Preconception and Pregnancy Nutrition: A Proactive Approach to Improving Pregnancy Outcomes

Presented by: Amy Ogle, M.S., R.D.
Registered Dietitian, Exercise Physiologist, ACE-Certified Personal Trainer, Co-author of Before Your Pregnancy
Objectives

By the end of these two sessions, participants will be able to:

- Recognize how and why good preconceptional nutrition status confers benefits to the prospective mother and baby, unique from the benefits of prenatal nutritional health.
- Offer examples of pre-existing medical conditions that may require customized nutrition intervention.
- Identify the ideal time frame for prospective fathers to practice preconceptional guidelines and how in subfertile males, might improve fertility.
- Identify healthy foods and beverages to eat prior to and during pregnancy. Identify foods/beverages/supplements that should be limited or avoided.
- Explain the role that proper food handling has on protecting against infection and environmental contaminants.
Perceived need?
True or False:

A fetus can draw everything it needs (from mom) to properly develop in the womb?
Nature’s drive for survival and balance determines the allocation of nutrients:

Mother = Priority #1

Placenta = Priority #2

Fetus = Priority #3

(Not “all or none” prioritization, but baby compromises the most)

“If policymakers and implementers are truly interested in preventive nutrition, the target of interventions needs to shift to a different part of the life cycle. Investment in the preconceptional female will yield enormous nutritional benefits in other parts of the life cycle. We know unequivocally that healthier females – before pregnancy – are more likely to produce healthier babies, who develop into healthier children.”

Paradigm shift #1:

Nutritional Wellness
from a Life Course Perspective
(Every patient interaction is an opportunity to reinforce this concept.)

Recommended resources: March of Dimes; CDC’s Preconception Health and Health Care
Plan nested within this new paradigm:
Men and women need \textit{at least} 90 Days of optimal nutritional status before conception.
Sperm and Egg Formation

• Getting to the haploid number of chromosomes in sex cells involves specialized cell divisions and different timelines

Timeline differs:
• Men: continuous/90 day
• Females: at birth → at ovulation → upon fertilization

Sperm & Oxidative Stress Balance

3. Lifestyle:
- smoking
- alcohol
- obesity
- stress
- advanced paternal age
- poor diet

4. Environmental
- heat
- pollution
- heavy metals
- plasticizers
- pesticide/ herbicides

5. Infection
- genito-urinary tract
- systemic infection

6. Autoimmune
- vasectomy
- torsion
- chronic prostatitis

7. Testicular

8. Chronic Disease
- diabetes
- CRF
- haemoglobinopathies
- hyperhomocysteinaemia

Damage to sperm DNA results
In infertility and miscarriage

Damage to sperm membrane
Decreases motility and the sperm’s ability to fuse with oocyte

Source: European Society of Human Reproduction and Embryology ISSN 1460-2369
Message:
Primary focus for men & preconceptional nutrition

- Good overall nutrition for men during sperm formation. Nutrition-related problems need ≥3 months to resolve.
- Make sure he’s relatively competent in the kitchen should he need to take greater responsibility later. Educate about safe food handling, prevention of foodborne illness.
- Practice for role modeling
Ovulation & Conception
“Nature” or Genotype and “Nurture” or Environment (Psychosocial/Physical/Nutritional)

A baby’s first “environment” is the womb environment
When to refer to a R.D. for preconceptional nutrition counseling:

- Type 1 or 2 diabetes; hyperinsulinemia/insulin resistance
- Polycystic Ovary Syndrome (PCOS)
- Overweight, underweight, eating disorder, post-bariatric
- Thyroid disease
- Vegetarian/vegan
- Fe-deficiency anemia, hemochromatosis
- GI/Autoimmune disease (e.g., Celiac; Crohn’s and Ulcerative Colitis)
- PKU
- Prior pregnancy health issues that could have nutrition component (e.g., prior NTD; preterm birth; hyperemesis)
Preconception and Interconception: More clues about underlying nutritional status

✓ Does she have pre-existing medical conditions (diagnosed, undiagnosed; good or poor control)?

✓ If patient has been pregnant before, what was the nutritional course? Multiples?

