


Nutrition in Infants, Children and Adolescents

Nutrition Through the Lifespan




UnitedHealthcare Community Plan

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1

Nutrition in Infants, Children and Adolescents

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2

2

What is Nutrition?

- Formal definition from Merriam Webster:
 - the act or process of nourishing or being nourished
 - *specifically* : the sum of the processes by which an animal or plant takes in and utilizes food substances
- Seems to imply that ingestion of digestible stuff is nutrition



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3

3

What is Nutrition?

- Perhaps the better question is
 - What is GOOD nutrition?
 - Or
 - What is the BEST nutrition?
 - Or
 - What is the HEALTHIEST nutrition?



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4

4

What is Nutrition?

My orientation is:

What is the best way to sustain an individual's physiology to achieve personal growth, optimal efficiency, and purposeful longevity?

- Physiology
- Personal Growth
- Efficiency
- Purposeful Longevity



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What is Nutrition?

- Physiology is the sum of the biologic functioning of an organism



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What is Nutrition?

Purposeful Longevity comes from the combination of physiology, genetics, efficiency, and self preservation; how one adjusts to the vicissitudes and struggles during the progression through time



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9

9

What is Nutrition?

FOCUS: Physiology

How to maintain the best biologic functioning a person can achieve.

Proper intake

1. Food
2. Fluids
3. Air
4. Medications
5. Sleep
5. Other factors



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10

10

What is Nutrition?

FOCUS: Physiology

How to maintain the best biologic functioning an individual can achieve.

Proper intake:

What would you add to the list?



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11

11

What Impacts Our Nutrition Decisions?

I am the master of my fate:
I am the captain of my soul.

William Ernest Henley



Well, not exactly, although we can make choices that affect our health.



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12

12

What Impacts Our Nutrition Decisions?

Personal choices

Learned behaviors

Genetics (Nucleus DNA)

Epigenetics (Extranuclear DNA)



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13

13

What Impacts Our Nutrition Decisions?

Let me tell you a personal story that highlights how we are impacted by unconsciously acquired information.

The Thermometer Story



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14

14

What Impacts Our Nutrition Decisions?

Next I want to share some research on Epigenetics

Nutrition and its role in epigenetic inheritance of obesity and diabetes across generations

Daniela Kaspar, et.al.

Mammalian Genome volume 31, pages119–133(2020)

- Evidence that phenotypes acquired during life affect the offspring's health across generations
- Phenotypes are the expressions of the genes: Obesity, Diabetes, Hypertension, Hair Color, Height



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15

15

What Impacts Our Nutrition Decisions?

Mammalian Genome volume 31, pages119–133(2020)

- Epigenetic inheritance
 - Any mode of inheritance that is transmitted via gametes (ova and sperm)
 - **BUT** that is **NOT** encoded in the nucleotide sequence of the Nuclear DNA (it is DNA separate from the nucleus of the cell)



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16

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What Impacts Our Nutrition Decisions?

Transgenerational Epigenetic Inheritance

Epimutations are associated with the inheritance of acquired traits such as Diabetes and Obesity



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17

17

What Impacts Our Nutrition Decisions?

The Dutch famine birth cohort of the
hunger winter 1944/45

Intrauterine exposure to maternal
undernutrition from the famine
(grandparents) **(FO)**



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18

18

What Impacts Our Nutrition Decisions?

The Dutch famine birth cohort of the hunger winter 1944/45

Caused the development of the **metabolic syndrome** including **obesity**, elevated blood glucose levels, and **decreased glucose tolerance** in later life of people born during the famine **(F1)**

(children of F0, parents of F2)



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19

19

What Impacts Our Nutrition Decisions?

The Dutch famine birth cohort of the hunger winter 1944/45

The prenatal undernutrition not only affected the generation born during the hunger winter **(F1)**,

But also their offspring (grandchildren) **(F2)**.

