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Physical Activity, Sedentary Behavior, and Gestational Diabetes

Lisa Chasan-Taber
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Physical Activity, Sedentary Behavior, and Gestational Diabetes

Lisa Chasan-Taber, Sc.D.
Professor of Epidemiology
University of Massachusetts - Amherst
Gestational Diabetes

Any degree of glucose intolerance with onset or first recognition during pregnancy
Maternal Morbidities According to Age

Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 2005
How the first nine months shape the rest of your life
The new science of fetal origins
BY ANNIE MURPHY PAUL.
Fetal Basis of Adult Disease

- Environmental factors in utero can have profound influences on:
  - Lifelong health
  - Development of adult diseases
    - Cancer, CVD, diabetes, obesity
    - Asthma, allergies, mental illness
    - Arthritis, osteoporosis, cognitive decline

- Critical developmental window of programming

GDM Confers a 7-Fold Risk for Future Type 2 Diabetes

Preventing Diabetes in Women with Gestational Diabetes

Avoiding the slippery slope: preventing the development of diabetes in women with a history of gestational diabetes

Preventing Diabetes in Women with Gestational Diabetes

Through the looking glass: gestational diabetes as a predictor of maternal and offspring long-term health
Pregnancy as a Stress Test for Future Cardiovascular Disease

- Population with complicated pregnancy
- Healthy population
- Threshold for vascular or metabolic disease

Adapted from Sattar and Greer; 2002, British Medical Journal.
High Priority Research Needs

**High Risk Pregnant Women**

- Maternal Outcomes
  - Gestational diabetes
  - Hypertension

**Pregnancy**

**Delivery**

- Maternal Outcomes
  - Cesarean delivery

- Neonatal Outcomes
  - Large for gestational age
  - NICU admission

**Offspring Outcomes**

- Obesity
- Type 2 diabetes
- CVD risk factors

**Postpartum and Beyond**

- Maternal Outcomes
  - Type 2 diabetes
  - Postpartum weight retention
  - CVD risk factors

*Modified from Bennett et al. J Women’s Health 21(9):2012*
GDM Risk Factors

- Well documented
  - Prepregnancy overweight/obesity
  - Family history of diabetes
  - Advanced maternal age
  - Ethnicity
  - History of abnormal glucose tolerance/macrosomic infant
  - History of infertility
  - PCOS

Research on possible modifiable risk factors is critical

- Poor diet before or during pregnancy
- Low physical activity before or during pregnancy
- Smoking
- Stress
How Active Are Pregnant Women?
According to national surveys, 2x as many women are sedentary during pregnancy vs. the national average. Only 16% meet guidelines. Pregnant women who are active, exercise less frequently, for shorter durations, and lower intensity.

Evenson et al. *Paediatric and Perinatal Epidemiology* 2004, 18, 400–407
Hispanic Americans

- Hispanics are the largest minority group in the U.S.
  - highest birth and immigration rates
  - 25% of all US births in 2007

- by 2050
  - Hispanic women will comprise 24% of the female population in the US

- Hispanic children represent the largest minority group of US children
  - 1 of every 6 children
Hispanic Health Disparities

Diabetes Hospital Discharge Rate by Race/Ethnicity
Western Region and Massachusetts: 2003-2005

- **White non-Hispanic**
- **Black non-Hispanic**
- **Hispanic**
- **Asian non-Hispanic**

**State Overall: 133**

- Western Region: 452*, 396*, 118*, 36*
- Massachusetts: 368*, 242*, 114*, 45*
Probability of Developing Type 2 Diabetes after GDM Among Hispanic Women
Baystate Medical Center
Proyecto Buena Salud

NIH/NIDDK R01
DK064902

N=1,626 pregnant Hispanic Women

PI: Chasan-Taber, Co-I: Pekow, Markenson, Braun, Buonnaccorsi, Dole
Study Design

- **1st Interview**
  - 1st Prenatal Care Visit

- **2nd Interview**
  - Routine Ultrasound

- **3rd Interview**
  - Routine GDM screen

Gestational wk: 1 . . 4 . . 8 . . 12 . . 16 . . 20 . . 24 . . 28 . . 32 . . 36 . . 40