✓ Length of time between pregnancies?
  ✓ – Adequate enough for nutrient repletion?
Pregnancy: Further Considerations

- Singleton gestation or multiples?
- Severity of morning sickness; hyperemesis gravidarum?
- Does the patient understand the role that her diet plays in providing high quality nutrition to her baby? Her desire for good self care? Resistance?
- Dietary fears & misconceptions
- Good or poor understanding of calorie and nutrient needs to follow IOM Weight Gain recs?
How the first nine months shape the rest of your life

The new science of fetal origins

BY ANNIE MURPHY PAUL
Maternal Nutrition & Body Mass Index (BMI)

### Body Mass Index Table

<table>
<thead>
<tr>
<th>Height (Inches)</th>
<th>Normal</th>
<th>Overweight</th>
<th>Obese</th>
<th>Extreme Obesity</th>
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<tbody>
<tr>
<td>BMI</td>
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<td>76</td>
<td>156</td>
<td>164</td>
<td>172</td>
<td>180</td>
</tr>
</tbody>
</table>

Body Weight (pounds)

Main Preconception Message: If patient’s BMI is < 18.5 or > 25, customize her pre-pregnancy weight goal to fit her needs.

Talking points:

- Pace of loss or gain should be moderate (± ½ to 2 lbs/wk) within the framework of “energy balance system.”
- At the very least, improve by 2 BMI units in the desired direction.
- Offer a preview of personalized gestational weight gain goal and pace according to IOM Guidelines, 2009. Do not lose weight at any point of time during pregnancy.
- Use reliable birth control in interim.
Message to overweight/obese women before conception

- **Motto:** “Move more. Eat smarter.”
  - Cannot just focus on one or the other. The key is to do both. This requires planning.

- **Extra precaution:** AVOID herbal weight loss regimens (pills, cleansing programs, dieter’s teas). They usually contain dangerous harsh herbal laxatives (aloe, cascara sagrada, goldenseal, senna), herbal forms of caffeine (guarana), herbal “speed” (ephedra, ma huang).
Infertility and obesity research

“All who treat infertility should consider weight loss to be a prerequisite for obese women prior to any assisted reproduction programmes” – Clark, AM, et al.

References:
Immune system strength

• **Question:** Does a pregnant woman’s immune system gear down so that her body doesn’t reject the fetus?

• **Discussion:** Role of nutrition’s influence
Implantation of blastocyst & pregnancy outcome

- Robust immune system involvement:
  - Early: implantation & development of placental anchor/vasculature
  - Later: onset of labor
Nutrition & Exercise for Immune System Strength:

• Improves obesity/insulin resistance—chronic, low grade inflammation

• Regular exercise lowers inflammatory markers
  – C-reactive protein, possibly homocysteine

• Safe food handling (viral & bacterial contamination)

• Whole foods, oils, culinary herbs and spices with anti-inflammatory effects

• Vitamins:
  – Folic acid and possible mediation of intrauterine infections (recall causes of very early PTL)
  – Vitamin D and immune system health

• Keep your intestinal tract healthy; preliminary support of probiotics & prebiotics – Dietary sources for both
THE HUMAN MICROBIOME PROJECT SAYS THE HUMAN BODY HAS 100 TRILLION MICROSCOPIC LIFE FORMS LIVING IN IT.

YOU CALL THIS LIVING?
Microbiome

- Healthy bacterial colonies – such as those in the gut – lead to healthier immune system, which can boost reproductive health!
Distribute Handouts:

ChooseMyPlate.gov – Recommend Super Tracker (for nonpregnant & pregnant)

March of Dimes “Healthy Eating,” “Folic Acid, Omega-3 Fatty Acids and DHA”, & “Shopping on a Budget”
Nutrient Availability for Moms & Babies

Recall Nature’s drive:
Mother = Priority #1
Placenta = Priority #2
Fetus = Priority #3
Do you need a supplement?
Practitioner: Ask pt. if they are already taking any vitamin, mineral, or herbal supplements.

