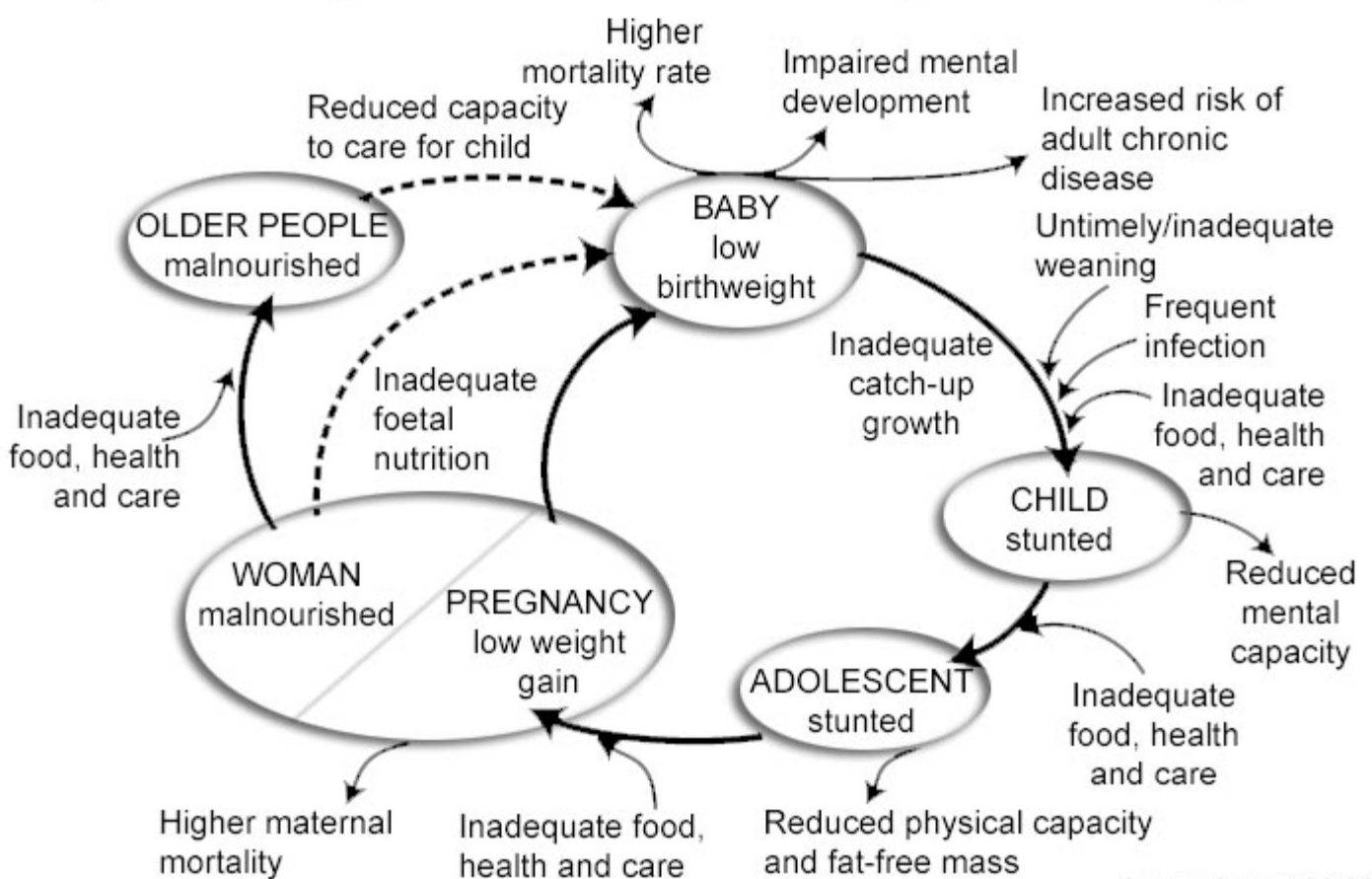


## Impact of hunger and malnutrition throughout the life cycle



Source: Seres ACC/SCN

# Nutrition in pregnancy

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2013

## Outlines

### Nutrition prior to pregnancy

- Health habits that contribute to healthy pregnancies

### Growth & development during pregnancy

- Placental development
- Fetal growth & development during pregnancy
- Critical periods

### Maternal weight

- Weight prior to conception
- Weight gain during pregnancy
- Exercise during pregnancy

### Nutrition during pregnancy

- Energy & nutrition needs
- Common nutrition-related concerns of pregnancy

### High-risk pregnancies

- Malnutrition & pregnancy
- The mother's age
- Practices incompatible with pregnancy

## Nutrition prior to pregnancy

3

## Health habits that contribute to healthy pregnancies

Achieve and maintain a healthy body weight

Choose an adequate and balanced diet.

