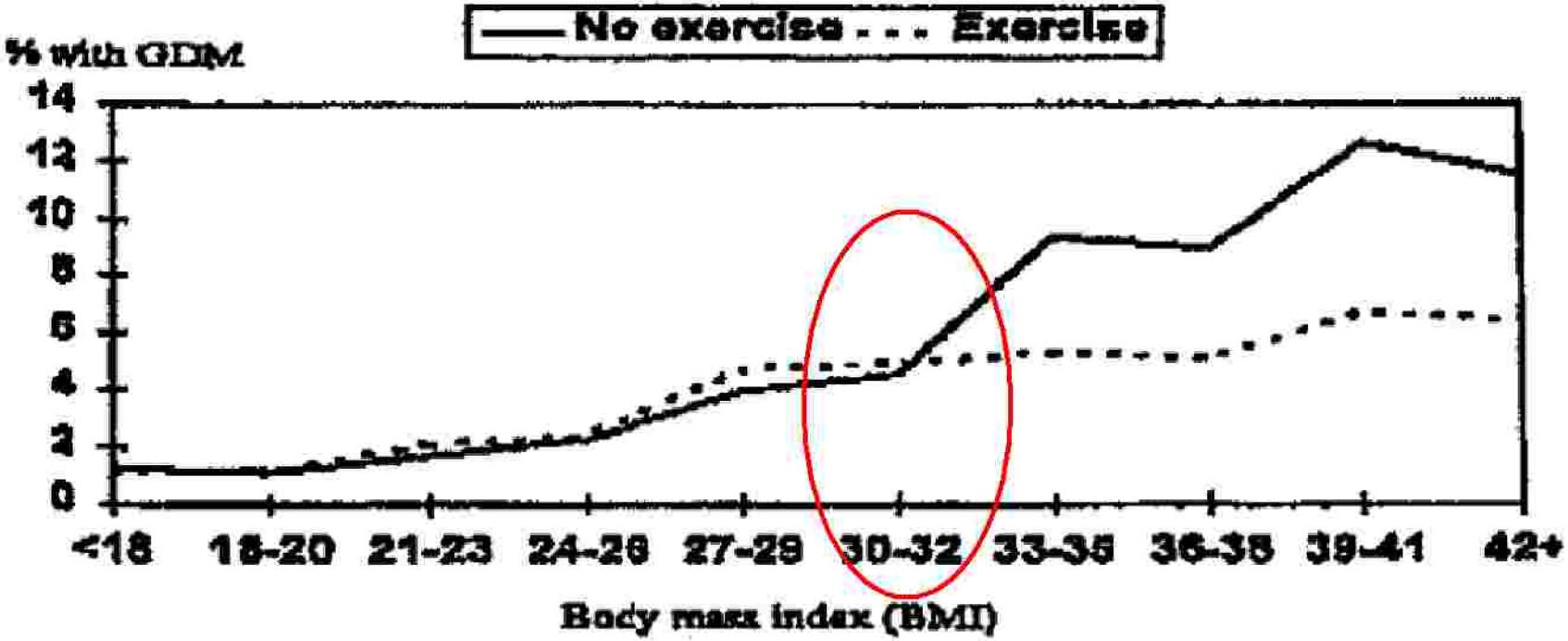


FIG. 4. Prevalence of gestational diabetes mellitus (GDM) by body mass index (BMI) and exercise status, central New York, 1995–1996. (Dye TD, Knox KL, Artal R, et al. Physical activity, obesity and diabetes in pregnancy. Am J Epidemiol. 1997;146:961–965, with permission)

Physical Activity Before and During Pregnancy and Risk of Gestational Diabetes Mellitus

A meta-analysis

Deirdre K. Tobias, sm[1]
Cuilin Zhang, md, phd[2]
Rob M. van Dam, md, phd[1,3]
Katherine Bowers, phd[2]
Frank B. Hu, md, phd[1,4]

OBJECTIVE — Gestational diabetes mellitus (GDM) is one of the most common complications of pregnancy and is associated with a substantially elevated risk of adverse health outcomes for both mothers and offspring. Physical activity may contribute to the prevention of GDM and thus is crucial for dissecting the vicious circle involving GDM, childhood obesity, and adulthood obesity, and diabetes. Therefore, we aimed to systematically review and synthesize the current evidence on the relation between physical activity and the development of GDM.

RESEARCH DESIGN AND METHODS — Medline, EMBASE, and Cochrane Reviews were searched from inception to 31 March 2010. Studies assessing the relationship between physical activity and subsequent development of GDM were included. Characteristics including study design, country, GDM diagnostic criteria, ascertainment of physical activity, timing of exposure (prepregnancy or early pregnancy), adjusted relative risks, CIs, and statistical methods were extracted independently by two reviewers.

RESULTS — Our search identified seven prepregnancy and five early pregnancy studies, including five prospective cohorts, two retrospective case-control studies, and two cross-sectional study designs. Prepregnancy physical activity was assessed in 34,929 total participants, which included 2,813 cases of GDM, giving a pooled odds ratio (OR) of 0.45 (95% CI 0.28–0.75) when the highest versus lowest categories were compared. Exercise in early pregnancy was assessed in 4,401 total participants, which included 361 cases of GDM, and was also significantly protective (0.76 [95% CI 0.70–0.83]).

CONCLUSIONS — Higher levels of physical activity before pregnancy or in early pregnancy are associated with a significantly lower risk of developing GDM.

nancy (5,6). Ch
GDM are more lik
impaired glucose

-7 PRE-PREGNANCY STUDY (34.929 PARTICIPANTS, 2813 GDM):

-5 EARLY PREGNANCY STUDY (4401 PARTICIPANTS, 361 GDM)

