Early childhood obesity prevention through maternal lifestyle intervention.

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Fetal Environment – healthy lifestyle important

Maternal obesity & excessive pregnancy weight gain linked to big babies

Excessive weight gain during pregnancy linked to childhood obesity
Healthy lifestyle is a balance:

Eating Habits

NOT- Eating for two but Eating TWICE as healthy!! Portion sizes..

Activity

<table>
<thead>
<tr>
<th>Prepregnancy BMI</th>
<th>BMI (kg/m²)</th>
<th>Total weight gain range (lbs)*</th>
<th>Rates of weight gain for second and third trimester (Mean range lbs/wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>28-40</td>
<td>1</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5-24.9</td>
<td>25-35</td>
<td>(1-1.3)</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>15-25</td>
<td>0.6</td>
</tr>
<tr>
<td>Obese (including all classes)</td>
<td>≥30.0</td>
<td>11-20</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*Calculations assume a 1.1-4 lbs [0.5-2 kg] weight gain in 1st trimester (Seiga-Riz et al. 1994; Abrams et al. 1995; Carmichael et al. 1997).
Weight history of OW/OB women before pregnancy

<table>
<thead>
<tr>
<th>Overwt Mother</th>
<th>Overwt Father</th>
<th>Overwt Maternal Gramma</th>
<th>Overwt Paternal Gramma</th>
<th>No Overwt Relative</th>
<th>BMI Baby’s Father</th>
<th>Preg Wt Retention</th>
<th>Previous Wt Retained (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54%</td>
<td>37%</td>
<td>41%</td>
<td>29%</td>
<td>11%</td>
<td>27.7±5.3</td>
<td>88%</td>
<td>13.0±9.4</td>
</tr>
</tbody>
</table>

Increasing trend

Wt retention
Previous preg Partners

Home environment?

N=107 OW/OB
2/3rds unstable BW

If we restore the balance, can excessive gestational weight gain be prevented?

Eating Habits

Activity
PARmed-X for pregnancy
(medical prescreening & exercise prescription)
- 4 page document
- current history of pregnant women & occupation
  - list of contraindications to exercise
    - absolute, relative
  - Aerobic conditioning guidelines
    F. (frequency) 3-4 times/week
    I. (intensity) target HR zones
    T. (time) 15 up to 30 minutes
    T. (type)
  - Muscle conditioning guidelines & precautions
  - Safety considerations & reasons to consult physician/midwife/health care professional

Instructions for use.

Patient completes first page

Check list for health status

Activity habits past month & intentions

Occupation
Medical prescreening
In checklist form

Prescription for aerobic activity
PARmed-X for PREGNANCY

Prescription for Aerobic Activity

F. FREQUENCY: Begin at 3 times per week and progress to four times per week

I. INTENSITY: Exercise within an appropriate RPE range and/or target heart rate zone

T. TIME: Attempt 15 minutes, even if it means reducing the intensity. Rest intervals may be helpful

T. TYPE: Non weight-bearing or low-impact endurance exercise using large muscle groups (e.g., walking, stationary cycling, swimming, aquatic exercises, low impact aerobics)
Objective:
To investigate the impact of exercise and occupational activity on birth weight

Study Design:
Questionnaires were mailed at 2 weeks post partum to subjects identified from delivery room logs. Case-control design
- cases were birth wts < 15th %ile for GA
- controls were > 15th %ile;
- 2 controls recruited per case

Results:

- 853 potential subjects, 529 (62%) returned questionnaires.
- Univariable & multivariable analyses showed:
  - odds of giving birth to a low birth weight baby was increased for those who engaged in structured exercise ≥ 5 times per week (4.61; 1.73, 12.32)
  - and for those who engaged in structured exercise ≤ 2 times per week (2.64; 1.29, 5.39)
Conclusions:

• Structured exercise frequency during late pregnancy appears to be a determinant of birth weight
• Too much vs too little vs just right!!

***** 3 – 4 times per week *******

The shape of things to come

FREQUENCY
TWO OR LESS TIMES PER WEEK
TOO LITTLE!!?