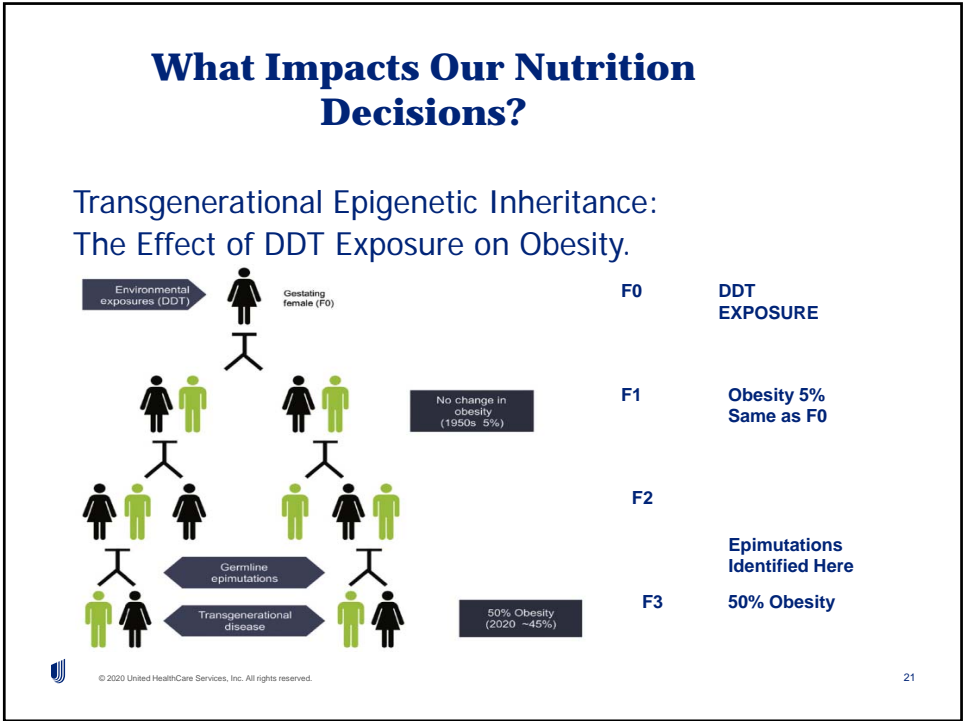
Possibly also subsequent generations **(F3, F4, etc.)**



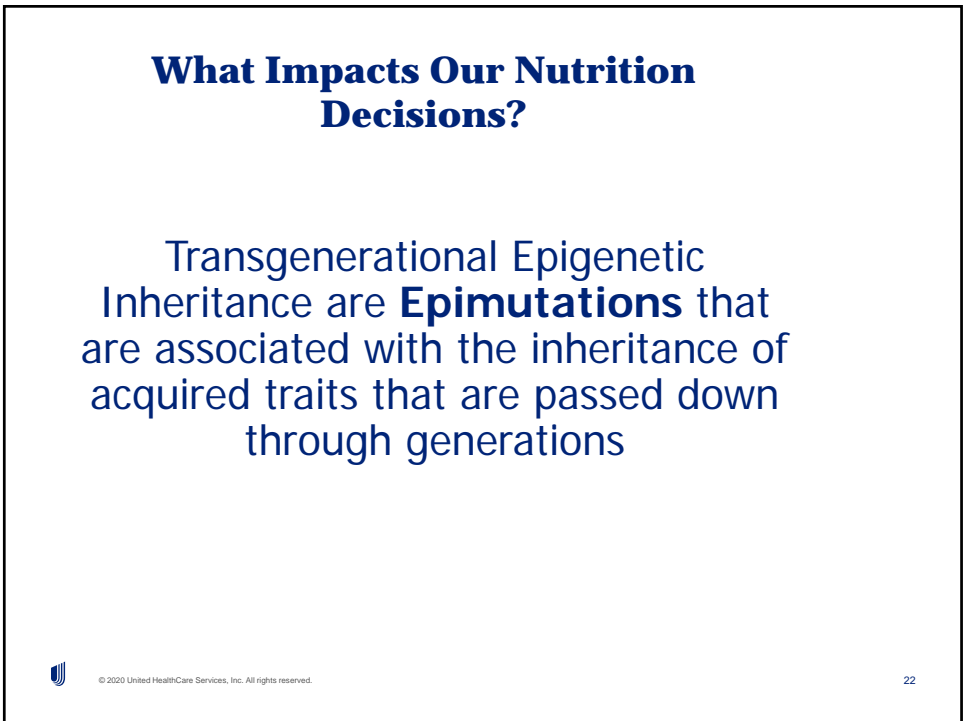
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20