PRE-PREGNANCY

EARLY PREGNANCY

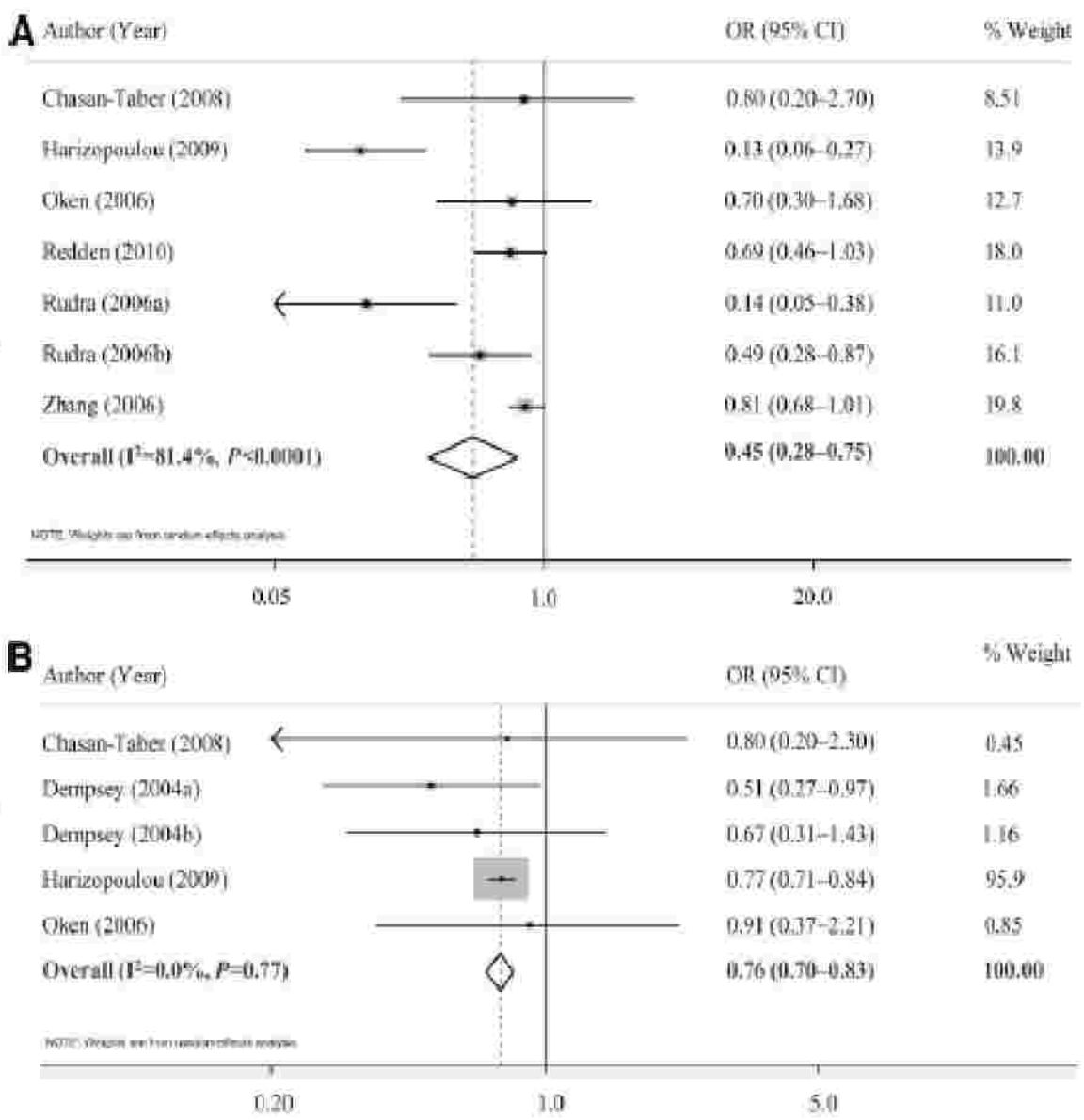


Figure 2—*Results of meta-analyses. A: Prepregnancy physical activity. B: Early pregnancy physical activity.*

A Prospective Study of Pregravid Physical Activity and Sedentary Behaviors in Relation to the Risk for Gestational Diabetes Mellitus

Cuilin Zhang, MD, PhD; Caren G. Solomon, MD, MPH; JoAnn E. Manson, MD, DrPH; Frank B. Hu, MD, PhD

Background: Although gestational diabetes mellitus (GDM) has been associated with substantial adverse health outcomes for both mothers and offspring, few modifiable risk factors for GDM have been identified.

Methods: We conducted a prospective cohort study among women in the Nurses' Health Study II to assess whether the amount, type, and intensity of pregravid physical activity and sedentary behaviors are associated with GDM risk. The analysis included 21 765 women who reported at least 1 singleton pregnancy between 1990 and 1998. Physical activity and sedentary behaviors were assessed through validated questionnaire.

Results: We documented 1428 incident GDM cases. After controlling for body mass index, dietary factors, and other covariates, there was a significant inverse association between vigorous activity and the risk of GDM. The multivariate relative risk (RR) comparing the highest with the lowest quintile of vigorous activity was 0.77 (95% confidence interval [CI], 0.69-0.94) ($P = .002$ for trend). Among women who did not perform vigorous activity, brisk walking pace was associated with significantly lower GDM risk (RR, 0.66; 95% CI, 0.46-0.95) compared with an easy pace. Women who spent 20 h/wk or more watching television but did not perform vigorous activity had a significantly higher GDM risk than women who spent less than 2 h/wk watching television and were physically active (multivariate RR, 2.30; 95% CI, 1.06-4.97).

Conclusion: Our prospective study provides strong evidence that regular physical activity before pregnancy is associated with lower GDM risk.

Arch Intern Med. 2006;166:543-548

Table 2. Relative Risks of GDM According to Quintiles of Prepregnancy Activity Score (MET-Hours per Week)

Physical Activity	Quintile of Activity Score 1	2	3	4	5	*P* Value for Trend
Total						
MET-hours per week, range (median)	0.2-4.8 (2.3)	4.9-11.3 (7.8)	11.4-21.3 (15.9)	21.4-40.3 (29.0)	≥40.4 (63.2)	
Cases, No.	312	313	265	287	251	
Person-years	39 312	40 594	40 049	40 080	40 076	
RR1* (95% CI)	1.00	0.94 (0.83-1.14)	0.83 (0.70-0.97)	0.86 (0.73-1.02)	0.71 (0.60-0.84)	<.001
RR2† (95% CI)	1.00	0.97 (0.87-1.20)	0.88 (0.75-1.04)	0.90 (0.80-1.11)	0.81 (0.68-1.01)	.01
Vigorous						
MET-hours per week, range (median)	0	0.2-2.8 (1.4)	2.9-8.7 (6.0)	8.8-22.0 (15.0)	≥22.1 (38.8)	
Cases, No.	397	262	270	275	224	
Person-years	49 041	31 374	37 897	41 732	40 066	
RR1* (95% CI)	1.00	0.94 (0.71-1.26)	0.81 (0.67-1.16)	0.70 (0.60-0.82)	0.72 (0.62-0.84)	<.001
RR2† (95% CI)	1.00	0.95 (0.71-1.28)	0.84 (0.71-1.20)	0.75 (0.64-0.87)	0.77 (0.69-0.94)	.002

Abbreviations: BMI, body mass index; CI, confidence interval; GDM, gestational diabetes mellitus; MET, metabolic equivalent; RR, relative risk.

*Adjusted for age (5-year categories), race/ethnicity, cigarette smoking status (never, past, or current), family history of diabetes in a first-degree relative (yes, no), parity (0, 1, 2, ≥3), alcohol intake (0.0, 0.1-5.0, 5.1-15.0, or >15.0 g/d) and dietary factors (quintiles of total energy, cereal fiber, glycemic load, and total fat).

†Adjusted for variables in model 2 and BMI (calculated as weight in kilograms divided by the square of height in meters) before the index pregnancy (<20.0, 20.0-21.9, 22.0-24.9, 25.0-29.9, and ≥30.0).

Lo stile di vita pre-gravidico è un predittore indipendente del rischio di diabete gestazionale

Donati M, Bacchi E, Zambotti F, Baldisser G, Dall'Alda M, Moretta R, Di Sarra D, Bonin C, Bonora E, Moghetti P

Società Italiana di Diabetologia 2012

MATERIALI E METODI

Sono reclutate 247 gravide consecutive (media±DS: età 32.8±4.2 anni, 98,8% caucasiche) afferenti all'ambulatorio di ostetricia per eseguire il test combinato alla 12esima settimana di gestazione e che sono state successivamente sottoposte ad anamnesi e a controlli periodici, con OGTT alla 15-16 e alla 24-26 settimana e ulteriore controllo della glicemia a digiuno a 30-32 settimane.

Alla 15^ settimana i soggetti hanno compilato il questionario Kaiser, che fornisce 4 indicatori specifici (Attività lavorative, Cura della famiglia e della casa, Abitudini di vita attive, Sport) e due indicatori complessivi (Attività totale e Attività totale pesata) di attività fisica nell'anno precedente la gravidanza.

La diagnosi di diabete gestazionale è stata effettuata secondo i criteri IADPSG 2010.

RISULTATI

Nell'intera popolazione studiata 37 donne (15%) hanno presentato GDM. Le donne con GDM differivano dalle non diabetiche in termini di Attività fisica totale e totale pesata (p=0.01 e p=0.03, rispettivamente), mentre gli indicat i Attività lavorativa e Abitudini di vita attive erano al limite della significatività.