1st Trimester 2nd Trimester 3rd Trimester

Birth Outcomes (Medical Record Abstraction)

Pregnancy Physical Activity Questionnaire (PPAQ)

Sports/Exercise

Household/Caregiving

Occupational

Total Physical Activity

NIH/NICHD R03HD39341; PI: Chasan-Taber, Co-I: Freedson, Hosmer, Markenson
Type and Intensity of Physical Activity

Proportion of Active Time by Intensity of Physical Activity

Proportion of Active Time by Type of Physical Activity

Sedentary Behavior

- Watching Television
- Using a Computer
- Reading/Talking on the Phone

- <0.5 hours/day
- 0.5-<2 hours/day
- 2-<4 hours/day
- ≥4 hours/day
Meta Analysis: Physical Activity and GDM

**Prepregnancy Activity:**
- OR = 0.45
- (95% CI 0.28-0.75)

**Pregnancy Activity:**
- OR = 0.76
- (95% CI 0.70-0.83)

Tobias DK et al. Diabetes Care 2011;34:223-229
**Table 3.** Sedentary Behavior and GDM: Project Viva

<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>Before Pregnancy (n=1,638)</th>
<th>During Pregnancy (n=1,581)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDM</td>
<td>Abnormal Glucose Tolerance</td>
</tr>
<tr>
<td></td>
<td>Cases (n)</td>
<td>Adjusted OR* (95% CI)</td>
</tr>
<tr>
<td>Sedentary lifestyle (total activity 2 h/wk or less)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sedentary</td>
<td>63</td>
<td>1.0 (Referent)</td>
</tr>
<tr>
<td>Sedentary</td>
<td>13</td>
<td>1.44 (0.70–2.96)</td>
</tr>
<tr>
<td>Sedentary television viewing (h/d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 2</td>
<td>46</td>
<td>1.0 (Referent)</td>
</tr>
<tr>
<td>2 or more</td>
<td>30</td>
<td>1.28 (0.75–2.18)</td>
</tr>
</tbody>
</table>

Meta Analysis: Television Viewing and Risk of Type 2 Diabetes

<table>
<thead>
<tr>
<th>Type 2 diabetes</th>
<th>Weight, %</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu et al, 2001</td>
<td>18.9</td>
<td>1.20 (1.08-1.32)</td>
</tr>
<tr>
<td>Hu et al, 2003</td>
<td>29.8</td>
<td>1.16 (1.09-1.24)</td>
</tr>
<tr>
<td>Krishnan et al, 2009</td>
<td>36.6</td>
<td>1.17 (1.12-1.23)</td>
</tr>
<tr>
<td>Ford et al, 2010</td>
<td>14.7</td>
<td>1.37 (1.21-1.55)</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>1.20 (1.14-1.27)</td>
</tr>
</tbody>
</table>

Test for heterogeneity: \( P = .11; I^2 = 50.4\% \)
Meta Analysis: Television Viewing and Risk of Type 2 Diabetes
Interventions to Reduce the Incidence of Type 2 Diabetes

Diabetes Prevention Program Research Group *NEJM* 2002; 346: 393
## Interventions to Reduce the Incidence of GDM

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Study population</th>
<th>Intervention</th>
<th>GDM Criteria</th>
<th>Association</th>
</tr>
</thead>
</table>
| Barakat, 2013 | Spain n=510       | Group exercise: 50-55 min, 3x week  
*Duration*: 10-12 to 38-39 weeks | WHO  
IADPSG | OR 0.62 (95% CI 0.40-0.98)  
OR 0.90 (95% CI 0.52-1.57) |
| Stafne, 2012  | Norway n=855       | Group exercise: 60 min, 1x week  
*Individual exercise*: 45 min, 2x week  
*Duration*: 18-22 to 32-26 weeks | WHO | PA 7%; C 6%  
p=0.37 |
| Luoto, 2011   | Finland n=399      | *Individual exercise*: 800 MET-hrs/wk  
*Duration*: 8-12 to 37 weeks | ADA | PA 15.8%, C 12.4%  
p=0.31 |
| Phelan, 2011  | Providence, RI n=401 | *Individual exercise*: 30 min on most days of the week  
*Duration*: 10-16 weeks to 6 months post-partum | Not reported | PA 13.6%, C 8.1%  
p=n.s. |
An Exercise Intervention to Prevent GDM