20



21



22

What Impacts Our Nutrition Decisions?

- These genetic changes affect:
- How we process food
- Experience food,
- Approach eating, and Exercise



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23

23

What Nutrition Is Recommended?

The US Department of Agriculture (USDA)
Dietary Guidelines for Americans 2015-
2020, 8th ed.

(The 9th Edition is pending)

- A **variety of vegetables** from all of the subgroups—
dark green, red and orange, legumes (beans and peas),
starchy, and other
- **Fruits**, especially whole fruits
- **Grains**, at least half of which are whole grains
- **Fat-free or low-fat dairy**, including milk, yogurt,
cheese, and/or fortified soy beverages
- A variety of **protein foods**, including seafood, lean
meats and poultry, eggs, legumes (beans and peas), and
nuts, seeds, and soy products
- **Oils** (healthy fats)



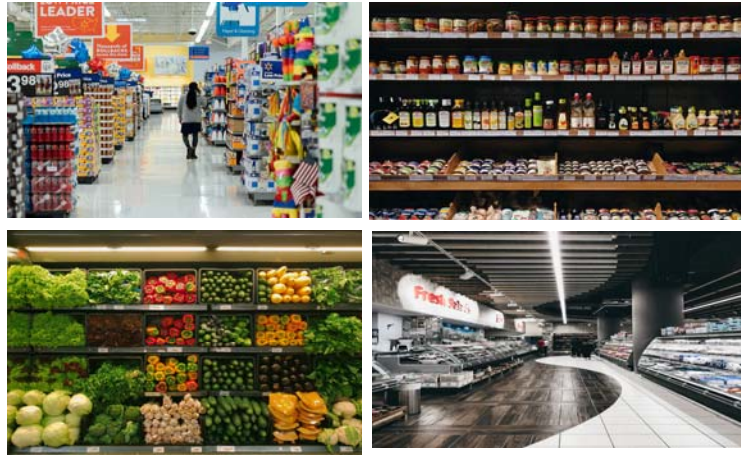
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24

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What Nutrition Is Recommended?

This sounds great. You can eat almost anything from the supermarket or at any restaurant.



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What Nutrition Is Recommended?

But is it really that simple?



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What Nutrition Is Recommended?

Dietary Guidelines for Americans 2015-2020, 8th ed.

In addition:

- Consume less than 10 percent of calories per day from added sugars
 - Consume less than 10 percent of calories per day from saturated fats
 - Consume less than 2,300 milligrams (mg) per day of sodium
 - Other recommendations and limitations
-
- It is not that simple



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27

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What Nutrition Is Recommended?

How does this translate into every day eating and drinking?

ANSWER: I am not sure. There are many reputable sources advising correct dietary intake.

What is healthiest?



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28

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What Nutrition Is Recommended?

The US Department of Agriculture (USDA)
Dietary Guidelines for Americans 2015-2020, 8th ed.
(The 9th Edition is pending)

The answers are a rehash of slides 25 and 27 with suggestions on how to prepare food, short cuts (use the microwave), and helpful hints.

Not the most functional answer.



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29

29

What Nutrition Is Recommended?

SLIDE 25

The US Department of Agriculture (USDA)
Dietary Guidelines for Americans 2015-2020, 8th ed.
(The 9th Edition is pending)

- A **variety of vegetables** from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other
- **Fruits**, especially whole fruits
- **Grains**, at least half of which are whole grains
- **Fat-free or low-fat dairy**, including milk, yogurt, cheese, and/or fortified soy beverages
- A variety of **protein foods**, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products
- **Oils** (healthy fats)



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30

30

What Nutrition Is Recommended?