Be physically active

Receive regular medical care

Manage chronic conditions

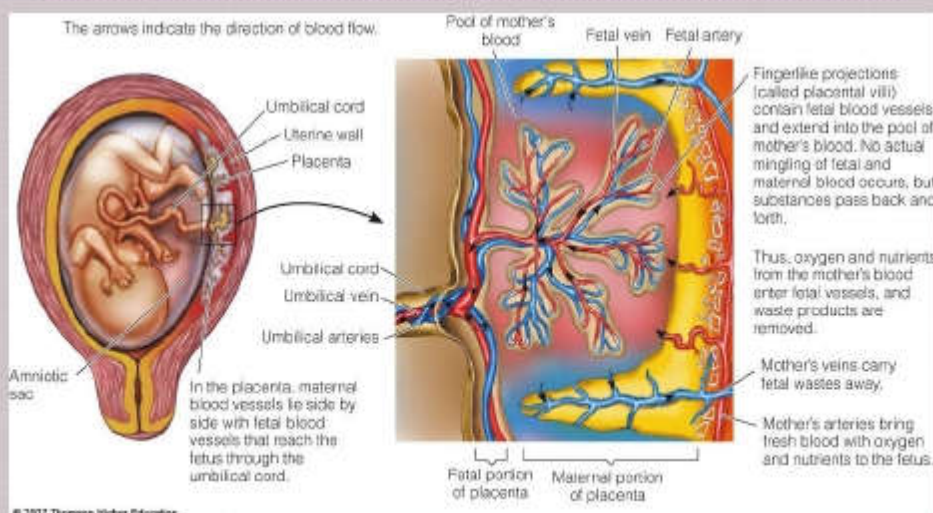
Avoid harmful influences

4

## Growth & Development during Pregnancy

5

## Placental development



▶ 6

## Fetal growth & development



A newly fertilized ovum (a zygote). < 1w after fertilization: rapidly divided multiple times & ready for implantation



After implantation: placenta develops & provide nourishment to the developing embryo. An embryo 5w after fertilization is about 1/2 inch long.



A **fetus** after 11w of development is just over an inch long. Notice the umbilical cord & blood vessels connecting the fetus with the placenta.

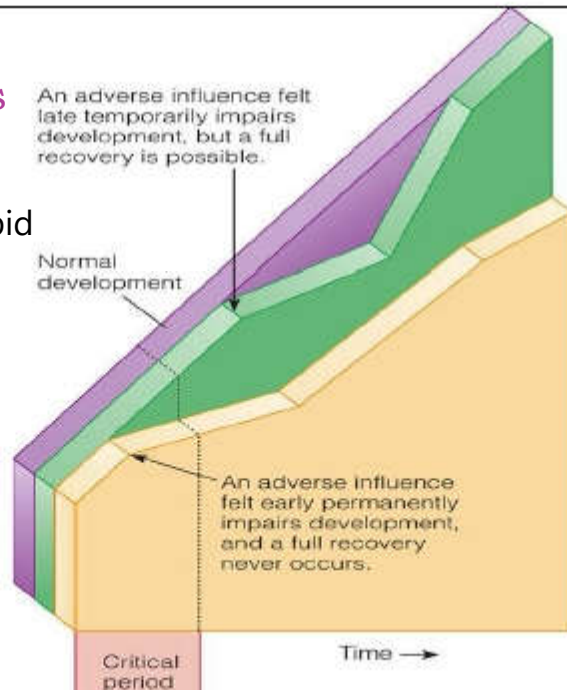


A **newborn infant** after 9m of development measures close to 20 inches in length. From 8w to term, this infant grew 20x longer & 50x heavier