All'analisi logistica, includendo come variabili indipendenti BMI pre-gravidico, parità, familiarità per diabete ed età, il BMI pre-gravidico risultava essere il solo predittore di GDM. Tuttavia, inserendo nell'analisi anche gli indicatori Kaiser, la comparsa di GDM era associata negativamente all'Attività fisica totale e a quella totale pesata praticata prima della gravidanza:

OR 95% CI: 0.77 (0.59-0.98), p=0.04

0.74 (0.55-0.98), p=0.03

CONCLUSIONI

In conclusione, questi dati suggeriscono che uno stile di vita attivo prima della gravidanza riduce il rischio di GDM, anche indipendentemente dal BMI e dalla familiarità per diabete.

Acta Diabetol (2010) 47 (Suppl 1):S83–S89
DOI 10.1007/s00592-009-0136-1

ORIGINAL ARTICLE

DURANTE LA GRAVIDANZA??

Maternal physical activity before and during early pregnancy as a risk factor for gestational diabetes mellitus

Vicentia C. Harizopoulou · Alexandros Kritikos · Zisis Papanikolaou · Evangelia Saranti · Dimitrios Vavilis · Eleftherios Klonos · Ioannis Papadimas · Dimitrios G. Goulis

Abstract The aim of this study was to assess whether the levels of physical activity before and during early pregnancy are associated with the prevalence of gestational diabetes mellitus (GDM). The study group included 160 puerperas. Among them, 40 (25%) diagnosed as having GDM during their recent pregnancy, whereas the remaining 120 (75%) served as controls. The international physical activity questionnaire (IPAQ-Greek version) was applied twice, in an attempt to estimate the level of physical activity before and during early pregnancy. Women who were "inactive" before or during early pregnancy had odds ratio (OR) 7.9 [95% confidence interval (CI) 3.7–16.56] and 1.3 (95% CI 1.2–1.4) of developing GDM, compared to "minimally active" or "active" women, respectively. Pregnancy resulted in a decrease in the level of physical activity ($P < 0.005$) during early pregnancy, independently of the diagnosis of GDM and morbidity during early pregnancy. We conclude that physical inactivity before and during early pregnancy is associated with increased risk for developing GDM in late pregnancy.

Table 2 Levels of physical activity in gestational diabetes mellitus, control cases and total cases before pregnancy and during early pregnancy

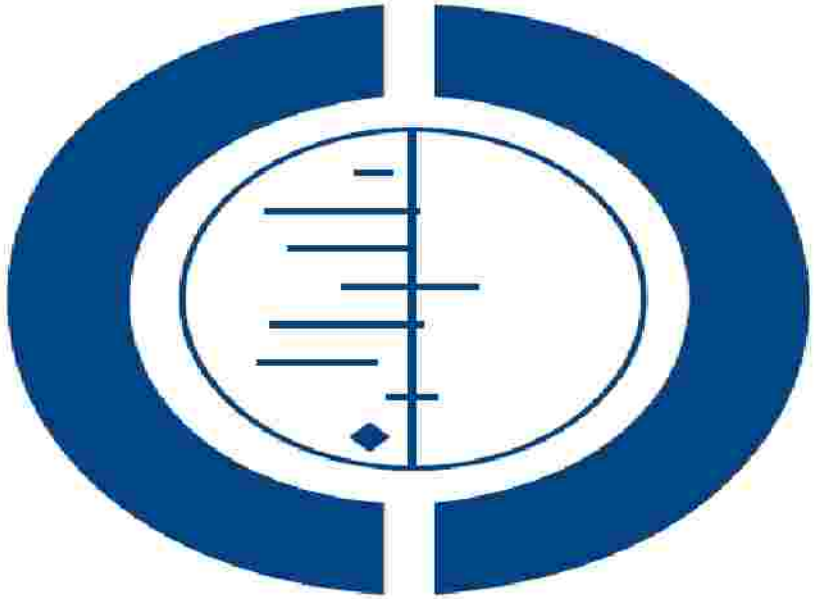
Levels of physical activity	GDM cases	Control cases	Total cases
n	40	120	160
Before pregnancy			
Inactive	33 (83)	27 (22)	60 (38)
Minimally active	7 (17)	62 (52)	69 (43)
HEPA active	0 (0)	31 (26)	31 (19)
During early pregnancy			
Inactive	40 (100)	97 (81)	137 (85)
Minimally active	0 (0)	22 (18)	22 (14)
HEPA active	0 (0)	1 (1)	1 (1)

Data are given as absolute numbers (percentage)

GDM Gestational diabetes mellitus, *HEPA* health enhancing physical activity

Exercise or other physical activity for preventing pre-eclampsia and its complications (Review)

Meher S, Duley L



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The association between an increase in regular physical activity and a reduction in the risk of hypertension is well documented for non-pregnant people. It has been suggested that exercise may help prevent pre-eclampsia and its complications. Possible adverse effects of increased physical activity during pregnancy, particularly on the risk of preterm birth and fetal growth restriction, are unclear. It is, therefore, important to assess whether exercise reduces the risk of pre-eclampsia and its complications and, if so, whether these benefits outweigh the risks.

Objectives

To assess the effects of exercise, or increased physical activity, on prevention of pre-eclampsia and its complications.

Search strategy

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (December 2005), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2005, Issue 1), and EMBASE (2002 to February 2005). We updated the search of the Pregnancy and Childbirth Group's Trials Register on 18 January 2010and added the results to the awaiting classification section.

Selection criteria

Studies were included if these were randomised trials evaluating the effects of exercise or increased physical activity during pregnancy for women at risk of pre-eclampsia.

Data collection and analysis

Two review authors independently selected trials for inclusion and extracted data. Data were entered on Review Manager software for analysis, and double checked for accuracy.

Main results

Two small, good quality trials (45 women) were included. Both compared moderate intensity regular aerobic exercise with maintenance of normal physical activity during pregnancy. The confidence intervals were wide and crossed the line of no effect for all reported outcomes including pre-eclampsia (relative risk 0.31, 95% confidence interval 0.01 to 7.09).

