



Noncommunicable Diseases in Children and Adolescents

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OUTLINE

1 Undernutrition

2 Childhood Obesity

3 Food Allergy

Undernutrition--Definition

Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization.

Undernutrition is one type of malnutrition

Stunting is defined as low height-for-age $<-2SD$

Wasting is defined as low weight-for-height $<-2SD$

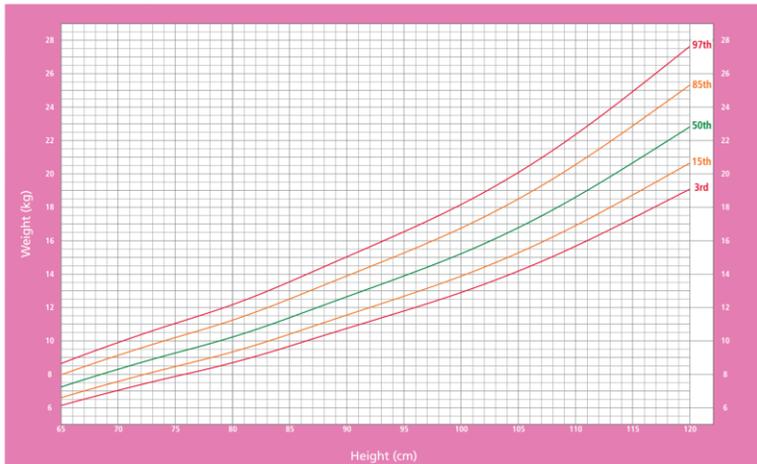
Underweight is defined as weight-for-age $<-2SD$



Undernutrition--Definition

Weight-for-height GIRLS

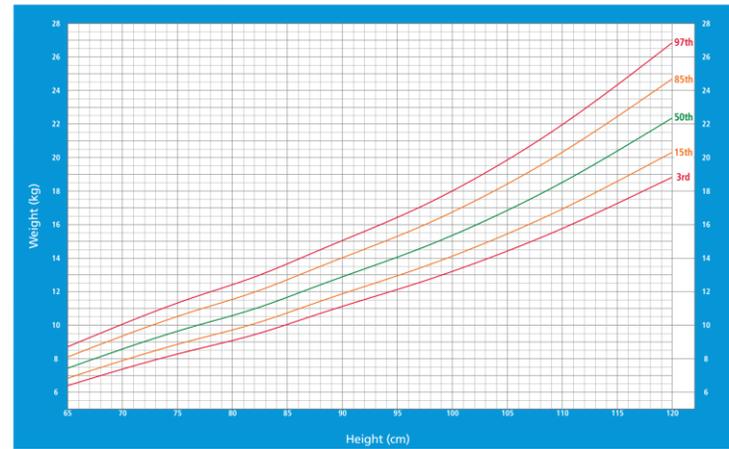
2 to 5 years (percentiles)



WHO Child Growth Standards

Weight-for-height BOYS

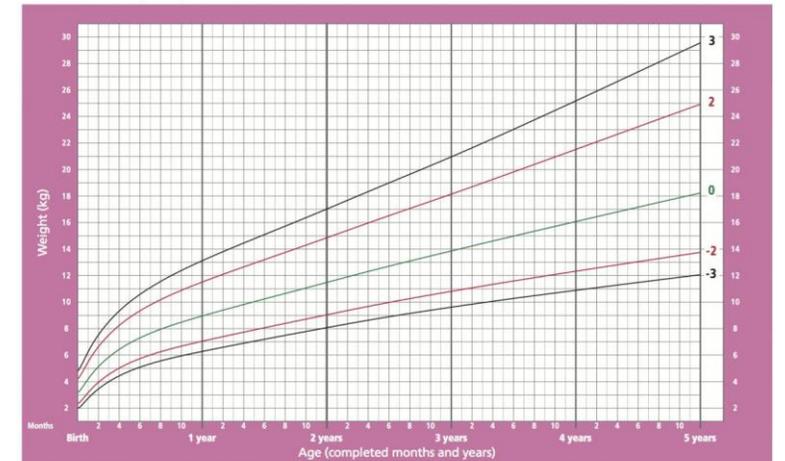
2 to 5 years (percentiles)