7

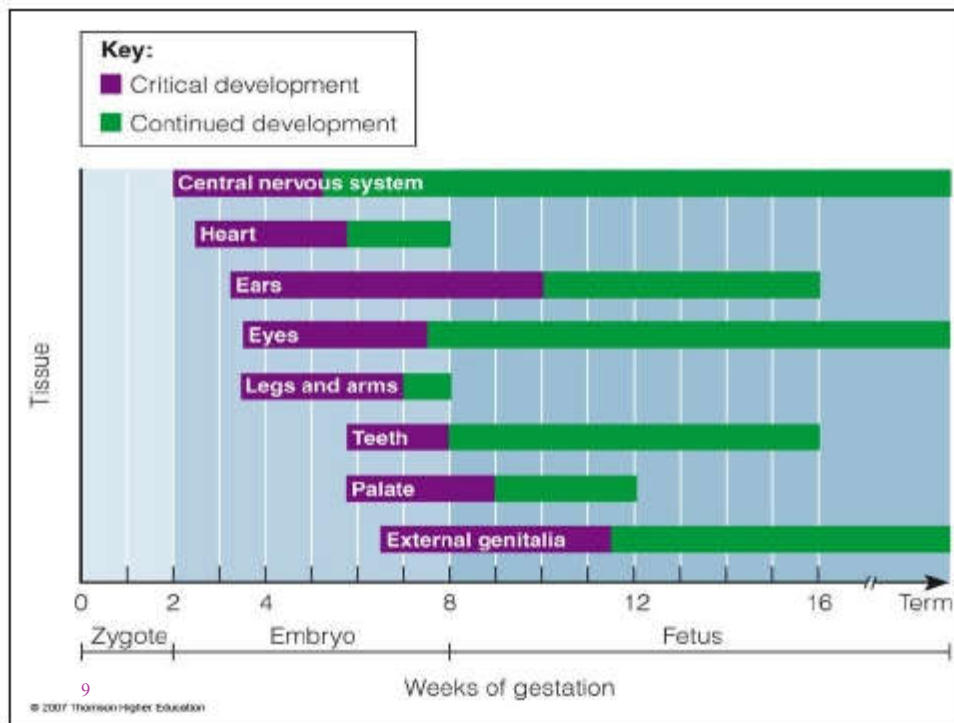
## Critical periods

“ Times of intense development & rapid cell division



8

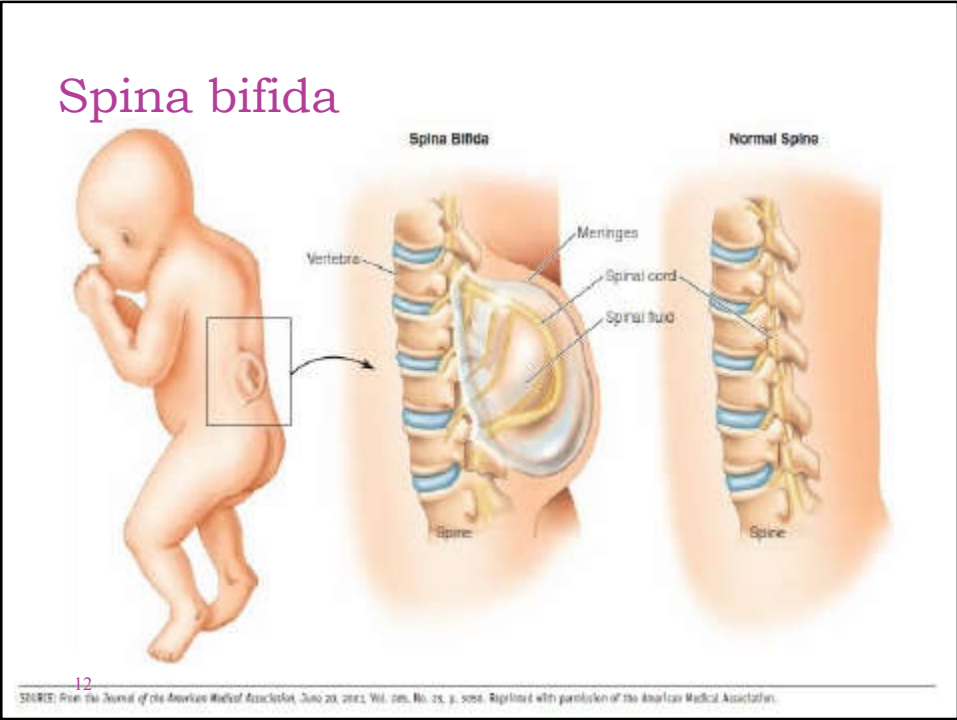
© 2012 Thomson Higher Education



## Neural tube defects

### “ Factors:

- “ Previous pregnancy with neural tube defects
- “ Maternal diabetes
- “ Maternal use of antiseizure medications
- “ Maternal obesity
- “ Folate supplementation reduces the risk

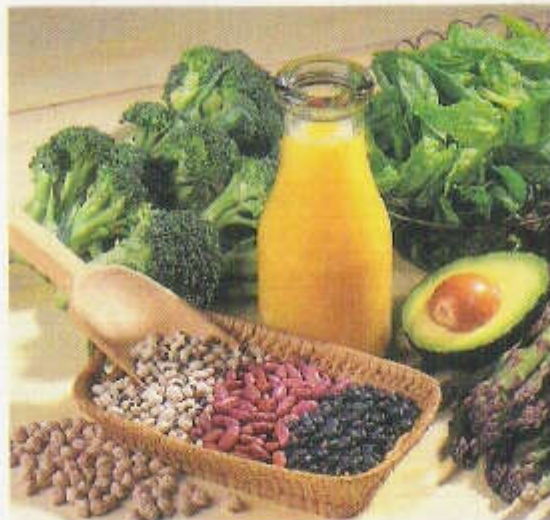




## Folate supplementation

- “ Reduces risk of neural tube defects
- “ RDA ♀ 400 µg/day, during pregnancy: 600 µg/day
- “ Many fortified grains
- “ Those who have previously given birth to a child with a neural tube defect may be prescribed a 4 milligram daily supplement.