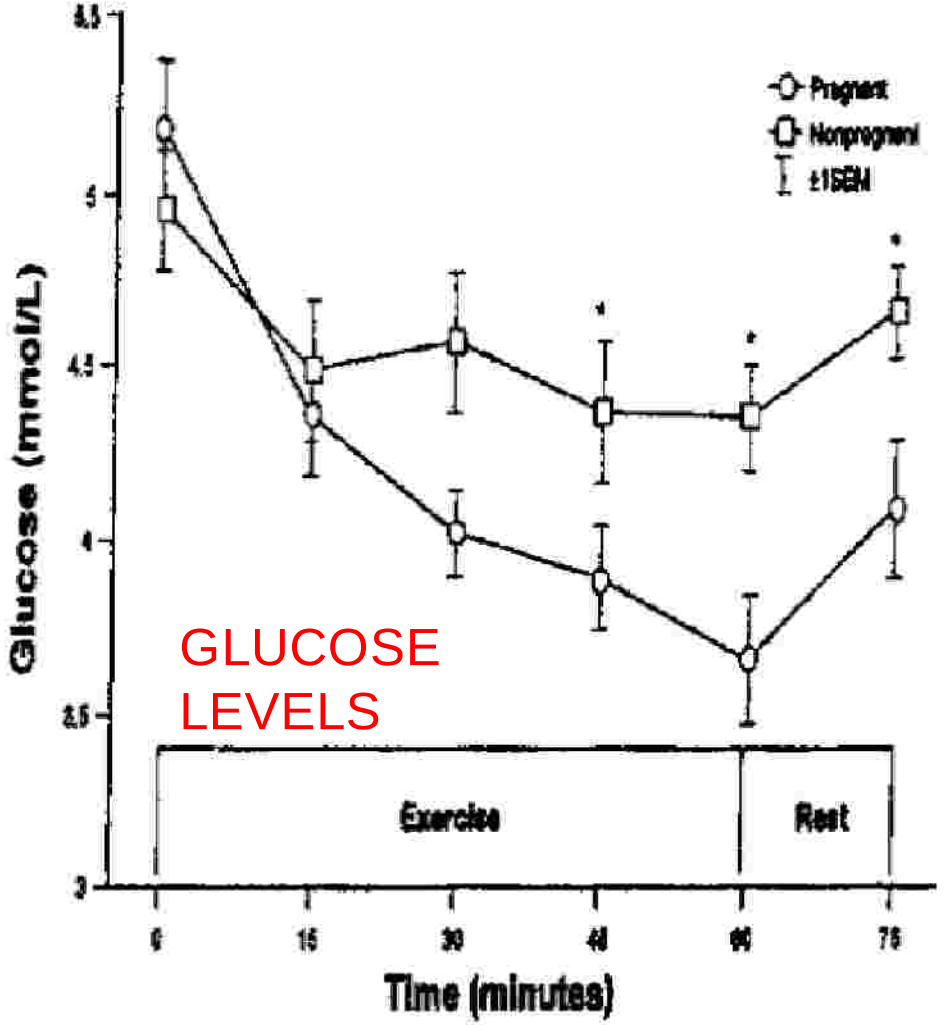
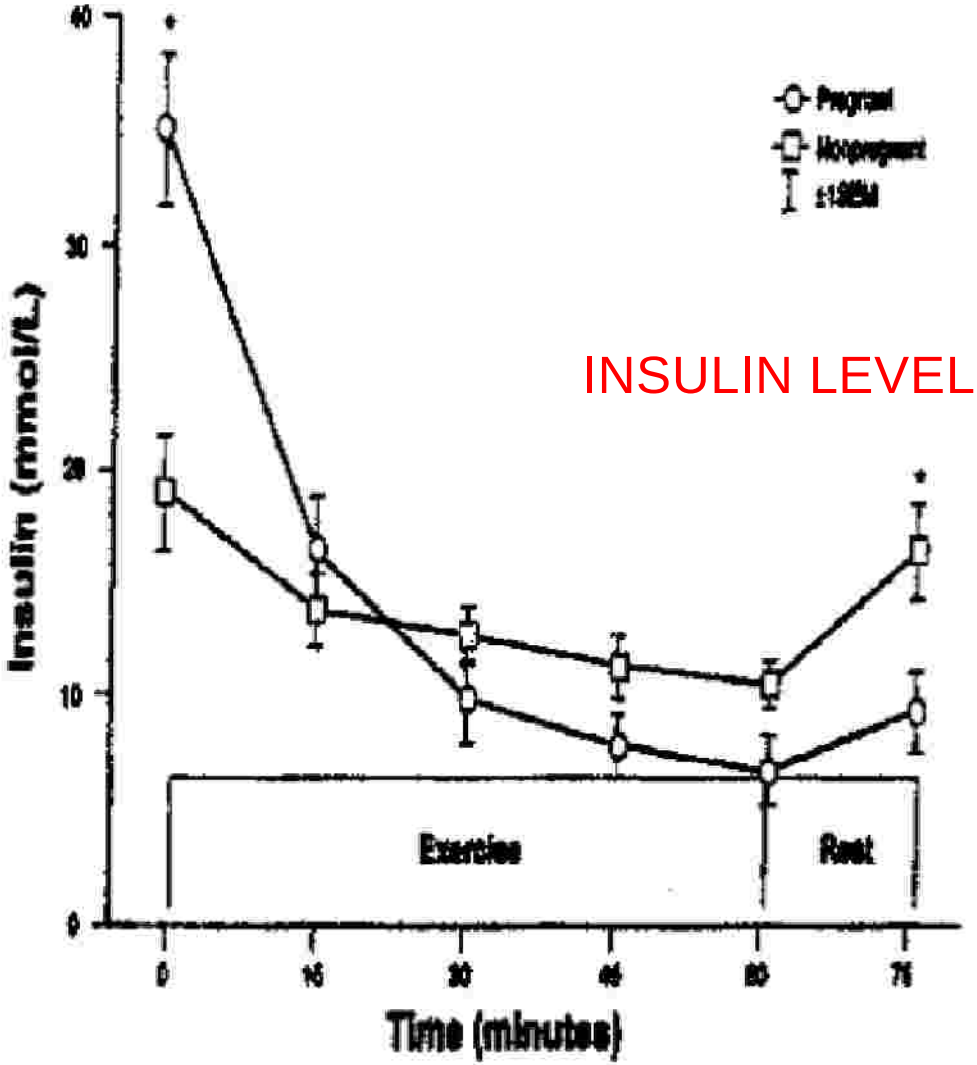


FIG. 2. Glucose concentrations during prolonged exercise: pregnant versus nonpregnant. $^*P < 0.05$. (Soultanakis HN, Artal R, Wiswell RA. Prolonged exercise in pregnancy: glucose homeostasis, ventilatory and cardiovascular responses. Semin Perinatol. 1996;20:315–327, with permission)



INSULIN LEVELS

FIG. 3. Insulin concentrations during prolonged exercise: pregnant versus nonpregnant. $*P < 0.05$. (Soultanakis HN, Artal R, Wiswell RA. Prolonged exercise in pregnancy: glucose homeostasis, ventilatory and cardiovascular responses. Semin Perinatol. 1996;20:315–327, with permission)

Studi sull'effetto dell'esercizio sulla riduzione della glicemia in donne con DM			
Autori	Soggetti	Metodo	Conclusioni
Jovanoic-Peterson, 1989	19 GDM (28 sett.gestazione) randomizzate a 6 week dieta o dieta+esercizio	3 volte settimana, 20 minuti, arm ergometro al <50% VO2max	Nel gruppo intervento più bassa HbA1c e glicemia a digiuno
Avery and Walker, 2001	12 GDM (30-34 weeks)	Risposta acuta a 30min di esercizio al 35% o 55% VO2max	Diminuzione glucemia ad entrambe le intensità
Garcia-Patterson, 2001	20 GDM (30.7 weeks gestation)	Postprandial walking at 2.52 km/h. Studio in 2 giorni.	Diminuzione glicemia post-esercizio
Lesser, 1996	6 GDM e 5 normal women (28-38 week gestation)	30 min bike (1 seduta 60% VO2max) 14 ore prima di un pasto (600kcal)	Esercizio non migliora glicemia postprandiale
Avery, 1997	GDM (exercise group n=15, 28weeks gestation or control group, n= 14, 26 week)	Home-based exercise (70% HR max, 30 min, 3-4 volte sett) + dieta	Con esercizio aumento fitness cardiovascolare, senza differenze in controllo metabolico

Studi sull'effetto dell'esercizio sulla riduzione della glicemia in donne con DM			
Autori	Soggetti	Metodo	Conclusioni
Branksto n, 2004	GDM (29 weeks gestation) randomized to diet alone group (n=16) or diet + resistance training (n=16)	2 volte settimana circuit resistance exercise, HR <140 beats/min	Numero di donne che richiedevano insulina non differiva tra i due gruppi
Bung, 1993	41 GDM (1 week failure of intensive dietary therapy) a dieta+esercizio o dieta+insulina	45 minuti di esercizio su bici (HR <140 bm) intervallati ogni 15 min da 4 minuti di recupero	Nessuna differenza tra gruppi in termini di glicemia e outcome neonatali. Esercizio riduce terapia insulinica
Davenport, Mottola 2008	Intervention group GDM 10, control group 20	Nutrition intervention. Walking program 3 volte settimana, 40 minuti, 30% VO2 picco	Riduzione glucemia a digiuno e 1 ora dopo il pasto. Minor richiesta insulina.

Effects of a Partially Home-Based Exercise Program for Women With Gestational Diabetes

MELISSA D. AVERY, CNM, PhD, ARTHUR S. LEON, MD, FACSM, AND RICHARD A. KOPHER, MD

Objective: To examine the effectiveness of a partially home-based, moderate-intensity aerobic exercise program for women with gestational diabetes.