The B.A.B.Y. Study

Behaviors Affecting Baby and You

NIH/NIDDK
R01 DK074876

N=290 pregnant ethnically diverse women

Pl: Chasan-Taber, Co-Pl Braun, Stanek, Marcus, Markenson
Eligible participants

Baseline Assessment
PPAQ, actigraph, 24 hr recall

Exercise Arm
12 Week Intervention
In person education on exercise
followed by mail & telephone follow-up

Health & Wellness Arm
12 Week Intervention
In person education on health & wellness
followed by mail & telephone follow-up

Follow-up Assessment
PPAQ, actigraph, 24 hr recall

Gestational Diabetes Screen

B.A.B.Y. Study Intervention Content

- Face-to-Face Visit
  - Tailoring Questionnaire
  - Stage-Matched Manual
  - Pedometer and Activity Log
  - Goal Setting
- Booster Telephone Calls
  - Problem Solving
  - Progress Toward Goals
- Mailings
  - Individually Tailored Report
  - Tip Sheets
  - Stage-Matched Manual
Stage Matched Manuals

Seamos Saludables

¿Necesito esto?

JumpStart to Health

Try it, You’ll like it...

Libro 4

Book 2

Seamos Activas

Siga Adelante...
Tip Sheets

10 Minute Physical Activities from A-Z

Accumulate 30 minutes a day of activity. (Try exercising in 10-15 minute bouts)

Invigorate yourself with fresh air. Park farther away from your destination and

Rake the leaves. Get outdoors and do your chores

How Do People Find Time to Get 10 Minutes of Exercise?

- Markie has mapped out a path through her house. While dinner cooks, she walks up and down the stairs, through the bedrooms, and across the hall. Her final stop is the kitchen so she can march in place and stir dinner every once in a while.
Pedometer

- Omron Pedometer HJ112
Health & Wellness Materials

- *Your Pregnancy & Birth* Fourth Edition
- *Easing Back Pain During Pregnancy*
- *Travel During Pregnancy*
- *Morning Sickness*
Change in Total PA from Pre to Post Intervention

- **Pre:** 5.2 Met-hrs/wk (~1 hr 20 min)
- **Post:**

Chasan-Taber et al., Journal of Physical Activity and Public Health 2011: 8(Suppl 2)
Change in Sports/Exercise from Pre to Post Intervention

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET-hrs/wk</td>
<td>1.3</td>
<td>~20 min</td>
</tr>
</tbody>
</table>

Chasan-Taber et al., Journal of Physical Activity and Public Health 2011: 8(Suppl 2)
Impact of Exercise Intervention on Gestational Diabetes

![Graph showing the impact of exercise intervention on gestational diabetes.](image-url)
Estudio Parto

Randomized Trial of a Postpartum Diabetes Prevention Program for Hispanic Women

NIH/NIDDK
2R01 DK064902

N=300 Postpartum Hispanic Women

PI: Chasan-Taber, Co-PI Braun, Pekow, Marcus, Rosal, Markenson
Proyecto Mamá

Randomized Lifestyle Intervention in Overweight and Obese Pregnant Hispanic Women

NIH/NIDDK
R01 DK097011

N=300 pregnant Hispanic Women

PI: Chasan-Taber, Co-PI Braun, Pekow, Stanek, Marcus, Rosal, Markenson
Inter-Generational Cycle: Diabetes Begets Diabetes

Preexisting type 2 diabetes

Gestational diabetes

Impaired adult glucose tolerance

In-utero exposure to gestational diabetes

Fetal hyperinsulinism

Childhood obesity

Adolescent impaired glucose tolerance

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