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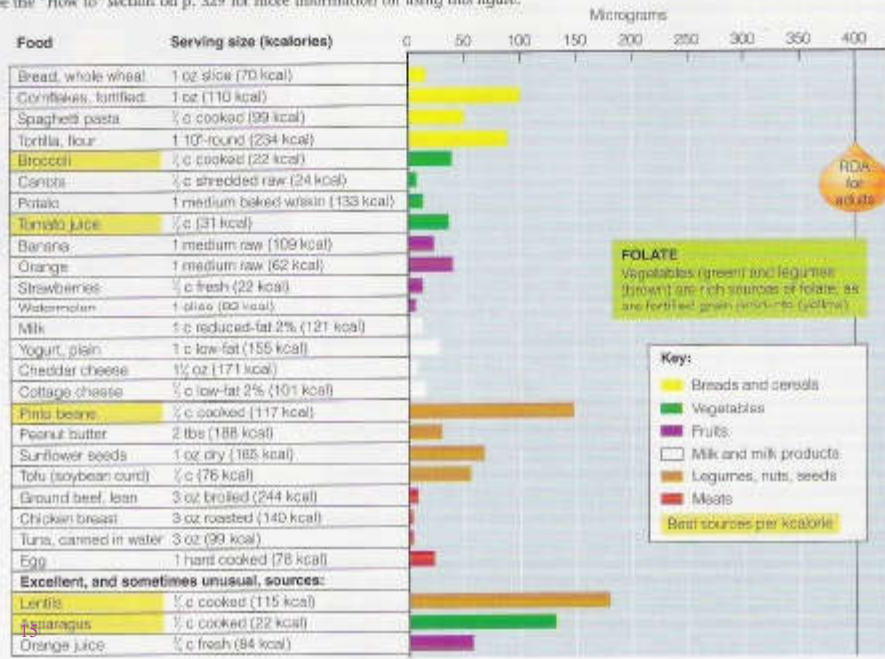
Leafy dark green vegetables (such as spinach and broccoli), legumes (such as black beans, kidney beans, and black-eyed peas), liver, and some fruits (notably citrus fruits and juices) are naturally rich in folate.

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**FIGURE 10-11 Folate in Selected Foods**

See the "How to" section on p. 329 for more information on using this figure.



Maternal weight

## Maternal Weight

- “ A mother’s weight prior to conception & weight gain during pregnancy → influence birthweight.
- “ Higher birthweights present fewer risks for infants.
- “ Lower birthweights present more problems.



▶ 17

## Weight prior to conception

### Underweight

- Tend to have lower birth weight babies
- Higher rates of preterm (premature <38 weeks) infants & infant deaths

### Overweight & obesity

- Tend to be born post term (>42 weeks)
- Tend to be greater than 9 pounds at birth (macrosomia)
- More difficult labor and delivery, birth trauma, and cesarean sections
- Higher risk for neural tube defects, heart defects and other abnormalities