Methods: This was a randomized experimental design. Thirty-three women with gestational diabetes were randomly assigned to the exercise or the no-exercise group. Subjects underwent hemoglobin A_1C assay and submaximal cycle ergometer fitness tests at baseline and at study conclusion. Subjects kept diaries of home fasting and 2-hour postprandial blood glucose determinations. Exercise subjects were asked to exercise for 30 minutes three to four times weekly at 70% of estimated maximal heart rate for the weeks of study participation. Two exercise sessions weekly were supervised by the investigator, and two were unsupervised at home. Control-group subjects were asked to maintain their current activity level.

Results: Daily fasting and postprandial blood glucose levels, hemoglobin A_1C, incidence of exogenous insulin therapy, and incidence of newborn hypoglycemia were not different between the groups. There was a training effect in the exercise group ($P = .005$) but not in the control group ($P = .25$). A significant decline in daily grams of carbohydrate consumed was observed in the control group ($P = .03$), but not in the exercise group ($P = .97$). No complications were found in the subjects who exercised.

Conclusions: A partially home-based exercise program did not reduce blood glucose levels, but did result in a modest increase in cardiorespiratory fitness. The intervention appeared safe. *(Obstet Gynecol 1997;89:10–5.*

A walking intervention improves capillary glucose control in women with gestational diabetes mellitus: a pilot study.

MH Davenport, MF Mottola et al.
Appl. Physiol. Nutr. Metab 33:511-517, 2008

Obiettivo:
verificare efficacia di un programma di esercizio fisico strutturato a bassa intensità sulla glicemia in donne con GDM

Materiali e Metodi:

Gruppo Intervento (n.10) Dieta+ Es.aerobico

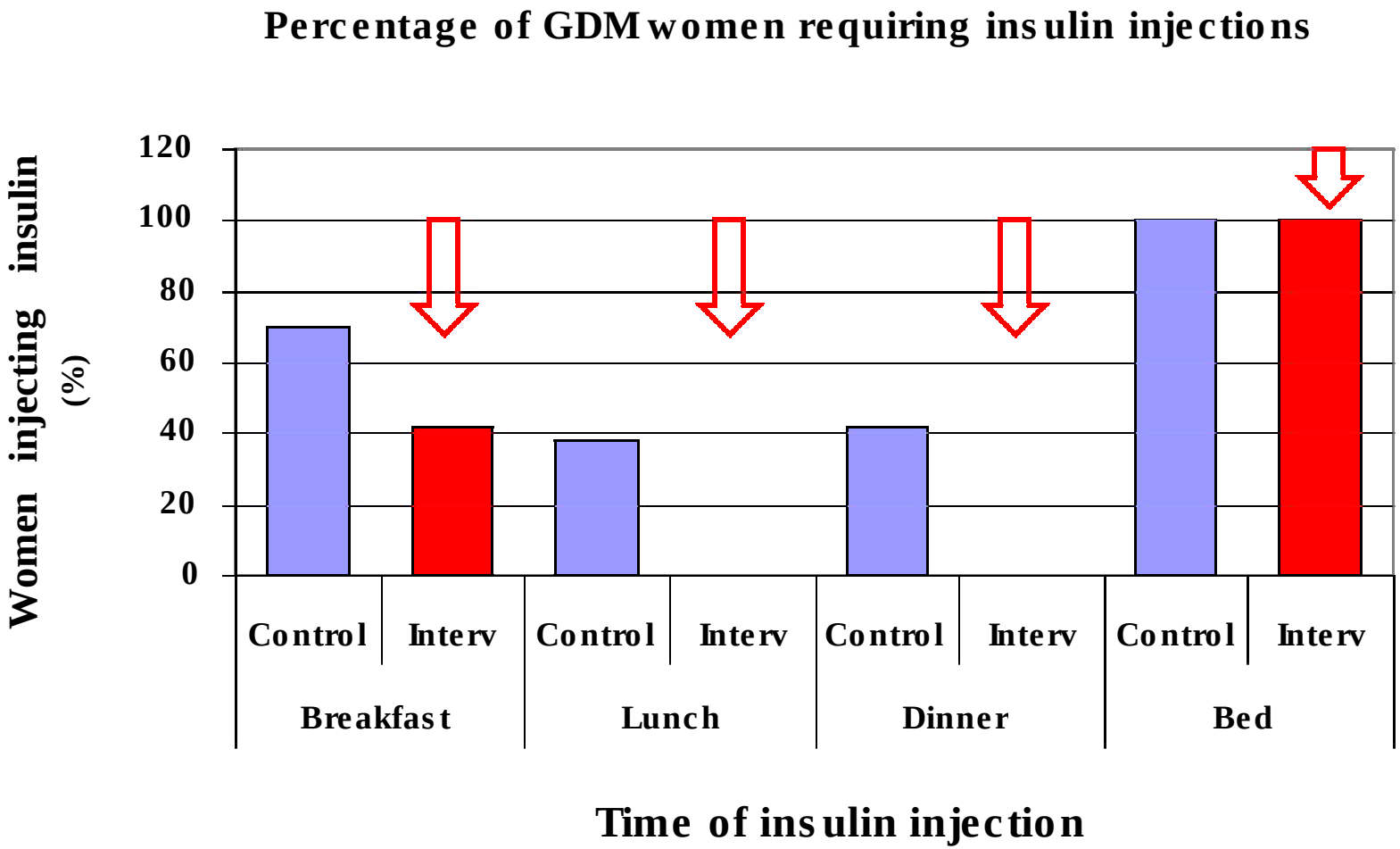
Gruppo Controllo (n.20) Routine ambulatoriale

Esercizio fisico: cammino,
3-4 volte settimanali,
40 minuti 30%HRR

Risultati

Gruppo	Età	Peso pre-gravidico (kg)	Peso in gravidanza Totale (kg)	Peso in gravidanza (kg*sett)	Richiesta insulina settimana
Controllo	33.3±5.9	32.8±5.9	12.7±8.4	0.35±0.23	0.50±0.37
Intervento	32.9±7.1	32.9±7.1	12.0±9.7	0.33±0.24	0.16±0.13*

Gruppo	Soggetti che hanno richiesto insulina (%)	Settimana gestazione e inizio insulina	Peso alla nascita (g)	Macrosomia	Cesareo	Settimana parto
Controllo	70	29.0±5.82	3607±560	5/20	11/20 (55%)	38.3±0.9
Intervento	70	28.5±6.4	3639±792	3/10	5/10 (50%)	38.8±0.8


Percentage of GDM women requiring insulin injections
Women injecting insulin (%)
120
100
80
60
40
20
0
Control
Interv
Control
Interv
Control
Interv
Control
Interv
Breakfast
Lunch
Dinner
Bed
Time of insulin injection

American Journal of Obstetrics and Gynecology (2004) **190**, 188–93

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Resistance exercise decreases the need for insulin in overweight women with gestational diabetes mellitus

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Received April 22, 2003; revised July 22, 2003; accepted July 24, 2003

Objective: This study examines the effects of circuit-type resistance training on the need for insulin in women with gestational diabetes mellitus.

Study design: Thirty-two patients with gestational diabetes mellitus were randomly assigned either to a group that was treated with diet alone or to a group that was treated with diet plus resistance exercise.

Table III Outcomes

Outcome	Diet alone (n = 16)	Diet plus exercise (n = 16)	*P* value
Required insulin (n)	9 (56.3%)	7 (43.8%)	.48
Amount of insulin required (units/kg)	0.48 ± 0.3*	0.22 ± 0.2	< .05
Latency to insulin requirement (wk)	1.11 ± 0.8*	3.71 ± 3.1	< .05

Values are means ± SD, except where indicated.
* Significant difference between diet alone and diet plus exercise groups.