PRESCRIPTION FOR AEROBIC ACTIVITY DURING PREGNANCY

INTENSITY

Exercise within an appropriate RPE range and/or target heart rate zone
TARGET HEART RATE ZONE

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>140-155</td>
</tr>
<tr>
<td>20-29</td>
<td>135-150</td>
</tr>
<tr>
<td>30-39</td>
<td>130-145</td>
</tr>
</tbody>
</table>

Work at the lower end of the HR range at the start of a new exercise program and in late pregnancy.


N=156; peak testing; 16-20 weeks

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>135-150</td>
</tr>
<tr>
<td>30-39</td>
<td>130-145</td>
</tr>
</tbody>
</table>

Target Heart Rate Zones:

20-29 years N=60
Fit – 145 – 160 beats/minute
Unfit – 129 - 144 beats/minute

30-39 years N=96
Fit – 140 – 156 beats/minute
Unfit – 128 – 144 beats/minute

New Target Heart Rate Zones Based on Age & Fitness:

<table>
<thead>
<tr>
<th>Age</th>
<th>Target Heart Rate Based on Fitness</th>
<th>Low</th>
<th>Active</th>
<th>Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td></td>
<td>129-144</td>
<td>135-150</td>
<td>145-160</td>
</tr>
<tr>
<td>30-29</td>
<td></td>
<td>128-144</td>
<td>130-145</td>
<td>140-156</td>
</tr>
</tbody>
</table>

New zones in the “Move for Two” DVD
Move For Two
DVD

Funded by:
Middlesex London Health Unit

Spellbound Productions

Released
Jan. 19th,
2011.

Guidelines: Overweight & Obese Pregnant Women?

• Current guidelines present THR zones of 60-80% of max aerobic capacity -PARmed-X for Pregnancy
• OW/OB may not be capable of exercise at this intensity
• The ACSM (2005) suggest overweight and obese women initiate an aerobic exercise program of \(20 \text{ to } 39\% \text{ of } \text{VO}_2\text{reserve}\)

N = 106 OW & OB pregnant women; 16-20 weeks pregnant (medically prescreened- PARmed-X for Preg)

Validated THR zones based on age:
• 20 to 29 years = 102 – 124 bpm;
• 30 to 39 years = 101 – 120 bpm

BORG’S RPE SCALE

6  Very, very light
7  Somewhat light
8  Fairly light
9  Somewhat hard
10 Hard
11 Very hard
12 Very, very hard
“TALK TEST”

The exercise intensity is excessive if you cannot carry on a verbal conversation while exercising.
Muscle conditioning exercise examples

Muscle conditioning precautions

Tear-off sheet to open communication
Advice from Health Canada

Safety considerations and Reasons to stop exercise & consult health care provider

If we restore the balance, can excessive weight gain be prevented??

Nutrition & Exercise Lifestyle Intervention Program (NELIP)
Pre-pregnant BMI $\geq 25 \text{ kg/m}^2$

Medically prescreened Entry – 16 – 20 weeks gestation

3-Day Food Intake Record NELIP until Delivery

Handed in 24 hr food records-weekly

Nutrition: Women are educated about serving sizes:
A palm is equal to 3 ounces (ex. 3 ounces of meat, fish or poultry).

A fist is equivalent to a 1-cup measure (ex. 1 cup of lettuce or yoghurt).

A thumb is equal to 2 tablespoons (ex. 2 tbsp. of peanut butter or cheese).
A thumb tip is equal to 1 teaspoon (ex. 1 tsp. of margarine).

Target Total Daily
2000 kcal (8360 kJ);
200 gm carbohydrates; 40-55%

Modified GDM diet
Smaller meals more often

Nutrition:

Do not “eat for two”
But eat twice as healthy!!