▶ 18

## Weight gain during pregnancy

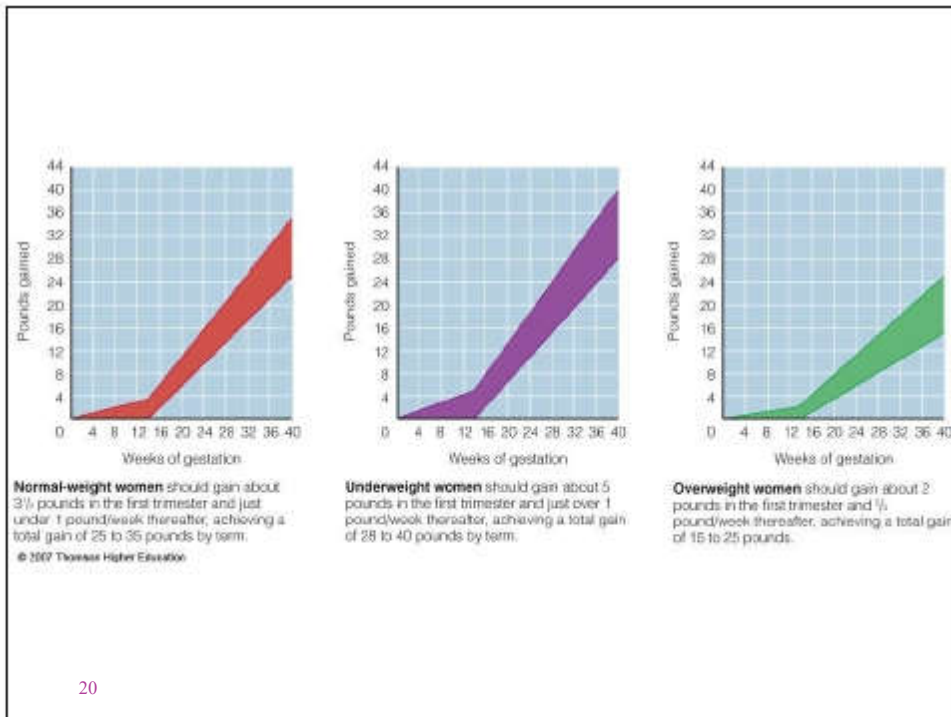
### Recommended Weight Gains

Prepregnancy Weight	For single birth	For twin birth
Underweight (BMI <18.5)	28 to 40 lb (12.5 to 18.0 kg)	Insufficient data to make recommendation
Healthy weight (BMI 18.5 to 24.9)	25 to 35 lb (11.5 to 16.0 kg)	37 to 54 lb (17.0 to 25.0 kg)
Overweight (BMI 25.0 to 29.9)	15 to 25 lb (7.0 to 11.5 kg)	31 to 50 lb (14.0 to 23.0 kg)
Obese (BMI ≥30)	11 to 20 lb (5.0 to 9.0 kg)	25 to 42 lb (11.0 to 19.0 kg)

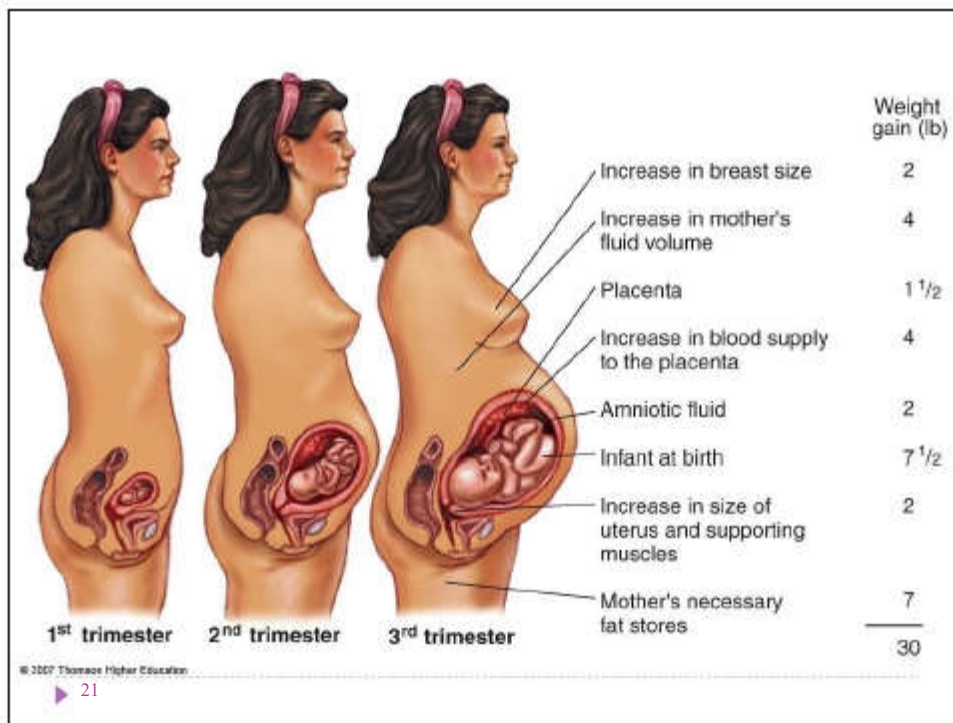
### Weight-Gain Patterns

- 3 ½ pounds first trimester
- 1 pound per week thereafter

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▶ 21

## Exercise during pregnancy



- Adjust duration and intensity as needed
- Improves fitness, prevents gestational diabetes, facilitates labor, and reduces stress
- Low-impact activities are recommended.

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## Guidelines

### Do

- Begin gradually if just starting
- Exercise regularly
- Warm ups and cool downs
- 30 or more minutes of moderate activity
- Watch fluids
- Enough energy intake

### Don't

- No vigorous exercise
- Keep out of hot and humid weather
- No exercise when sick with fever
- No exercise while lying on your back
- No prolonged standing while motionless
- Stop if painful, uncomfortable, or fatiguing
- No activities harmful to abdomen
- No bouncy or jerky movements
- No scuba dive, saunas, steam rooms, or hot whirlpools

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## Nutrition during pregnancy

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## Energy & Nutrient Needs during Pregnancy