SLIDE 27

The US Department of Agriculture (USDA)
Dietary Guidelines for Americans 2015-2020, 8th ed.
(The 9th Edition is pending)

In addition:

- Consume less than 10 percent of calories per day from added sugars
- Consume less than 10 percent of calories per day from saturated fats
- Consume less than 2,300 milligrams (mg) per day of sodium
- Other recommendations and limitations

- It is not simple



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31

31

What Nutrition Is Recommended?

Let's look at this question from the
view point of age groups.

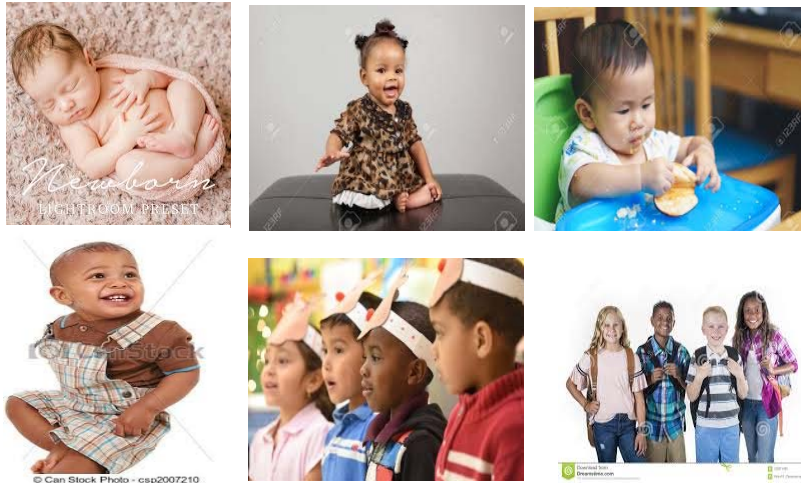


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32

32

What Nutrition Is Recommended?



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33

33

What Nutrition Is Recommended?

Dietary Recommendations for Children and Adolescents:

A Guide for Practitioners

- American Heart Association, Samuel S. Gidding, Barbara A. Dennison, Leann L. Birch, Stephen R. Daniels, Matthew W. Gilman, Alice H. Lichtenstein, Karyl Thomas Rattay, Julia Steinberger, Nicolas Stettler and Linda Van Horn
- Pediatrics February 2006, 117 (2) 544-559; DOI: <https://doi.org/10.1542/peds.2005-2374>

TABLE 3

Daily Estimated Calories and Recommended Servings for Grains, Fruits, Vegetables, and Milk/Dairy by Age and Gender

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34

34

What Nutrition Is Recommended?

TABLE 3
Daily Estimated Calories and Recommended Servings for Grains, Fruits, Vegetables, and Milk/Dairy by Age and Gender

	1 y	2–3 y	4–8 y	9–13 y	14–18 y
Kilocalories ^a	900	1000			
Female			1200	1600	1800
Male			1400	1800	2200



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35

35

What Nutrition Is Recommended?

Dietary Recommendations for Children and Adolescents: A Guide for Practitioners

	1 y	2–3 y	4–8 y	9–13 y	14–18 y
Fat, % of total kcal	30–40	30–35	25–35	25–35	25–35
Milk/dairy, cups ^a	2 ^c	2	2	3	3
Lean meat/beans, oz	1.5	2		5	
Female			3		5
Male			4		6
Fruits, cups ^d	1	1	1.5	1.5	
Female					1.5
Male					2
Vegetables, cups ^e	3/4	1			
Female			1	2	2.5
Male			1.5	2.5	3
Grains, oz ^a	2	3			
Female			4	5	6
Male			5	6	7



36

36

What Nutrition Is Recommended?

I included this here to show you one example of dietary recommendations.

This will be in the take home document.