WHO Child Growth Standards

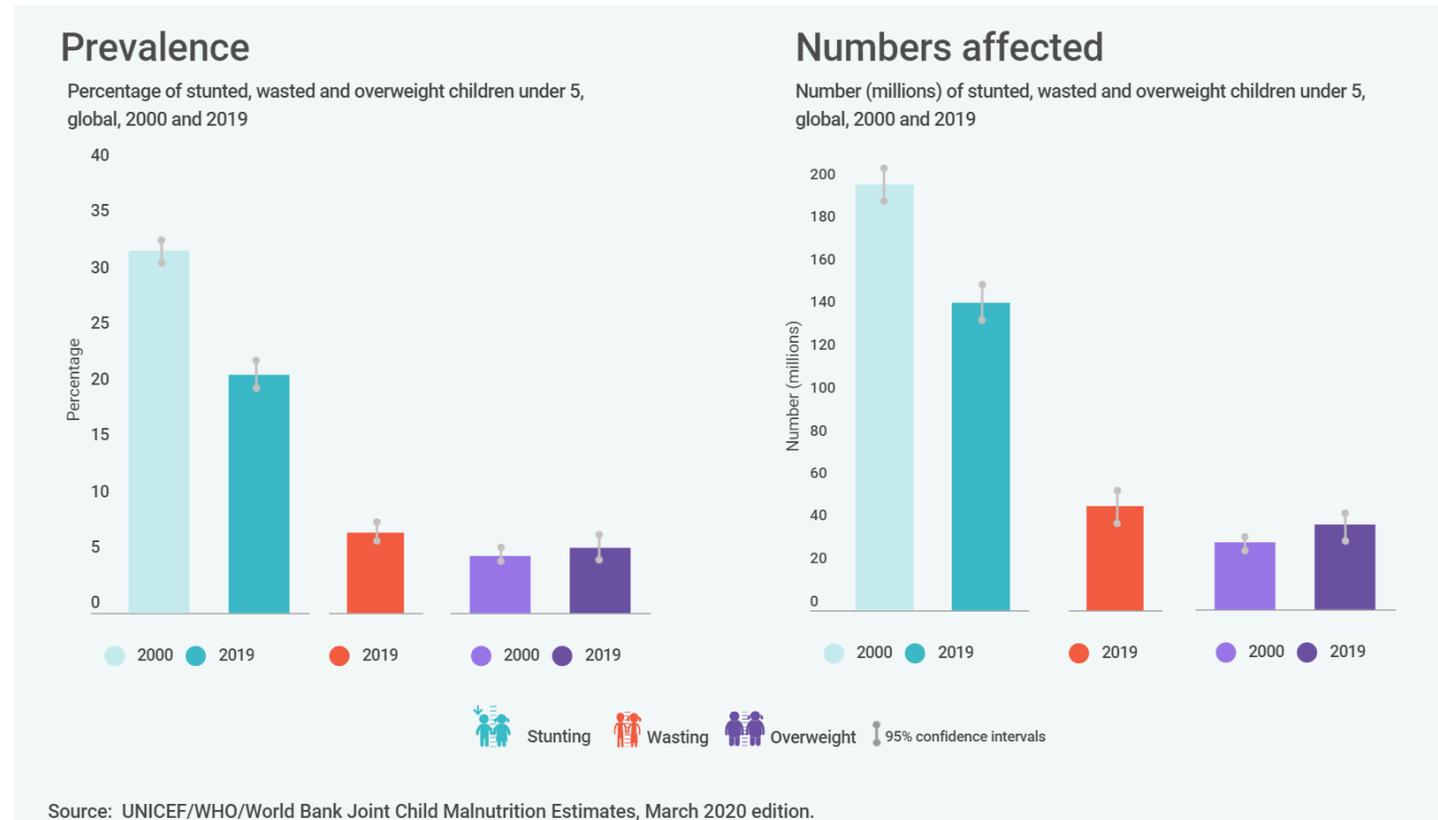
Weight-for-age GIRLS

Birth to 5 years (z-scores)