### Energy

- Second trimester +340 kcal/day
- Third trimester +450 kcal/day

### Protein

- + 25 grams/day
- Use food, not supplements

### Essential Fatty Acids

- Omega-3
- Omega-6

▶ 25

**TABLE 5-2** Sources of Omega-3 and Omega-6 Fatty Acids

### Omega-6

Linoleic acid	Vegetable oils (corn, sunflower, safflower, soybean, cottonseed), poultry fat, nuts, seeds
Arachidonic acid	Meats, poultry, eggs (or can be made from linoleic acid)

### Omega-3

Linolenic acid	Oils (flaxseed, canola, walnut, wheat germ, soybean) Nuts and seeds (butternuts, flaxseeds, walnuts, soybean kernels) Vegetables (soybeans)
EPA and DHA	Human milk Pacific oysters and fish <sup>a</sup> (mackerel, salmon, bluefish, mullet, sablefish, menhaden, anchovy, herring, lake trout, sardines, tuna) (or can be made from linolenic acid)

<sup>a</sup>All fish contain some EPA and DHA; the amounts vary among species and within a species depending on such factors as diet, season, and environment. The fish listed here, except tuna, provide at least 1 gram of omega-3 fatty acids in 100 grams of fish (3.5 ounces). Tuna provides fewer omega-3 fatty acids, but because it is commonly consumed, its contribution can be significant.

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## Nutrients for Blood Production & Cell Growth

Folate

- 600 µg/day

Vitamin B<sub>12</sub>

- 2.6 µg/day

Iron

- 27 mg/day

Zinc

- 2 mg/day for adults ≤ 18 years of age
- 11 mg/day for adults 19-50 years of age

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## Nutrients for Bone Development

Vitamin D

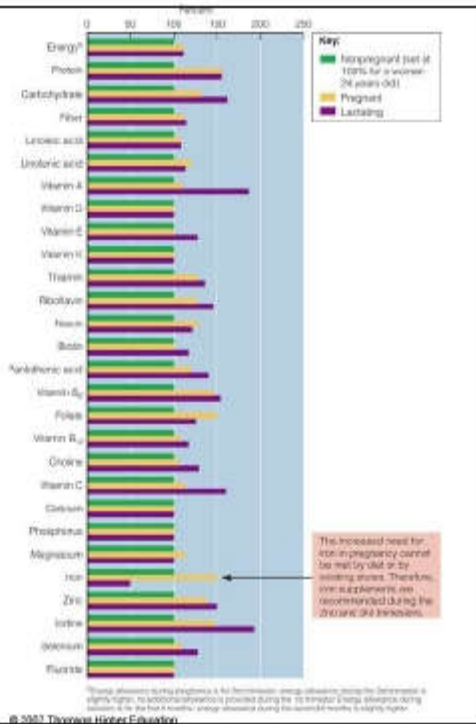
- to use and absorb calcium effectively

Calcium

- to allow for calcification of fetal bones

▶ 28

Other nutrients needed to support growth, development, & health of the mother and fetus



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## Nutrient Supplements



Amount Per Tablet	% Daily Value For Pregnant/Lactating Women
Vitamin A 5,000 IU	100%
Vitamin C 100 mg	20%
Vitamin D 400 IU	80%
Vitamin E 10 IU	20%
Thiamin 1.5 mg	30%
Riboflavin 1.7 mg	34%
Niacin 16 mg	32%
Vitamin B <sub>6</sub> 1.3 mg	26%
Folate 600 mcg	120%
Vitamin B <sub>12</sub> 2.4 mcg	100%
Choline 550 mg	110%
Iron 27 mg	486%
Zinc 12 mg	120%
Iodine 220 mcg	440%
Selenium 55 mcg	110%

- “ Prenatal supplements prescribed by physicians
- “ May help to reduce risk for preterm delivery, low infant birthweights, and birth defects

▶ 30

## Common Nutrition-Related Concerns of Pregnancy

### Nausea

- Morning (anytime) sickness
- Ranges from mild queasiness to debilitating nausea & vomiting
- Hormonal changes

### Constipation & hemorrhoids

- Altered muscle tone & cramping space for organs
- Straining during bowel movements

### Heartburn

- Digestive muscles are relaxed and there is pressure on the mother's stomach
- Stomach acid backs up into the lower esophagus

### Food cravings & aversions

- Common
- Do not reflect real physiological needs
- Hormone-induced changes in sensitivity to taste and smell

### Nonfood cravings

- Pica
- Often associated with iron-deficiency

▶ 31

## Alleviation strategies

### Nausea

- Eat desired foods at desired times
- Arise slowly upon awakening
- Eat dry toast or crackers
- Chew gum or hard candies
- Eat small, frequent meals
- Avoid offensive foods
- Consume carbonated beverages & avoid citrus juice, coffee, tea, water, or milk when nauseated