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37

37

Nutrition By Age

Infants

What is the best nutrition for an infant Birth to 6 months of life?

Poll: Just write down your answer.

Choices:

- A. Breastmilk
- B. Breastmilk
- C. Breastmilk

Did everyone get that one right?



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38

38

Nutrition By Age

Infants

At what age should solid foods be introduced?

Choices:

- A. 4 months
- B. 6 months
- C. 8 months
- D. When the baby gets fussy



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Nutrition By Age

Infants

At what age should solid foods be introduced?

Ans: 6 months



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Nutrition By Age

Infants

The American Academy of Pediatrics recommends Breastfeeding

Breastfeeding is recommended past 6 months and up to a year

Not as the sole source of nutrition after 6 months

WHY BREASTFEEDING?



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41

41

Nutrition By Age

Infants

- Babies who are breastfed for at least 6 months are **less likely to be overweight.**
- Duration of breastfeeding also is inversely related to the risk of obesity.
 - The longer the breastfeeding, the less likely obesity**
- A reduction of 40% in the incidence of type 2 diabetes mellitus** is reported with exclusive breastfeeding to at least 6 months



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Nutrition By Age

Infants

- 80% of mothers expect to breastfeed
 - only 14% are exclusively breastfeeding at 6 months.
- Critical periods for breastfeeding cessation
 - transition home from hospital
 - 6-8 weeks of age
 - transition of mother going back to work
 - between 6-8 months due to self-weaning and/or introduction of solids.



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43

43

Nutrition By Age

Infants

Food Introduction

- Introduce solid foods around 6 months** of age
 - Expose baby to a wide variety of healthy foods
 - Also offer a variety of textures

- <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/HALF-Implementation-Guide/Age-Specific-Content/Pages/Infant-Food-and-Feeding.aspx>



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44

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Nutrition By Age

Infants

Infant Food and Feeding

- Many families introduce complementary **solid foods too soon**
- This occurs around 3-4 months, especially if the infant is perceived as fussy.

<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/HALF-Implementation-Guide/Age-Specific-Content/Pages/Infant-Food-and-Feeding.aspx>



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45

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Nutrition By Age

Infants

Infant Food and Feeding

- Introduction of solids prior to 4 months associated with
 - increased weight gain
 - adiposity

<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/HALF-Implementation-Guide/Age-Specific-Content/Pages/Infant-Food-and-Feeding.aspx>



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46

46

Nutrition By Age

Infants

Infant Food and Feeding

- The weight gain impacts both **infancy** and **early childhood**.
- It is **not true** that introducing solids helps calm fussy babies

<https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/HALF-Implementation-Guide/Age-Specific-Content/Pages/Infant-Food-and-Feeding.aspx>



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47

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Nutrition By Age

Infants

Infant Food and Feeding

- Parents assume that once a child rejects a food, it means the child did not like it
- Many babies and toddlers need to be exposed to foods multiple times before accepting them.
- A food should be **offered 10-15 times** before giving up



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48

48

Nutrition By Age

Infants

Food Introduction

Recommendations:

- Wait until around **6 months** to introduce solids.
- Introduce a **wide variety** of foods
- It is okay if the infant doesn't like something the first time, and it is important to **keep offering it**.



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Nutrition By Age

Infants

Food Introduction

Recommendations:

One possible exception

Introduction of peanuts (peanut butter) at 2-4 months may reduce the risk of allergy later in life



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Nutrition By Age

Infants

Food Introduction

Recommendations:

- After 9 months, offer **2-3 healthy and nutritious snacks per day** between meals
- Maintain fruit and vegetable consumption after finger foods are introduced



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51

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Nutrition By Age

Infants

Food Introduction

Recommendations:

- 6 months and older
 - Encourage use of spoons and fingers to feed themselves
 - Encourage drinking from a cup starting at 6 months of age



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Nutrition By Age

Infants

Food Introduction

- Babies have an innate ability to self-regulate their food:

ALLOW THEM TO DO THIS

- Responsive feeding helps foster self-regulation.
- Eating at regular intervals helps to reduce overeating



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53

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Nutrition By Age

Infants

Food Introduction

- At 9 months
 - There is a considerable drop in fruit and veggie consumption, and
 - There is an increase in non-nutritive finger and snack foods.