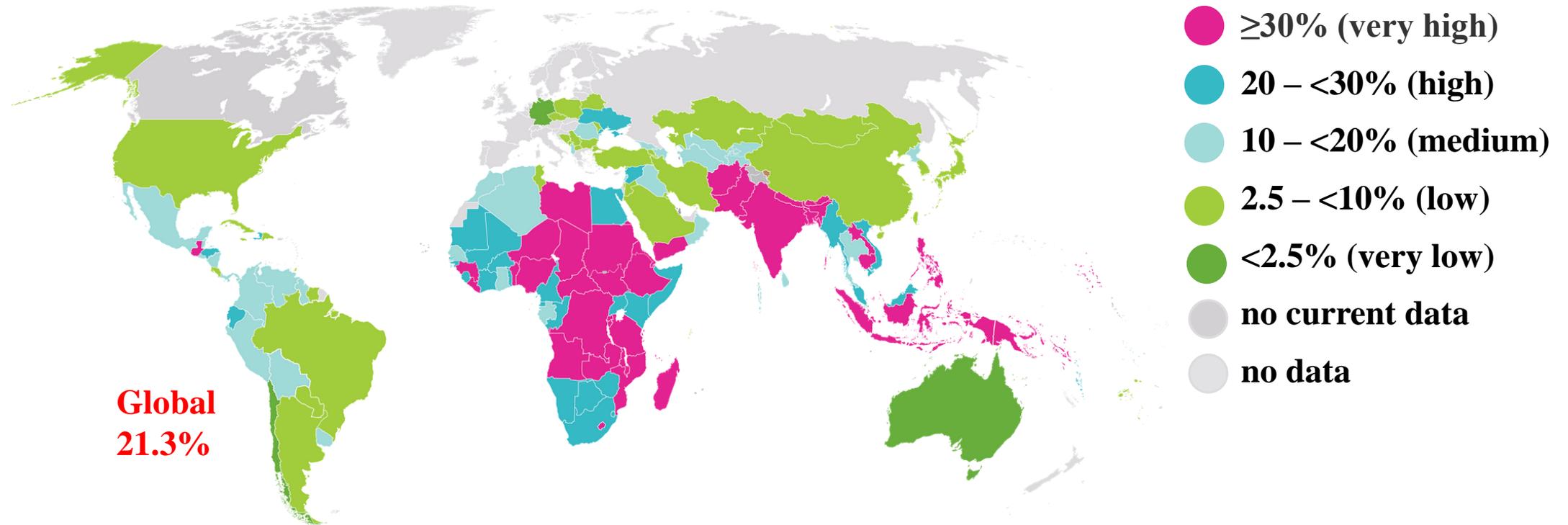
WHO Child Growth Standards

Undernutrition--Prevalence



Undernutrition--Prevalence

In three regions, stunting affects 1 in every 3 children



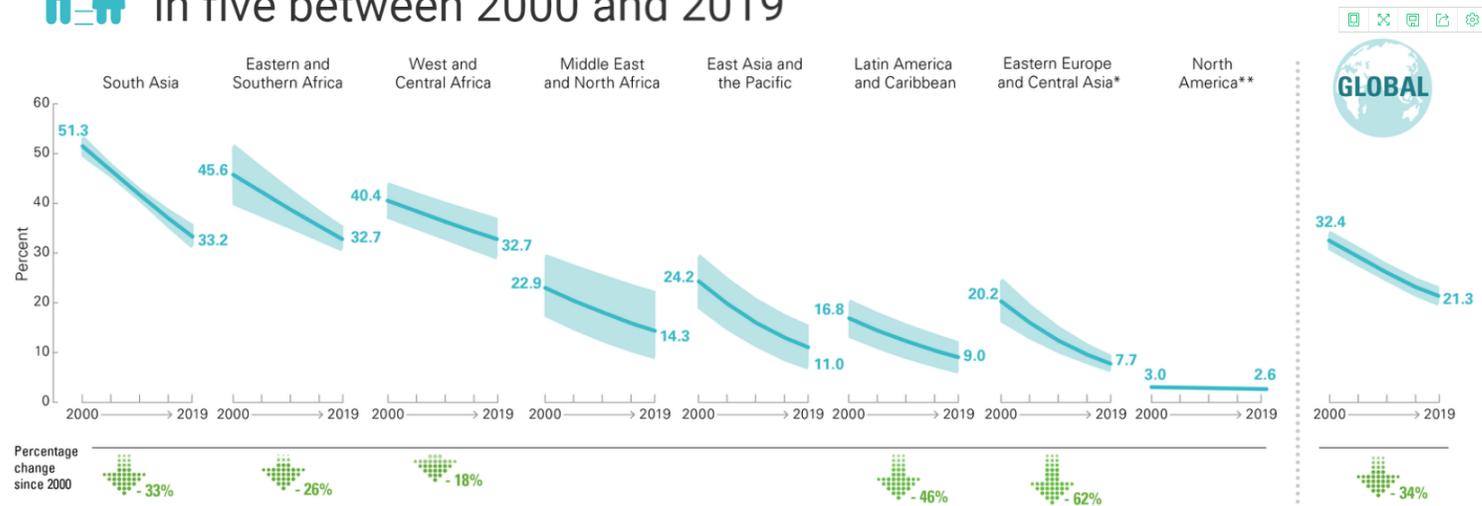
Percentage of children under 5 who are stunted (%), by country, 2019