N=65

Pre: 2228±475 to 1900±343 kcal/day *
Pre: CHO 319±155 g to 259±9 g/day *
Pre: Protein 16.9±2.4% to 18.4±2.3 % daily intake *

Exercise walking program (3-4 X /week);
Individualized program based on peak
fitness test (30 % HR_{reserve})
Heart rate monitor;
Average target heart rate ≈ 118 bpm
Exercise logs & pedometer
Start at 25 min – increase by 2 min/wk
until 40 min, then maintain
Exercise:

<table>
<thead>
<tr>
<th>Steps/day</th>
<th>Activity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5000</td>
<td>Sedentary</td>
</tr>
<tr>
<td>5000 - 7499</td>
<td>Low Active</td>
</tr>
<tr>
<td>7500 - 9999</td>
<td>Somewhat Active</td>
</tr>
<tr>
<td>≥ 10,000</td>
<td>Active</td>
</tr>
<tr>
<td>&gt;12,500</td>
<td>Highly Active</td>
</tr>
</tbody>
</table>

N=65

Lab – once per week + 2-3 X’s on own
Pedometer and exercise log sheets - confirmed
Daily step counts before program = 5677±1738 steps
25 min = 2861±288, increased to 40 min = 4407±451 steps
Total steps ≈ 10,000; 2.84±0.87 times per week

Summary: N=65; MC=260; BMI, age, parity (4:1)
• Weight gained by women on the NELIP was 6.8±4.1 kg (0.38±0.2 kg/week)
• Total pregnancy weight gain of 12.0±5.7 kg
• Excessive weight gain occurred before NELIP began at 16 weeks gestation
• Eighty percent of the women did not exceed IOM recommended pregnancy weight gain on NELIP
• Mean birth weight was not different between NELIP & Matched Cohort 3.59±0.5 kg vs 3.56±0.6 kg
• No babies born SGA in NELIP
• Reduction in babies 4.0-4.5 kg in overweight women

Nutrition & Exercise Lifestyle Intervention Program (NELIP) for normal weight pregnant women.

Prepreg BMI – 18.5-24.9 kg/m²
Medically prescreened at 16-20 weeks
Randomized after peak exercise test
LI – 30% HRR; N=23
MI – 70% HRR; N=26
HC – No exercise, standard care; N=45

Objective: compare N + LI vs MI
GWG; birth wt & wt retention
Nutrition Program – same in both intervention groups

Modified GDM diet

Target Total Daily
2000 kcal (8360 kJ);
200 gm carbohydrates- 40-55% total energy
Smaller meals more often

Exercise – Intervention women completed a peak exercise test to determine exercise intensity

LI – 30% HRR; 118±8 bpm
MI – 70% HRR; 139±7 bpm

Exercise walking program
(3-4 X /week);
1X in lab + 2-3 times at home
Heart rate monitor; Exercise logs
Start at 25 min – 5 min warm-up;
15 min target; 5 min cool down
Add 2 min to 15 min until reached 30 min
5 min warm-up; 30 min target; 5 min cool down (40 min)

Nutrition Results:

- **LI: Pre - 2177.7 ± 436.0; Post - 2047.1 ± 433.5 kcal/d**
- **MI: Pre - 2185.1 ± 519.5; Post - 2143.3 ± 402.8 kcal/d**

- **No change in total energy intake pre vs post or between groups**

- **LI: Pre – 300.6± 73.1; Post – 272.4± 66.9 g/d**
- **MI: Pre – 302.7± 78.; Post - 273.0 ± 60.7 g/d**

- **Decrease in CHO pre vs post in both groups; not diff**
- **Fat intake increased in MI but not LI group**