Correct this by maintaining availability of healthy foods



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Nutrition By Age

Problem Areas

Infants

- Iron Deficiency
 - May occur without Anemia
 - This is the most common cause of anemia in young children



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Nutrition By Age

Toddlers (1-3 years of age)

Food Introduction

- Feed a variety of baby food meats and vegetables
- Transition to equivalent table foods
- Iron supplementation should be considered



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Nutrition By Age

Toddlers and Preschoolers

Food Introduction

Do not use food as a reward

It encourages overeating

It encourages the wrong foods

It creates bad eating habits



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57

57

Nutrition By Age

Toddlers and Preschoolers

Food Introduction

Do any of these sound familiar?

- “Finish what is on your plate.”
- “No dessert until your plate is empty.”
- “If you are good, you can have some candy.”



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Nutrition By Age

Preschoolers

Food Introduction

SNACKS

- Snacks are an opportunity to provide nutrients
- This is not treat time**
- Toddlers and Preschoolers need more nutrients than they can get at meal time



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Nutrition By Age

Preschoolers

Food Introduction

SNACKS

- 2 healthy snacks per day
- Not Healthy:**
 - all-day snacking
 - continuous snacking
 - snacking in front of the television.



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Nutrition By Age

Preschoolers

Food Introduction

SNACKS

- Snacks should be eaten
 - at a planned time
 - while seated
 - with adult supervision.



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61

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Nutrition By Age

Children and Adolescents

Food Introduction

- Fruit Juices
- Children 2 to 18 years of age consume nearly half of their fruit intake as juice,
 - Lacks dietary fiber
 - Predisposes to excessive caloric intake



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62

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Nutrition By Age

Children and Adolescents Food Introduction

- Fruit juice consumption has some benefits
 - Historically, fruit juice was recommended as a source of vitamin C
 - It sometimes is recommended for treatment of constipation
 - e.g., Prune Juice



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Nutrition By Age

Children and Adolescents Food Introduction

- Potential detrimental effects
 - High sugar contributes to **excess calorie consumption**
 - Predisposes to **inappropriate weight gain**
 - Increased risk of **dental caries**



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Nutrition By Age

Children and Adolescents

- General attributes for food selection:
 - Select from the 5 food groups:
 - vegetables
 - fruits
 - grains (whole grains)
 - low-fat milk and dairy
 - quality protein sources (e.g., lean meats, fish, nuts, nut butters, seeds, eggs)



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Nutrition By Age

Children and Adolescents

- Promote a broad variety of food experiences
- Avoid highly processed foods
 - Energy dense with a high calorie content per weight of food



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Nutrition By Age

Children and Adolescents

- Rely on fresh components high in water content
 - Foods with a minimum amount of added sugar
 - Permitted is minimal sweetness that is necessary to promote the palatability and consumption of nutrient-rich food
- Use age appropriate portion size recommended in the recent 2015-2020 Dietary Guidelines (DGAs) (USDA)



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67

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Nutrition By Age

Chemicals in foods

- Chemicals used in food and food contact materials may contribute to disease and disability
- Accumulating evidence from laboratory animals and human epidemiological studies
- The FDA's toxicological testing recommendations have not been updated based on new scientific information
 - The Food Additives Amendment of 1958



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68

68

Nutrition By Age

Chemicals in foods

TABLE 1
Summary of Food-Related Uses and Health Concerns for the Compounds Discussed in This Statement