Table IV Home-monitored blood glucose levels

Blood glucose (mmol/L)	Diet alone (n = 12)	Diet plus exercise (n = 12)	*P* value
Fasting	5.1 ± 0.65	4.7 ± 0.39	.07
Breakfast (2 h)	6.2 ± 1.1	5.7 ± 0.40	.12
Lunch (2 h)	6.2 ± 0.72	5.9 ± 0.43	.12
Supper (2 h)	6.7 ± 0.83	6.4 ± 0.52	.34
Pooled postmeal (2 h)	6.4 ± 0.81*	6.0 ± 0.29	< .05

Values are means ± SD.
* Significant difference between diet alone and diet plus exercise groups.

Table V Demographic characteristics based on requirement for insulin therapy

Characteristic	Insulin (n = 16)	No insulin (n = 16)	*P* value
Maternal age (y)	31.9 ± 4.9	29.9 ± 4.3	.2
Gestational age at first visit (wk)	28.8 ± 2.1	29.7 ± 1.9	.3
Prepregnant BMI (kg/m^2)	28.3 ± 5.6	25.6 ± 3.3	.1
Weight gain up to diagnosis (kg)	9.2 ± 4.3	10.7 ± 4.0	.3
Total pregnancy weight gain (kg)	10.8 ± 5.0	11.7 ± 5.0	.6
GDM screen (mmol/L)	11.3 ± 1.0*	11.4 ± 0.9†	.9
Glucose tolerance test (mmol/L)			
Fasting	5.4 ± 0.7‡	5.0 ± 0.6§	.3
1 h	12.3 ± 1.0‡	11.5 ± 0.9§	.2
2 h	10.5 ± 1.4‖	9.1 ± 0.6§	< .05

Values are means ± SD.
* n = 9.
† n = 7.
‡ n = 7.
§ n = 9.
‖ Significant difference between insulin and no insulin groups.

Conclusion:
Resistance exercise training may help to avoid insulin therapy for overweight women with gestational diabetes mellitus.

Exercise and Type 2 Diabetes

The American College of Sports Medicine and the American Diabetes Association: joint position statement

Le linee guida per esercizio fisico nel diabete gestazionale sono ancora poco specifiche

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disease (CVD), blindness, kidney and nerve disease, and amputation (261). Although regular physical activity (PA) may prevent or delay diabetes and its complications (10,46,89,112,176,208,259,294),

PA AND PREVENTION AND CONTROL OF GDM — As the prevalence of diabetes continues to rise worldwide, it becomes increasingly important to identify high-risk populations and to implement strategies to delay or prevent diabetes onset. Women diagnosed with GDM are at substantially increased risk of developing type 2 diabetes; therefore, PA may be considered a tool to prevent both GDM and possibly type 2 diabetes at a later date (70). Prepregnancy PA has been consistently associated with a reduced risk of GDM (57,58,69,206, 290). Studies during pregnancy are sparse, with only one case-control study (57), one retrospective study (174), and one study of a cohort of Hispanic women (37) observing significant protective effects of PA, while others have not (58,69,206).

Engaging in 30 min of moderate-intensity PA (e.g., brisk walking) during most days of the week (e.g., 2.5 h/week) has been adopted as a recommendation for pregnant women without medical or obstetrical complications (222). However, few primary prevention studies have examined whether making a change in PA reduces risk of developing GDM. In 2006, a meta-analysis reviewed four RCTs on GDM in which pregnant women in their third trimester exercised on a cycle or arm ergometer or performed resistance training three times a week for 20–45 min compared with doing no specific program (36). The women involved in exercise had better BG control, lower fasting and postprandial glucose concentrations, and improved cardiorespiratory fitness, although frequency of prescription of insulin to control BG did not differ from nonexercisers, and pregnancy outcomes were unchanged.

Exercise and Type 2 Diabetes

The American College of Sports Medicine and the American Diabetes Association: joint position statement

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disease (CVD), blindness, kidney and nerve disease, and amputation (261). Although regular physical activity (PA) may prevent or delay diabetes and its complications (10,46,89,112,176,208,259,294),

Table 2—*Summary of ACSM evidence and ADA clinical practice recommendation statements*

	ACSM evidence and ADA clinical practice recommendation statements	ACSM evidence category (A, highest; D, lowest)/ ADA level of evidence (A, highest; E, lowest)
PA in prevention and control of GDM	• Epidemiological studies suggest that higher levels of PA may reduce risk of developing GDM during pregnancy.	*C*/*
	• RCTs suggest that moderate exercise may lower maternal BG levels in GDM.	B/*

Take home masseges: AF e GDM

- Le linee guida non specificano chiaramente frequenza, intensità e durata di attività fisica per un ottimale controllo glicemico in donne con GDM
- Gli studi sino ad ora pubblicati non hanno ancora chiarito come implementare un programma di training in donne a rischio di sviluppare GDM o con diabete gestazionale oltre che non aver ancora chiarito il rapporto costo/efficacia
- Ad oggi, per questa tipologia di donne è suggerita una regolare pratica di attività fisica, prevalentemente aerobica, di intensità leggero-moderata
- Per le donne con GDM che utilizzano insulina un attento monitoraggio glicemico pre e post training va adottato per svolgere attività motoria in sicurezza

Type of exercise

- Exercise prescription for the development and maintenance of fitness in non-pregnant women consists of activities to improve cardiorespiratory (aerobic exercise) and musculoskeletal (resistive exercise) status.

Exercise prescription in pregnancy should include the same elements.

- Aerobic exercise can consist of any activities that use large muscle groups in a continuous rhythmic manner—for example, activities such as walking, aerobic dance, swimming, cycling.
- In addition to aerobic activities, activities that promote musculoskeletal fitness are part of an overall exercise prescription. Typically, these include both resistance training and flexibility exercises.
- Limited information exists on strength training during pregnancy.

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Type of exercise

- In one study,51 individually prescribed strength training (one set of up to 12 repetitions) of multiple muscle groups was us d as part of an overall conditioning programme for pregnant women.
  - Fetal heart rates were monitored during training at 28 and 38 weeks gestation, and they remained unchanged.
  - It was concluded that relatively low weights with multiple repetitions lifted through a dynamic range of motion appear to be a safe and effective type of resistance exercise during pregnancy.

- Although supporting data are lacking, it would be prudent to limit repetitive isometric or heavy resistance weightlifting and any exercises that result in a large pressor effect during pregnancy. Because of the increased relaxation of ligaments during pregnancy, flexibility exercise should be individualised for the same reason.
- Maintenance of normal joint range of motion, however, should not interfere with a moderate exercise routine in pregnant women.

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High-risk exercise

- Snow and waterskiing
- Climbing
- Snowboarding
- Scuba diving
- Bungee jumping
- Hockey
- Mountain cycling
- Vigourose exercise at altitude

- Activities that increase the risk of falls, such as sk ng, or those that may result in excessive joint stress, such as jogging and tennis, sh uld include cautionary advice for most pregnant women, but evaluated on an individual basis with consideration for individual abilities. Certainly, the risk of related injuries is difficult to predict.

FREQUENCY

- Iniziare da 3 volte alla settimana e arrivare a 4-5 volte a settimana.

INTENSITY

- Intensity is the most difficult component of an exercise regimen to prescribe for pregnant women.
- To derive health benefits, non-pregnant women are advised to participate in at least moderate intensity exercise.
- In the combined CDC/ACSM recommendations for physical activity and health, moderate exercise is defined as exercise of 3–4 METS or any activity that is equivalent in difficulty to brisk walking.
- There is no reason to alter this recommendation for pregnant women with no medical or obstetric
- complications.