## Gestational weight gain and weight retention at 2 months postpartum

<table>
<thead>
<tr>
<th>Variables</th>
<th>Low-intensity (n=23)</th>
<th>Moderate-intensity (n=26)</th>
<th>Controls (n=45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWG before the intervention (kg)</td>
<td>4.9 ± 2.7</td>
<td>4.6 ± 2.5</td>
<td>na</td>
</tr>
<tr>
<td>Excessive GWG before intervention (%)</td>
<td>48%</td>
<td>42%</td>
<td>na</td>
</tr>
<tr>
<td>GWG during the intervention (kg)</td>
<td>10.4 ± 2.1</td>
<td>10.3 ± 2.9</td>
<td>na</td>
</tr>
<tr>
<td>Weekly GWG during the intervention (kg)</td>
<td>0.49 ± 0.1</td>
<td>0.47 ± 0.1</td>
<td>na</td>
</tr>
<tr>
<td>Total GWG (kg)</td>
<td>15.3 ± 2.9</td>
<td>14.9 ± 3.8</td>
<td>18.3 ± 5.3 *</td>
</tr>
<tr>
<td>Weight retention (kg) 2MoPP</td>
<td>5.4 ± 3.9</td>
<td>4.6 ± 3.3</td>
<td>7.2 ± 3.8 #</td>
</tr>
<tr>
<td>Weight retention ≤ 2.0 kg (%)</td>
<td>18</td>
<td>28</td>
<td>7 #</td>
</tr>
</tbody>
</table>

Gestational weight gain (GWG) according to the IOM recommendations (2009); Total - 11.5-16 kg; weekly rate of weight gain – 0.4-0.5 kg/week for normal weight.

- NELIP – LI or MI prevented excessive GWG (70%)
- Increasing intensity - LI to MI did not change GWG
- Suggesting LI or MI combined with nutrition program is important
- Excessive GWG occurred early in pregnancy as women gained too much prior to intervention
- Babies no difference between groups

At delivery (6-18 hours) NELIP follow-up:
Birth weight & length
Skinfold measurements
Girth and circumference
Davenport et al. Timing of excessive pregnancy-related weight gain and offspring adiposity at birth. Obstet Gynecol 2013 [In Press]

- N=172; 33.7% NW; 33.7% OW; 32.6% OB
- NELIP women (all BMI categories);
- Weight gain before intervention – 16-20 weeks
- Weight gain on intervention to delivery
- Appropriate weight gain vs Excessive weight gain based on BMI category
- AP/AP; AP/XC; XC/AP; XC/XC
- Compared infant birth weight and adiposity (Catalano equation)
- Normative neonatal body fat is 12–14%.
Neonates of women who gained excessively in the first half of pregnancy had an increased risk (OR 2.64, 95% CI 1.35–5.17) of elevated body fat at birth compared with neonates of women with total excessive weight gain (OR 1.49, 95% CI 0.80–2.79).

A. Neonatal body fat grouped by weight-gain category. “Early excessive” and “overall excessive” categories are in excess of normative neonatal body fat.

B. The influence of total appropriate compared with total excessive weight gain on neonatal body fat on “late excessive” and “early excessive” categories.
Davenport et al. Timing of excessive pregnancy-related weight gain and offspring adiposity at birth. Obstet Gynecol 2013 [In Press]

- Timing of excessive maternal weight gain, specifically during the first half of pregnancy, is a stronger predictor of infant body fat at birth than total maternal weight gain
- Pre-pregnancy BMI did not matter
Healthy lifestyle is a balance:

Eating Habits

NOT- Eating for two but Eating TWICE as healthy!! Portion sizes..

Activity

If we restore the balance, can obesity be prevented in future generations??
Promotion of Active Living

• Pregnancy is time when many women change to a healthier lifestyle
  • improve eating habits
  • quit smoking
  • stop alcohol use
  • moderate caffeine consumption
• think about active living
Perhaps community programs which facilitate and encourage walking,
• such as mall walking (combined with elderly),
• which would also overcome barriers to exercise,
  • include child care,
  • family walks including children
May be successful in promoting active living and physical activity during pregnancy
Other ways to be physically active.....

Check out your cupboard.......
Other ways to be physically active:

- Increase steps taken per day – park farther away; take stairs
- Rake leaves; cut grass
- Gardening
- Shoveling snow!!
- Play with kids!
Eating Habits

Exercise Prescription for Pregnant Women

F – 3-4 times per week
I – mild – moderate
**Target HR zones; talk test; RPE
T – 25 – 30 (40) minutes
T – walking is OK!!

EARLY Prevention of excessive weight gain important!!
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