Category	Chemical	Food-Related Use	Selected Health Concerns
Indirect food additives	Bisphenols	Polycarbonate plastic containers	Endocrine disruption ³⁻⁸
		Polymeric, epoxy resins in food and beverage cans	Obesogenic activity, ⁹⁻ ¹² neurodevelopmental disruption ¹³⁻¹⁶
	Phthalates	Clear plastic food wrap	Endocrine disruption ¹⁷⁻²⁰
		Plastic tubing, storage containers used in industrial food production	Obesogenic activity ^{21,22}
	Multiple uses in food manufacturing equipment	Oxidative stress, ^{23,24} cardiotoxicity ^{25,26}	
Perfluoroalkyl chemicals (PFCs)	Grease-proof paper and paperboard	Immunosuppression, ^{27,28} endocrine disruption, ²⁹⁻³¹ obesogenic activity, ³² decreased birth wt ³³	
Direct food additives	Perchlorate	Food packaging	Thyroid hormone disruption ³⁴⁻³⁶
	Nitrates and nitrites	Direct additive as preservative and color enhancer, especially to meats	Carcinogenicity, ³⁷⁻³⁹ thyroid hormone disruption ^{40,41}



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69

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Nutrition By Age

Chemicals in foods

- Recommendations:
 - Consume **fresh or frozen** (unprocessed) fruits and vegetables
 - Avoid processed meats
 - Especially **maternal consumption during pregnancy**.
 - Avoid **microwaving in plastic**
 - Avoid placing **plastics in the dishwasher**.
 - Use **alternatives to plastic**, such as glass or stainless steel



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Nutrition By Age

Chemicals in foods

- Look for the plastic type on the recycling code on the bottom of products
 - Avoid plastics with codes 3 (phthalates), 6 (styrene), and 7 (bisphenols)
 - Exception: plastics labeled as “biobased” or “greenware”
 - This indicates that they are made from corn and do not contain bisphenols.
- Personal experience; many not labelled



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Nutrition By Age

Chemicals in foods

- Encourage hand-washing before handling foods and/or drinks
- Wash all fruits and vegetables that cannot be peeled.



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72

72

Vitamins and Supplements

Micronutrients and Vitamins

Micronutrient deficiencies can have devastating consequences

Vitamins and minerals, are key to helping infants and children grow, learn, and thrive



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73

73

Vitamins and Supplements

Micronutrients and Vitamins

Six essential nutrients that require supplementation:

- Iron
- Folate
- Vitamin A
- Iodine
- Zinc
- Vitamin D

The US Department of Agriculture (USDA) Dietary Guidelines for Americans 2015-2020, 8th ed.



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74

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Vitamins and Supplements

Micronutrients and Vitamins

IRON

- Helps develop the brain of a fetus and child
- Iron deficiency is a leading cause of Anemia during pregnancy
- Iron deficiency may result in
 - poor fetal growth
 - preterm birth
 - low birth weight



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75

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Vitamins and Supplements

Micronutrients and Vitamins

IRON

- Anemia during pregnancy increases the **risk of death** for both the mother and baby
- In addition, iron deficiency limits physical productivity and work capacity.



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76

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Vitamins and Supplements

IRON

- Iron Deficiency Birth through 3 years
 - adversely affects long-term neurodevelopment and behavior
 - some of these **effects may be irreversible**
- Term infants usually have sufficient iron stores to last until 4 to 6 months of age



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77

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Vitamins and Supplements

IRON

- BUT MAY NOT
- Exclusively and partially breastfed term infants should receive an iron supplement
 - 1 mg/kg per day
 - starting at 4 months of age



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78

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Vitamins and Supplements

IRON

- Toddlers (1-3 years of age)
 - Feed a variety of baby food meats
 - Feed iron rich baby food vegetables, e.g., spinach
 - Transition to equivalent table foods
 - Iron supplementation should be considered
- Other considerations
 - Vitamin C increases iron absorption
 - Soy (phytates) decrease iron absorption



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79

79

Vitamins and Supplements

Micronutrients and Vitamins

Folate

- This is Vitamin B9, Folic acid
- Essential in the earliest days of fetal growth
- Low Folate during pregnancy can lead to serious birth defects of the brain, spinal cord, and skull
- Critical for a mother to have enough Folate before and during early pregnancy