<https://data.unicef.org>

Undernutrition--Prevalence



Globally, stunting declined from one in three to just over one in five between 2000 and 2019

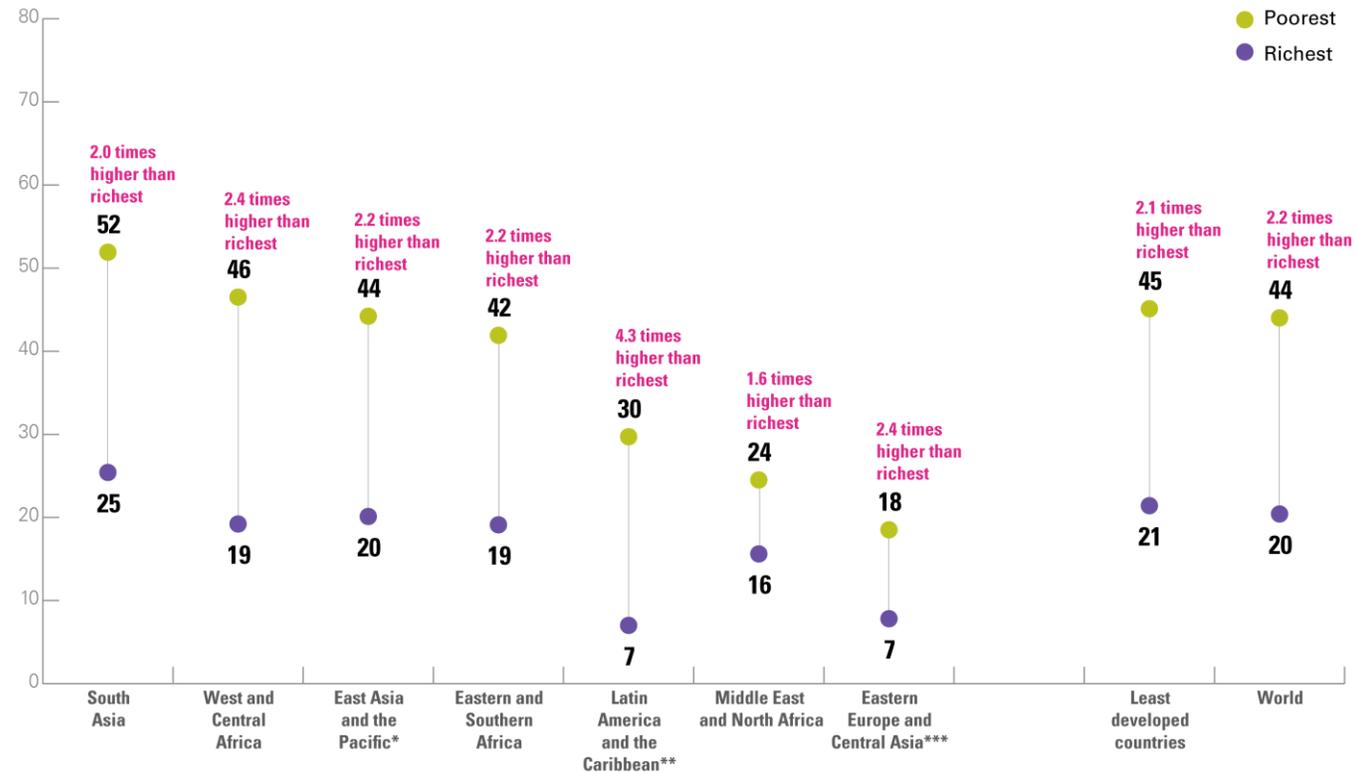


Percentage of children under 5 who are stunted, by region, 2000 to 2019

Notes: *The Eastern Europe and Central Asia sub-region estimates do not include Russian Federation due to missing data. **The North America regional average is based on United States data only, hence confidence intervals are not available. The percentage change since 2000 is only shown where the change is statistically significant.

Source: UNICEF/WHO/World Bank Joint Child Malnutrition Estimates, March 2020 edition.

Undernutrition--Prevalence