Explain:
- What supplements can and cannot do in preparation for conception
- *How soon* to start supplementing and dosage
- Safety warnings to prevent toxicities
Example: Fully-formed Vitamin A Warning
(a.k.a. retinol, vitamin A acetate, vitamin A palmitate)

- Preconception Vit A RDA = 2,300 IU/day.
- Do not exceed 10,000 IU of preformed vitamin A, the safe upper limit (UL); no UL for carotenoids
  - Why? If prospective mother regularly exceeds UL during the 2 weeks prior to conception through the 1st 6 weeks of pregnancy -- ↑ risk for birth defects of the skull, eyes, brain, heart, and/or spinal cord (Most defects occur at regular intakes over 25,000 to 30,000 IU.)
### Fully-formed Vitamin A Sources

<table>
<thead>
<tr>
<th>Amount</th>
<th>Item Name</th>
<th>Vitamin A content (IU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 oz</td>
<td>Liver (including chicken, turkey)</td>
<td>12,000-17,000</td>
</tr>
<tr>
<td>3.5 oz</td>
<td>Liver (including veal, pork, lamb, and beef)</td>
<td>20,000-36,000</td>
</tr>
<tr>
<td>3.5 oz</td>
<td>Foie gras (duck or goose liver)</td>
<td>30,000-40,000</td>
</tr>
<tr>
<td>1 slice</td>
<td>Liverwurst, liver sausage</td>
<td>4,000-7,500</td>
</tr>
<tr>
<td>1 oz slice</td>
<td>Liver cheese (pork liver)</td>
<td>5000-6,000</td>
</tr>
<tr>
<td>3.5 oz</td>
<td>Giblets (from chicken or turkey)</td>
<td>6,000-12,000</td>
</tr>
</tbody>
</table>

**Foods warranting caution/limitation**

**Supplements to AVOID**

<table>
<thead>
<tr>
<th>Amount</th>
<th>Item Name</th>
<th>Vitamin A content (IU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tbsp</td>
<td>Fish liver oils (e.g., cod liver oil)</td>
<td>400 - 14,000</td>
</tr>
<tr>
<td>1 dose</td>
<td>Certain vitamin supplements</td>
<td>those <em>exceeding</em> 5,000</td>
</tr>
</tbody>
</table>
Protein Foods

IRON

<table>
<thead>
<tr>
<th>mg</th>
<th>Food Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Oysters, 3 large</td>
</tr>
<tr>
<td>5</td>
<td>Liver, beef, cooked, 2 oz.</td>
</tr>
<tr>
<td></td>
<td>Beans, 1 cup cooked</td>
</tr>
<tr>
<td>5</td>
<td>Red, kidney, pinto</td>
</tr>
<tr>
<td>4</td>
<td>Blackeyed peas</td>
</tr>
<tr>
<td>3</td>
<td>Lentils</td>
</tr>
<tr>
<td>3</td>
<td>Chili con carne with beans, 1 cup</td>
</tr>
<tr>
<td>2½</td>
<td>Pork, cooked, 2 oz.</td>
</tr>
</tbody>
</table>
Natural Supplements/Herbs

“Natural” does not guarantee safety.

Recommendations for women who could become pregnant or are pregnant:

- Prudent to not take a chance until natural supplements are held to the same standards of quality as medications.

- Examples of where there is some leniency: Limited use of psyllium, red bush tea, black and green tea, cooking herbs and ginger is most likely safe.
Guidelines for Preconceptional and Prenatal Supplement Formulas:

**Folic Acid** – 400-800 mcg

**Iron** - 18 to 27 mg

**Calcium & Magnesium** - No more than 250 mg Ca and 25 mg Mg

**Vitamin A** - No more than 5000 IU, preferably some or all as beta-carotene form

**Others**

- **Zinc** (8 to 15 mg)
- **Vitamin D** (600 IU)
- **Vitamin C** (60 to 85 mg)
- **Vitamin B6** (1.3 to 2 mg)
- **Vitamin B12** (2.4 to 6 mcg)
- **Copper** (between .9 to 2 mg)
- **Iodine** (150 mcg)
- **Choline** (425 to 550 mg)

*Less than or equal to 100% RDA or 100% of the DV (Daily Value) for any other vitamins and minerals such as selenium.*

Pre-pregnancy Food Intake

- See handouts
- Plus, let’s take liberties… add a 6th food group, the liquid oils, to our preconception MyPlate

MyPlate source: USDA and DHHS
Pre-pregnancy → Pregnancy Food Intake

♦ Pre-pregnant: Understand what it takes to maintain weight by eating nutrient-dense foods.

♦ Pregnant: Limit 1\textsuperscript{st} trimester gain to 1-4 pounds, then add >300-400 calories/day (customize based on BMI) beginning in 2\textsuperscript{nd} trimester.