- The recommended intensity of physical activity for developing and maintaining physical fitness is
- somewhat higher. The ACSM recommends that intensity should be 60–90% of maximal heart rate or 50–85% of either maximal oxygen uptake or heart rate reserve.
- The lower end of these ranges (60–70% of maximal heart rate or 50–60% of maximal oxygen uptake) appears to be appropriate for most pregnant women who did not engage in regular exercise before pregnancy, and the upper part of these ranges should be considered for those who wish to continue to maintain fitness during pregnancy.
- In a meta-analysis study of exercise and pregnancy, it was reported that, with exercise intensities of 81% of heart rate maximum, no significant adverse effects were found.

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INTENSITY

- Ratings of perceived exertion have been found to be useful during pregnancy as an alternative to heart rate monitoring of exercise intensity.

- For moderate exercise, ratings of perceived exertion should be 12–14 (somewhat hard) on the 6–20 scale.

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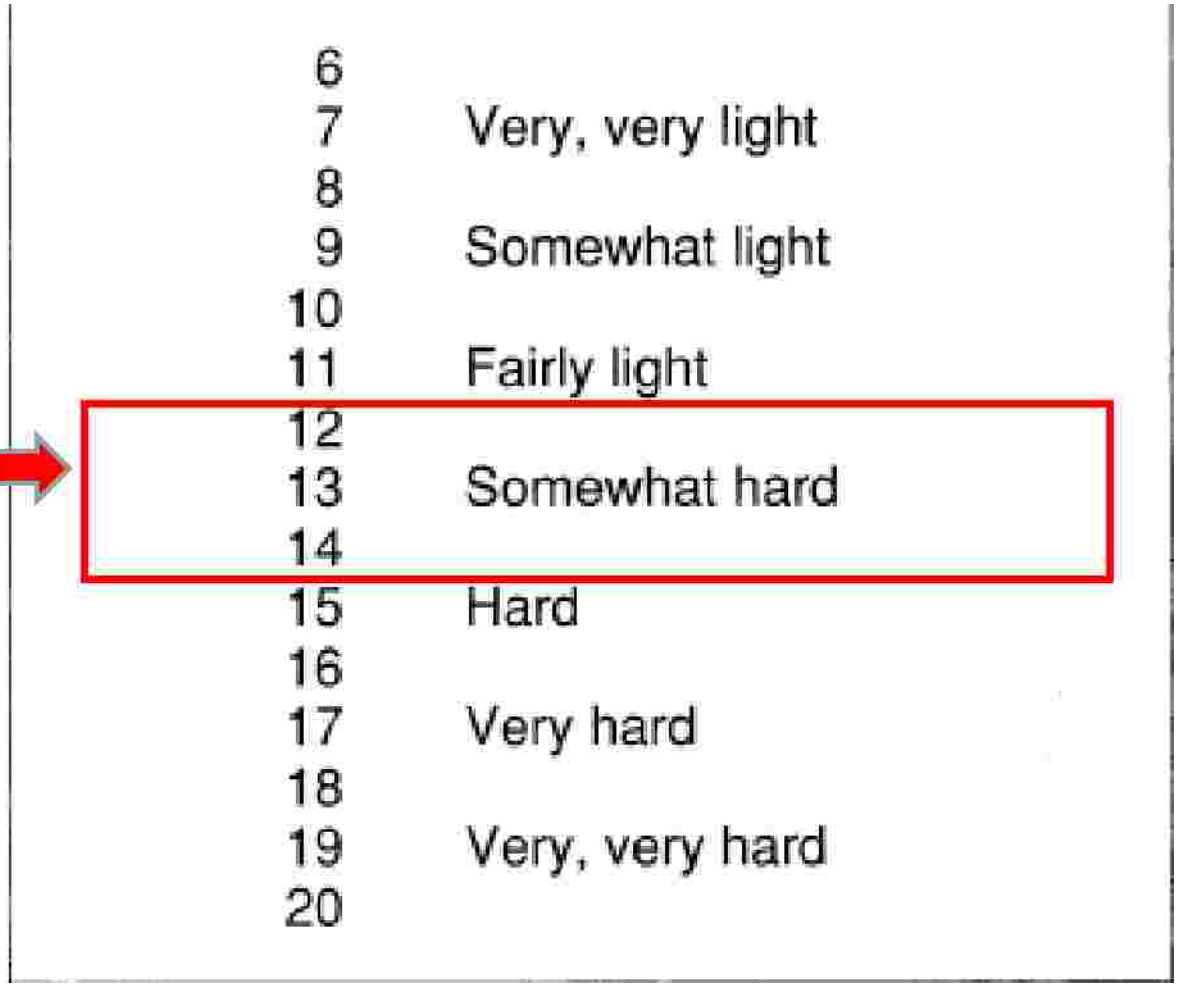
Scala di Borg
Percezione dello Sforzo

La percezione dello sforzo, mediante scala di Borg, non varia durante la gravidanza.

Intensità appropriata per la maggior parte delle gravide



- Although an upper level of safe exercise intensity has not been established, women who were regular exercisers before pregnancy and ho have uncomplicated, healthy pregnancies should be able to engage in high intensity exercise programmes, such as jogging and aerobics, with no adverse effects.
- The nutritional, cardiovascular, and musculoskeletal condition of the subject as well as fetal wellbeing should be periodically assessed during the prenatal office visits in pregnant women undertaking h intensity exercise programmes.
- Additional testing should be considered as clinically indicated—for example, non-stress fetal heart testing and ultrasound to assess fetal growth.
- Dietary modifications and changes in exercise routines should also be considered if clinically indicated.

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INTENSITY

Moderate intensity (40%-60% VO_2 reserve). Because heart rate (HR) variability during pregnancy, consider using the rating of preceived exertion (RPE) (12-14 on a scale of 6-20) or the talk test to monitor exercise intensity.

HR ranges that correspond to moderate-intensity exercise have also been developed for pregnant women based on age.

Age	Heart Rate Range
<20	140-155
20-29	135-150
30-39	130-145
>40	125-140

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$\dot{V}O_{2peak}$ Prediction and Exercise Prescription for Pregnant Women

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TABLE 3. Characteristics of fit, active, and unfit women aged 20–29 yr (N = 60; mean ± SEM)

	Fit (N = 15)	Active (N = 30)	Unfit (N = 15)
BMI ($kg \cdot m^{-2}$)	22.9 ± 0.7	26.3 ± 1.1	29.8 ± 1.2[a]
HR at peak (bpm)	176.3 ± 2.1	171.9 ± 1.9	159.7 ± 3.9[a,b]
$\dot{V}O_{2peak}$ ($mL \cdot kg^{-1} \cdot min^{-1}$)	31.3 ± 1.0	23.8 ± 0.3[a]	18.3 ± 0.6[a,b]
Speed at $\dot{V}O_{2peak}$ (mph)	4.2 ± 0.7[b]	3.5 ± 0.4[a]	3.1 ± 0.2[a,b]
Incline at $\dot{V}O_{2peak}$ (%)	12.0 ± 0.0[b]	11.9 ± 0.7[a]	10.0 ± 3.0[a,b]
R^2	0.59	0.80	0.44
$R^2_{adjusted}$	0.57	0.80	0.42
SEE	13.56	10.32	14.56
Mann–Whitney statistic (P value)	0.27	0.40	0.40

[a] Different from fit women ($P < 0.05$).
[b] Different from active women ($P < 0.05$).
R^2, coefficient of correlation between actual and predicted $\dot{V}O_{2peak}$; SEE, see between actual and predicted $\dot{V}O_{2peak}$.