Percentage of children under 5 who are stunted, by wealth quintile and by region, 2016

Undernutrition—Symptoms

Protein energy malnutrition (PEM)



Marasmus



Kwashiorkor

PEM-Diagnosis

- **Diagnosis usually based on history**
- **To determine severity: Body mass index (BMI), serum albumin, total lymphocyte count, CD4+ count, serum transferrin**
- **To diagnose complications and consequences: Complete blood count, electrolytes, blood urea nitrogen, glucose, calcium, magnesium, phosphate**

PEM-Causes

□ Primary PEM:

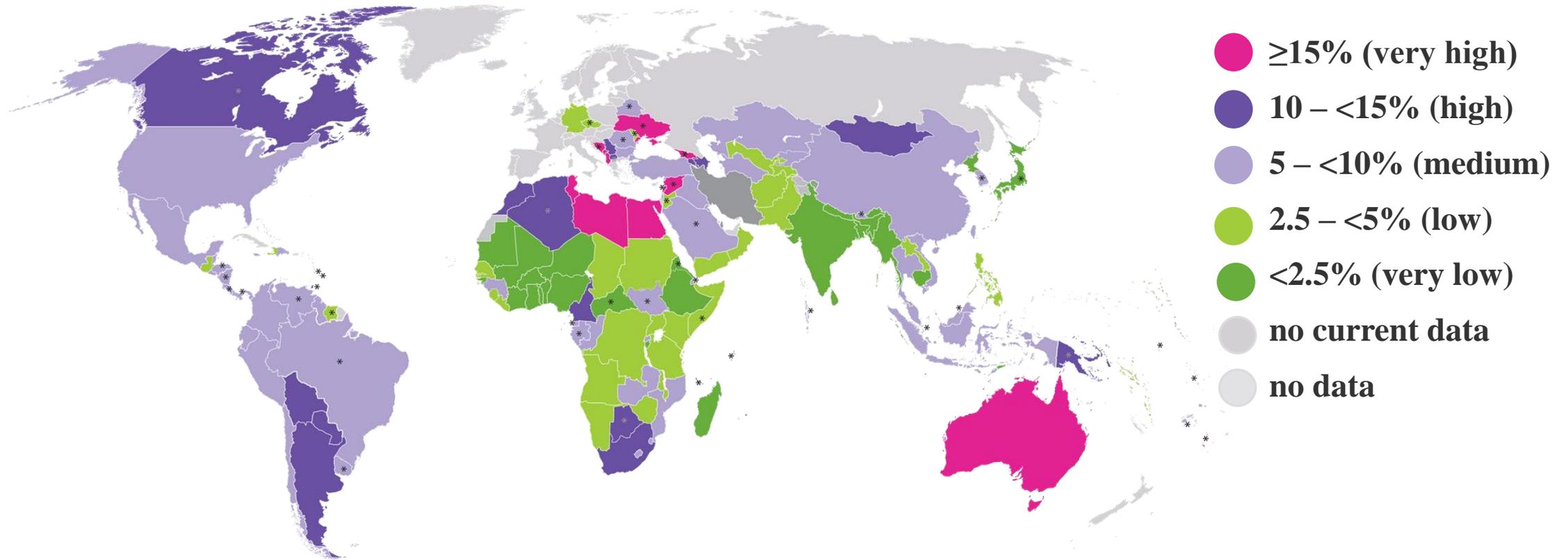
- Exclusive breast feeding for too long
- Dilution of formula
- Unclean/non-nutritious, complementary foods of low energy and micronutrient density
- Child abuse and anorexia nervosa