### Constipation & hemorrhoids

- High--fiber foods
- Exercise regularly
- 8 glasses of liquids each day
- Respond promptly to the urge to defecate
- Use laxatives only when prescribed by physicians

### Heartburn

- Relax & eat slowly
- Chew food thoroughly
- Eat small, frequent meals
- Drink liquids between meals
- Avoid spicy or greasy foods
- Sit up while eating; elevate head while sleeping
- Wait 1 hour after eating before lying down
- Wait 2 hours after eating before exercising

▶ 32

## High--risk pregnancies

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Factor	Condition That Raises Risk
Maternal weight	
• Prior to pregnancy	Prepregnancy BMI either $<18.5$ or $\geq 25$
• During pregnancy	Insufficient or excessive pregnancy weight gain
Maternal nutrition	Nutrient deficiencies or toxicities; eating disorders
Socioeconomic status	Poverty, lack of family support, low level of education, limited food available
Lifestyle habits	Smoking, alcohol or other drug use
Age	Teens, especially 15 years or younger; women 35 years or older
Previous pregnancies	
• Number	Many previous pregnancies (3 or more to mothers under age 20; 4 or more to mothers age 20 or older)
• Interval	Short or long intervals between pregnancies ( $<18$ months or $>59$ months)
• Outcomes	Previous history of problems
• Multiple births	Twins or triplets
• Birthweight	Low- or high-birthweight infants
Maternal health	
• High blood pressure	Development of gestational hypertension
• Diabetes	Development of gestational diabetes
• Chronic diseases	Diabetes; heart, respiratory, and kidney disease; certain genetic disorders; special diets and medications

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## Infant's birth weight

- “ High risk pregnancy ~ low birth weight
- “ Preterm infant = small, size & weight ~ age → catch up (+) ~ nutritional support
- “ SGA (small-for-gestational-age) ≠ → growth failure (+)
- “ LBW → complications >>
- “ Low socioeconomic ~ LBW; teen pregnancies, smoking, alcohol & drug abuse



▶ 35

## Malnutrition & Pregnancy

### Malnutrition & Fertility

- Severe malnutrition & food deprivation reduce fertility
  - ♂ lose the ability to produce viable sperm
  - ♀ develop amenorrhea
- Loss of sexual interest during starvation

### Malnutrition & Early Pregnancy

- Placenta problems
- Impaired development in infant

### Malnutrition & Fetal Development

- Fetal growth retardation
- Congenital malformations
- Spontaneous abortion and stillbirth
- Premature birth
- Low infant birthweight

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## Mother's Age

### Pregnancy in Adolescents

- Complications include iron-deficiency anemia & prolonged labor
- Higher rates of stillbirths, preterm births, & LBW infants
- Major public health problem & costly
- Encourage higher weight gains

### Pregnancy in Older Women

- Hypertension & diabetes
- High rate of birth defects – Down syndrome

▶ 37

## Maternal Health

- “ Medical disorders can threaten the life and health of both mother & fetus.
- “ Diagnosed and treated early → many diseases can be managed to ensure a healthy outcome—another strong argument for early prenatal care.
- “ The changes in pregnancy can reveal disease risks, making screening important & early intervention possible
- “ Preexisting diabetes; Gestational diabetes; Chronic hypertension; Gestational hypertension; Preeclampsia

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## - preexisting diabetes -

Risks of diabetes ~ how well it is managed

Before & during pregnancy

Without proper management of maternal diabetes

Mothers: high infertility rates, episodes severe hypoglycemia or hyperglycemia, preterm labor, pregnancy related hypertension

Infants: large, suffer physical & mental abnormalities, severe hypoglycemia or respiratory distress

To minimize complications

Glucose control before conception & continued throughout pregnancy

▶ 39

## - gestational diabetes -

### Risk factors

- Age 25 or older
- BMI  $\geq 25$  or excessive weight gain
- Complications in previous pregnancies: gestational diabetes or high birthweight infant
- Prediabetes or symptoms of diabetes
- Family history of diabetes