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80

80

Vitamins and Supplements

Micronutrients and Vitamins

Vitamin A

- Supports healthy eyesight
- Supports immune system functions
- Deficiency results in increased risk
 - Blindness
 - Death from infections
- Such as:
 - measles
 - diarrhea



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81

81

Vitamins and Supplements

Micronutrients and Vitamins

Iodine

- Required during pregnancy and early infancy
 - Critical for brain and cognitive development
- Deficiency
 - Can lead to developmental delays
 - The most common cause of preventable mental retardation



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82

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Vitamins and Supplements

Micronutrients and Vitamins
Zinc

- Promotes immunity and resistance to infection
- Supports proper growth and development of the nervous system
- Important for healthy pregnancies


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83

Vitamins and Supplements

Micronutrients and Vitamins
Vitamin D

- Essential for
 - bone health
 - muscle function
 - nerve function
- Helps the immune system fight off bacteria and viruses
- Deficiency causes Rickets

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84

Diseases Related to Nutrition

Nonalcoholic fatty liver disease

- Associated with childhood obesity
- Major contributor: High Fructose Syrup
- Too much fat accumulates in the liver

<https://www.cuimc.columbia.edu/news/what-parents-should-know-about-kids-and-fatty-liver-disease>



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85

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Diseases Related to Nutrition

Nonalcoholic fatty liver disease

- Triggers an inflammatory process
 - Injures liver cells
 - Initially is symptomless
- Cirrhosis
 - scarring of the liver
 - is rare in kids
 - long-term consequence that can lead to end-stage liver disease

<https://www.cuimc.columbia.edu/news/what-parents-should-know-about-kids-and-fatty-liver-disease>



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86

86

Diseases Related to Nutrition

Dyslipidemia in children

- Disorders of lipoprotein metabolism
 - High total cholesterol (TC)
 - High low-density lipoprotein cholesterol (LDL)
 - High non-high-density lipoprotein cholesterol (non-HDL-C)
 - High triglycerides (TG)
 - Low HDL-C



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https://www.uptodate.com/contents/dyslipidemia-in-children-definition-screening-and-diagnosis?topicRef=17048&source=see_link

87

87

Diseases Related to Nutrition

Dyslipidemia in children

Approximately **20 percent of children** (age 6 to 19 years) have adverse levels of one or more lipid values

- Elevated total cholesterol 7.1%
- Elevated LDL cholesterol 6.4%
- Elevated non-HDL-C 6.4%
- Elevated triglyceride 10.2%
- Low HDL-C 12.0%



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88

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Diseases Related to Nutrition

Dyslipidemia in children

- Causes:
 - Excessive dietary intake of saturated and trans fats
 - Obesity
 - Type 2 diabetes mellitus
 - Nephrotic syndrome
 - Genetic causes
- Genetic causes are not preventable with diet and life style changes.



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89

89

Nutrition in Infants Children and Adolescents

What is the best way to sustain an individual's physiology to achieve optimal growth, optimal efficiency, and purposeful longevity?

- There are as many answers to this question as there are nutritional experts.
- There is no single approach that fits all infants, children, and adolescents.



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90

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Nutrition in Infants Children and Adolescents

We all come with baggage that affects what is best for us and our children

- Genetic predispositions
- Epigenetic environmental impacts
- Learned behaviors
- Physiologic variations



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91

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Nutrition in Infants Children and Adolescents

- The best answer I can provide:
 - Take all these factors into account
 - Be educated
 - Avoid fads



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Nutrition in Infants Children and Adolescents

- Look to the past:
 - Family history
 - Human history
 - Traditions (some are good, some are not)



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Nutrition in Infants Children and Adolescents

Ask questions:

Not everything we are taught is accurate

Not everything published is true
Information changes with time.



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94

94

Nutrition in Infants Children and Adolescents

Gathering information gives you knowledge,

Analyzing it leads to understanding and wisdom

This should be the guide for your decisions about nutrition



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95

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QUESTIONS?



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96

96