□ Secondary PEM: Infection (eg, measles, diarrhea, others)

PEM--Management

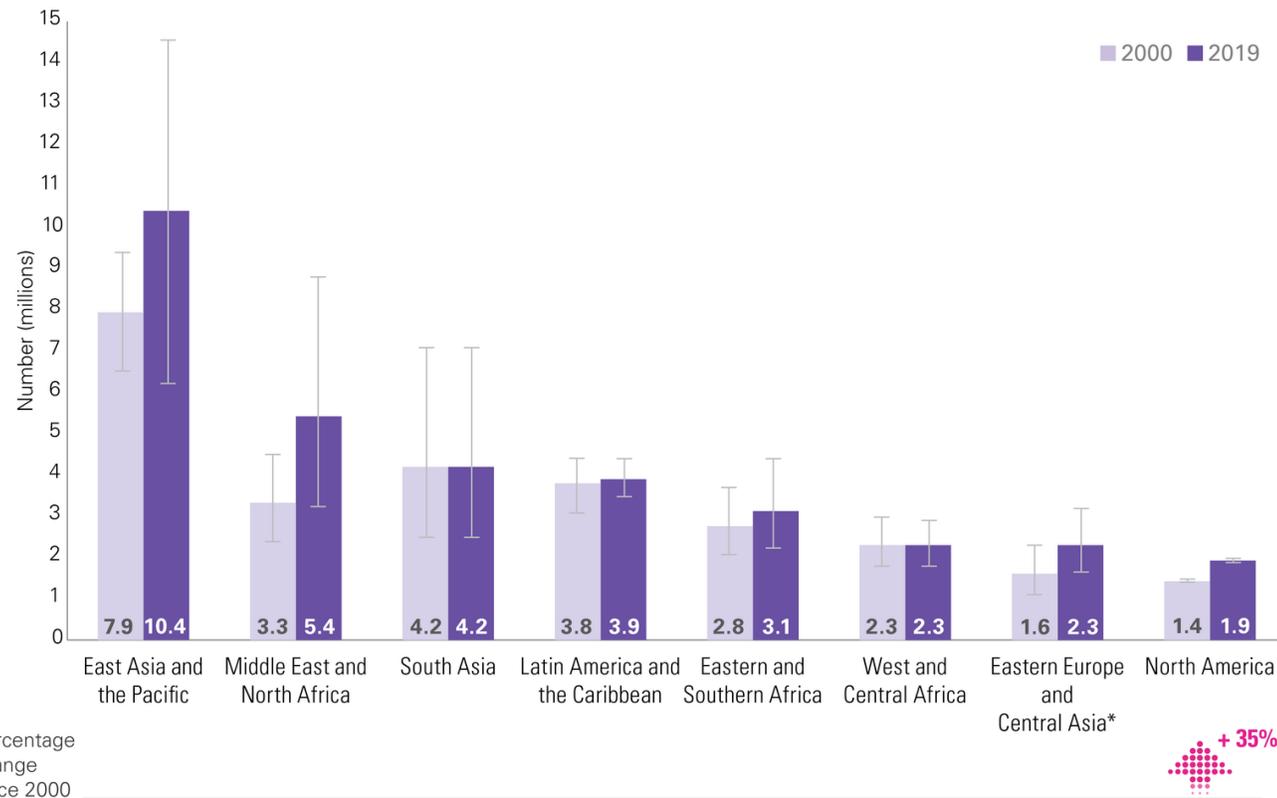
- **Children with severe malnutrition need therapy in the hospital. This includes parenteral nutrition and slow introduction of nutrients by mouth. Once their condition stabilises then they can gradually be introduced to a normal diet.**
- **Nutritious feeds:**
 - **Breast milk;**
 - **Establish a daily, graduated intake of ~3-4 g protein per kg (actual) body wt, ~200 kcal of energy per kg body wt**
 - **More frequent small feeds better than large meals**
 - **Micronutrient supplements:**
 - **To treat clinical conditions (eg, anemia,xerophthalmia)**
 - **To prevent further deficiencies**
 - **Water for thirst**
 - **Treat infections and illnesses;**
 - **Prevent hypothermia**