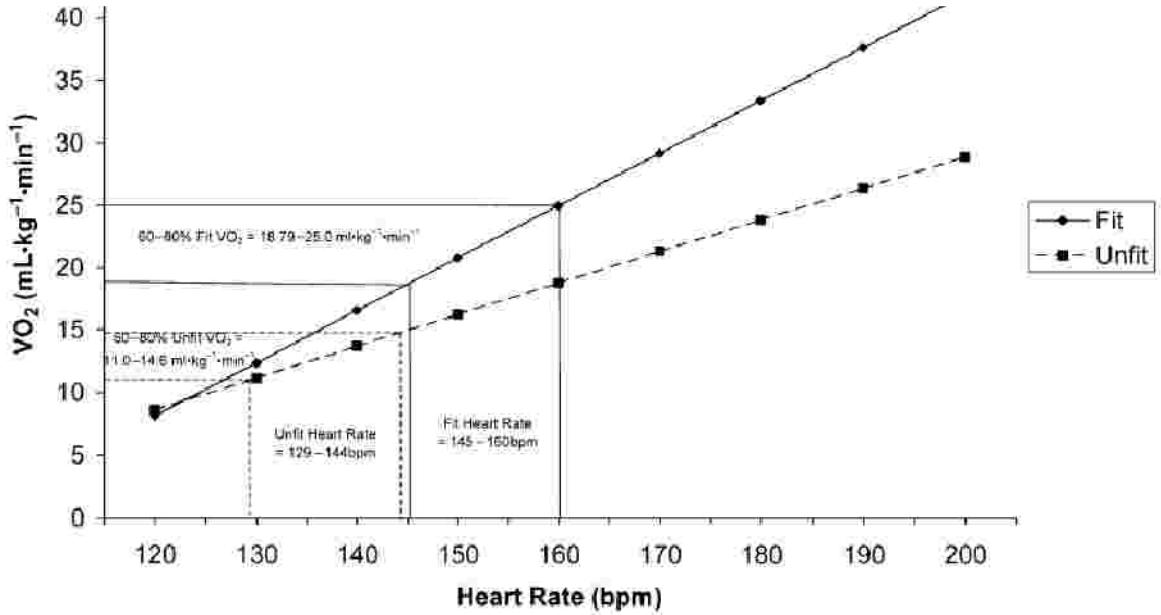

FIGURE 1—Linear regression lines of HR and $\dot{V}O_{2peak}$ for fit and unfit pregnant women aged 20–29 yr with target HR zones between 60 and 80% $\dot{V}O_{2peak}$. For fit women, HR = 2.372 × $\dot{V}O_2$ + 100.169 (HR range = 145–160 bpm). For active women, HR = 4.146 × $\dot{V}O_2$ + 73.152 (HR range = 132–152 bpm, not shown on graph). For unfit women, HR = 3.933 × $\dot{V}O_2$ + 86.088 (HR range = 129–144 bpm).

TIME

- At least 15 min gradually increasing to at least 30 min of accumulated modearte-intensity physical activity to total 150 min per week

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RATE OF PROGRESSION

- Il miglior periodo per aumentare la progressione di lavoro è durante il secondo trimestre, in assenza di rischi e disagi;
- Non è consigliato iniziare un nuovo programma o aumentare la somma di esercizi prima della 14ma settimana.
- Esercizi aerobici dovrebbero essere gradualmente e progressivamente aumentati durante il secondo trimestre da un minimo di 15 minuti per sessione a un massimo di circa 30 minuti

Increase in Aerobic exercise in 2° trimester

Week of Gestation	Duration (minutes/session)	Frequency (session/week)
16	15	3
17	17	3
18	19	3
19	21	3-4
20	23	4-5
21	25	3-4
22	26	4-5
23	27	3-4
24	28	4-5
25	29	3-4
26	30	4-5
27	30	3-4
28	30	4-5

RISCALDAMENTO E DEFATICAMENTO -1

Prima di iniziare attività aerobica e al termine della stessa, si deve prevedere un riscaldamento e defaticamento di 10-15 minuti.

Esercizi di stretching, mobilità articolare e di relax potrebbero essere inclusi nel periodo di riscaldamento e defaticamento.

RISCALDAMENTO E DEFATICAMENTO -2

Flessibilità articolare:

-collo;

-spalle;

-schiena;

-braccia;

-anche;

-caviglia;

-polso.

Static Stretching:

Tutti i maggiori muscoli. Evitare esercizi balistici.

Special Considerations

- Pregnant women who have been sedentary or have a medical condition should gradually increase activity to meet the raccommended levels above
- Pregnant women who are morbidly obese and/or have gestational diabetes mellitus or hypertension should consult their physician before beginning an exercise program and have their exercise prescriptions adjiusted to their medical condition, symptoms and functional capacity
- Pregnant women should avoid contact sports that may cause loss of balance or trauma to the mother or fetus
- Pregnant women should avoid exercising in the supine position after the first trimester to ensure that venous obstruction does not occur
- Pregnant women should avoid performing the valsalva maneuver during exercise
- Pregnant women should exercise in a thermoneutral environment and be well hydrated to avoid heat stress

Special Considerations

- During pregnancy the metabolic demand increases by 300 kcal/day. Women should increase caloric intake to meet the caloric costs of pregnancy and exercise
- Generally, exercise in the postpartum period may begin 4 to 6 weeks after delivery
- Deconditionally typically occurs during the initial postpartum period, so women should gradually increase physical activity levels until prepregnancy physical fitness levels are achieved

Attività fisica in acqua

Exercise in the water offers several physiological advantages to the pregnant woman.

The hydrostatic force of water pushes extravascular fluid into the vascular spaces, producing an increase in central blood volume that may lead to increased uterine blood flow.

Water is thermoregulating.

Studies of pregnant women exercising in the water have shown less fetal heart rate changes in the water than on land in response to exertion.
Pregnant women's heart rates and blood pressures during water exercise are lower than on land exercise, reflecting the immersion-induced increase in circulating blood volume. The physiology of water exercise offers some compensation for the physiological changes of exercise on land that may beneficially affect pregnancy.

Alcuni importanti consigli nell'esecuzione di esercizio fisico nella gravidanza

Vestiti leggeri che permettano dissipazione di calore
Indossare reggiseno di sostegno
Snack prima di fare attività fisica
Usare RPE per identificare l'intensità dell'esercizio
Bere acqua
Utilizzare calzature comode
Mantenere durante esercizi una buona postura
Riportare ogni sintomo indesiderato all'istruttore

Controindicazioni all’esercizio fisico - Assolute

- Hemodynamically significant heart disease
- Restrictive lung disease
- Incompetent cervix/cerclage
- Multiple gestation at risk for premature labor
- Persistent second or third trimester bleeding
- Placenta previa after 26 weeks of gestation
- Premature labor during the current pregnancy
- Ruptured membranes
- Preeclapsia/pregnancy-induced hypertension

Controindicazioni all'esercizio fisico - Relative

- Severe anemia
- Unevaluated maternal cardiac arrhythmia
- Chronic Bronchitis
- Poorly controlled type 1 diabetes
- Extreme morbid obesity
- Extreme undeweight (BMI<18)
- History of extremely sedentary lifestyle
- Intrauterine growth restriction in current pregnancy
- Poorly controlled hypertension
- Orthopedic limitations
- Poorly controlled seizure disorder
- Poorly controlled hyperthyroidism
- Heavy smoker

Sicurezza

- Consultare medico prima di iniziare attività motorie
- Iniziare gradualmente
- Evitare esercizi che richiedono salti o cambi di direzione
- Fare stretching prima e dopo attività ma con cautela
- Bere acqua prima, dopo e durante attività
- Non superare 38° di temperatura corporea
- Evitare zone calde per eseguire esercizio fisico
- Evitare esercizi in posizione supina dopo i 4 mesi di gravidanza
- Per esercizi di stretching e mobilità articolare eseguire movimenti lentamente e in modo controllato
- Evitare esercizi di forza muscolare, meglio resistenza muscolare
- Conoscere Motivi per cui si deve smettere attività immediatamente
- No competizioni atletiche
- Corretta integrazione alimentare
- Se la gravida avverte:stanchezza, dolori, fatica…fermarsi!