### Consequences

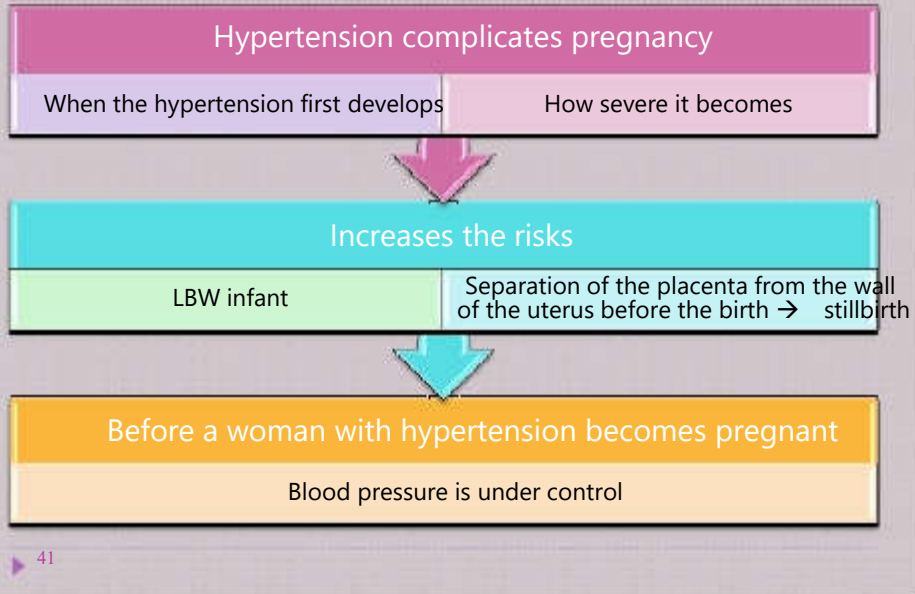
- Diabetes (usually type 2) after pregnancy
- Complications during labor & delivery
- High infant birthweight
- Birth defects

### Managements

- Diet
- Moderate exercise
- Insulin or other drugs

▶ 40

## - chronic hypertension -



## - gestational hypertension -

Some women develop gestational hypertension

50%

- ↑ BP is mild & does not affect the pregnancy adversely
- BP usually returns to normal during the 1<sup>st</sup> few weeks after childbirth

50%

- An early sign of the most serious maternal complication of pregnancy—preeclampsia

▶ 42

## - preeclampsia -

Signs & symptoms	The cause	Consequences	Treatments
<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Protein in the urine</li> <li>• Upper abdominal pain</li> <li>• Severe headaches</li> <li>• Swelling of hands, feet, &amp; face</li> <li>• Vomiting</li> <li>• Blurred vision</li> <li>• Sudden weight gain (1 lb/day)</li> <li>• Fetal growth retardation</li> </ul>	<ul style="list-style-type: none"> <li>• Remains unclear</li> <li>• Usually occurs with 1<sup>st</sup> pregnancies &amp; most often after 20 w gestation</li> <li>• Symptoms typically regress within 2 days of delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Affects almost all of the mother's organs—the circulatory system, liver, kidneys, and brain</li> <li>• Fetal growth retardation</li> <li>• Preterm birth or stillbirth</li> <li>• Eclampsia → maternal death</li> </ul>	<ul style="list-style-type: none"> <li>• Control BP</li> <li>• Prevent seizure</li> <li>• Induced labor or cesarean section</li> <li>• Preterm infant + all problems: poor lung development &amp; special care needs</li> <li>• Diet</li> <li>• Exercise <ul style="list-style-type: none"> <li>• stimulating placenta growth &amp; vascularity</li> <li>• reducing oxidative stress</li> </ul> </li> </ul>

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## Practices Incompatible with Pregnancy

### Alcohol

- Fetal alcohol syndrome

### Medicinal drugs

- Complications & problems with labor & serious birth defects

### Herbal supplements

- On the advice of physician only (may be safe or definitely harmful)

### Illicit drugs

- Easily cross the placenta & cause complications (preterm, LBW, perinatal death, etc.)

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## Practices Incompatible with Pregnancy...

### Smoking & Chewing Tobacco

- Fetal growth retardation
- Low birthweight
- Complications at birth
- Mislocation of the placenta
- Premature separation of the placenta
- Vaginal bleeding
- Spontaneous bleeding
- Fetal death
- Sudden infant death syndrome (SIDS)
- Middle ear diseases
- Cardiac and respiratory diseases

▶ 45

## Practices Incompatible with Pregnancy...

### Environmental Contaminants

- Lead can affect the nervous system of a fetus
- Fish with high levels of mercury should be avoided

### Foodborne illness

- Exhausted & dehydrated

### Vitamin-mineral megadoses

- Can be toxic, especially vitamin A

▶ 46

## Practices Incompatible with Pregnancy...

### Caffeine

- Moderate to heavy use may cause spontaneous abortion
- Wise to limit consumption

### Weight-loss dieting

- Hazardous, not recommended during pregnancy

### Sugar substitutes

- Acceptable, but follow guidelines

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## To enjoy healthy pregnancy

Get prenatal care

Eat a balanced diet, safely prepared

Take prenatal supplements as prescribed

Gain a healthy amount of weight

Refrain from cigarettes, alcohol, & drugs  
(including herbs, unless prescribed by  
physician)



## Reference

- Whitney E, Rolfes SR. 2011. Chapter 15 – *Life Cycle Nutrition: Pregnancy & Pregnancy*, in *Understanding Nutrition* 12<sup>th</sup> ed. Int'l Student ed. Wadsworth, Cengage Learning Inc., USA.