Childhood Obesity--Prevalence



Percentage of children under 5 who are overweight (%), by country, 2019

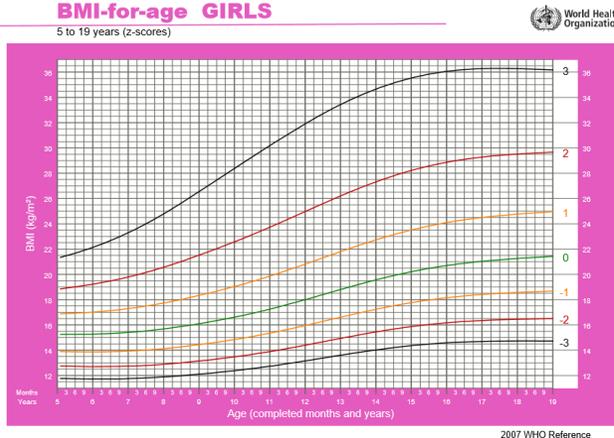
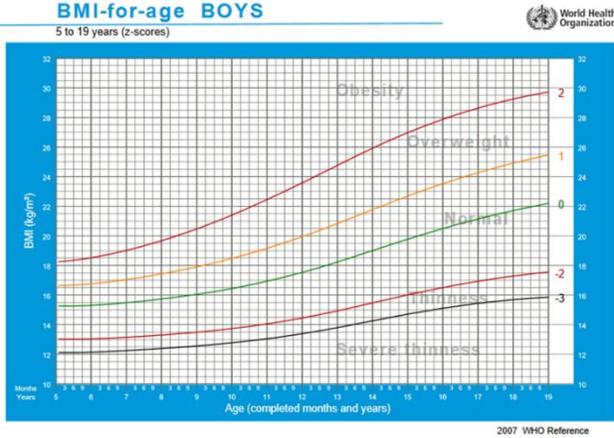
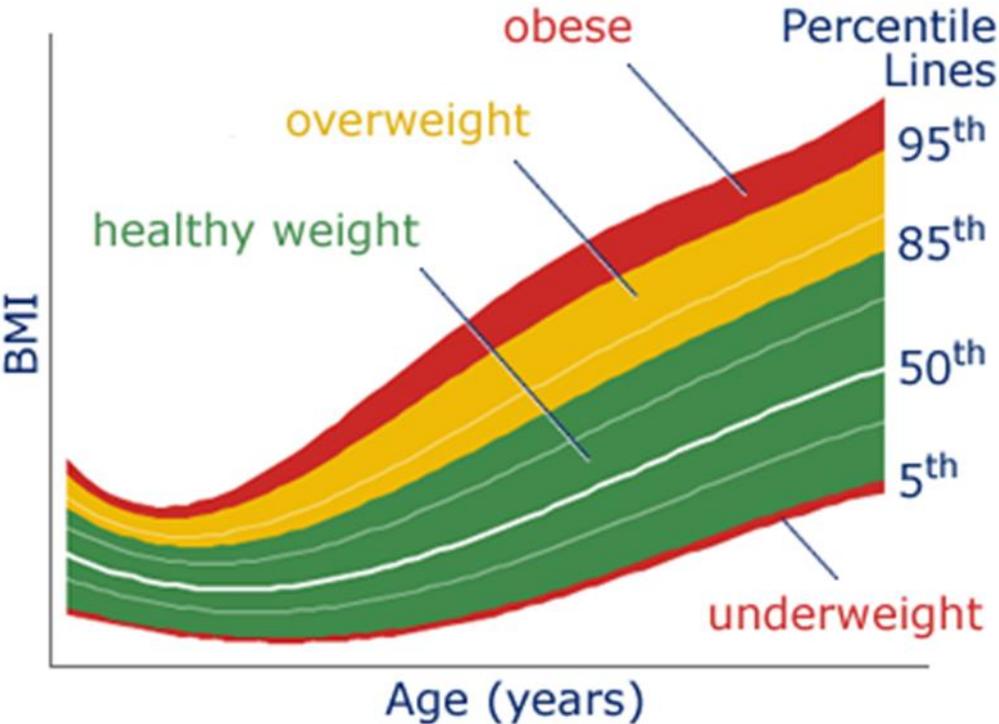
Childhood Obesity--Prevalence