♦ Balance of CARBS, PRO, FAT, vitamins, minerals, fiber, and other healthful components of foods. No meal skipping. Begin with MyPlate.gov and input your information to individualize.

♦ Pre-existing medical concerns (e.g., PCOS, diabetes) require more customization, as does a twin or triplet pregnancy.
Try these strategies on your own & with patients to create natural dietary balance

➢ Try to include 4-6 food groups at every meal

➢ Try to include small portions of at least 2-3 food groups at every snack

➢ Limit processed foods.

(Food demo + online guidance

www.choosemyplate.gov/food-groups/)
Staying well hydrated, mostly with water or “spa water”
• Are these a “need” or a “want”?
Controversial or not?

- These following nonnutritive sweeteners are FDA-approved or have FDA GRAS status for preconception and pregnancy.
  - Aspartame
    - Equal
    - Nutrasweet
  - Acesulfame-K
    - Sunett
  - Sucralose
    - Splenda
  - Stevia-based purified extract
    - Reb A Truvia, Sun Crystals, Pure Via
  - Saccharine (Sweet ‘n Low)
    - Most controversial history
### Table 5. Nonnutritive sweeteners (NNS) approved in the United States by the Food and Drug Administration

<table>
<thead>
<tr>
<th>Name (chemical name)</th>
<th>Times sweeter than sucrose</th>
<th>ADI&lt;sup&gt;a&lt;/sup&gt; and EDI&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Use in foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acesulfame K (5,6-dimethyl-1,2,3-oxathiazine-4(3H)-1,2,2-dioxide) (66)</td>
<td>200</td>
<td>ADI: 15 mg/kg BW&lt;sup&gt;c&lt;/sup&gt; EDI: 0.2 to 1.7 mg/kg BW</td>
<td>Approved for general use, except in meat and poultry. Combines well with other NNS; stable at baking temperatures</td>
</tr>
<tr>
<td>Aspartame (L-aspartyl-L-phenylalanine methyl ester) (68)</td>
<td>160-220</td>
<td>ADI: 50 mg/kg BW EDI: 0.2-4.1 mg/kg BW</td>
<td>Approved for general use. Degrades during heating</td>
</tr>
<tr>
<td>Luo han guo extract (cucurbitane glycosides, mogroside II, III, IV, V, VI) (70)</td>
<td>150-300</td>
<td>ADI: No ADI determined EDI: 6.8 mg/kg BW</td>
<td>GRAS&lt;sup&gt;g&lt;/sup&gt;. Intended for use as a tabletop sweetener, a food ingredient, and a component of other sweetener blends</td>
</tr>
<tr>
<td>Neotame (N-[N-3,3-dimethylbutyl]-L-aspartyl]-L-phenylalanine-1-methyl ester) (71)</td>
<td>7,000-13,000</td>
<td>ADI: 18 mg/kg BW EDI: 0.05-0.17 mg/kg BW</td>
<td>Approved for general use, except in meat and poultry. To date, little used in food processing</td>
</tr>
<tr>
<td>Saccharin (1,1-dioxo-1,2-benzothiazol-3-one) (14)</td>
<td>300</td>
<td>ADI: Prior sanctioned food ingredient; no ADI determined EDI: 0.1-2 mg/kg BW</td>
<td>Limited to &lt;12 mg/fl oz in beverages, 20 mg/serving in individual packages, or 30 mg/serving in processed foods</td>
</tr>
<tr>
<td>Stevia (steviol glycosides, rebaudioside A, stevioside) (74)</td>
<td>250</td>
<td>ADI: (determined by JECFA&lt;sup&gt;h&lt;/sup&gt; 4 mg/kg BW EDI: 1.3-3.4 mg/kg BW</td>
<td>GRAS&lt;sup&gt;g&lt;/sup&gt;. Intended for use as a sweetener in a variety of food products such as cereals, energy bars, and beverages and as a tabletop sweetener</td>
</tr>
<tr>
<td>Sucralose (trichlorogalactosucrose) (20)</td>
<td>600</td>
<td>ADI: 5 mg/kg BW EDI: 0.1-2.0 mg/kg BW</td>
<td>General use; heat stable for cooking and baking</td>
</tr>
</tbody>
</table>

<sup>a</sup>ADI = acceptable daily intake.  
<sup>b</sup>EDI = estimated daily intake.  
<sup>c</sup>BW = body weight.