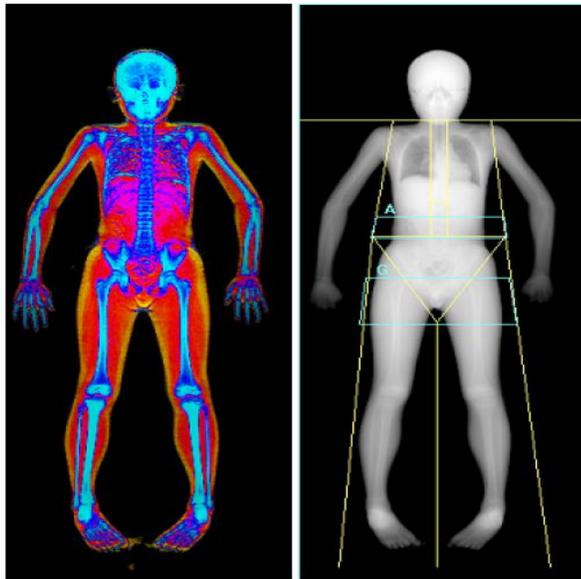
Number of children under 5 (in millions) who are overweight, by region, 2000 to 2019

<https://data.unicef.org>

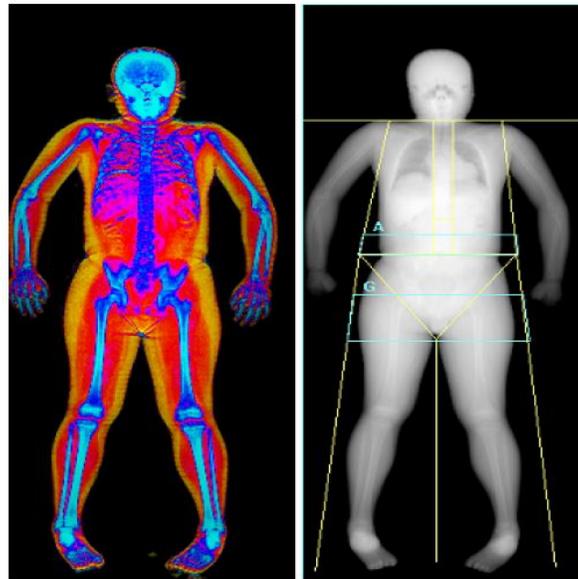
Childhood Obesity--Evaluation



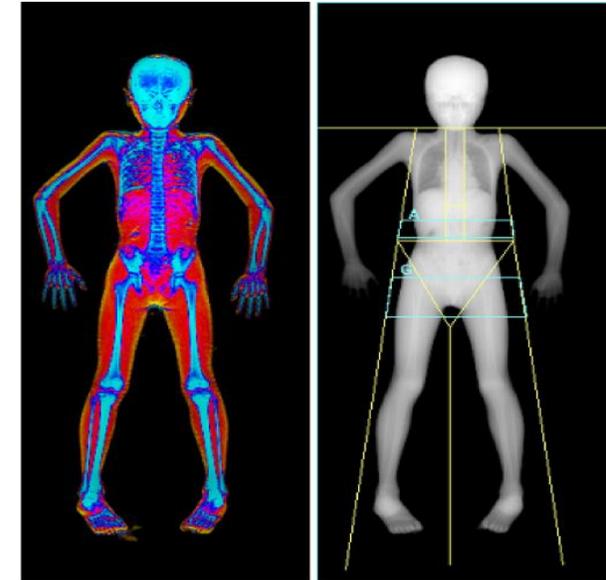
Childhood Obesity--Evaluation



Normal BMI
Body fat%:
24.0%



Obese
Body fat%:
36.2%



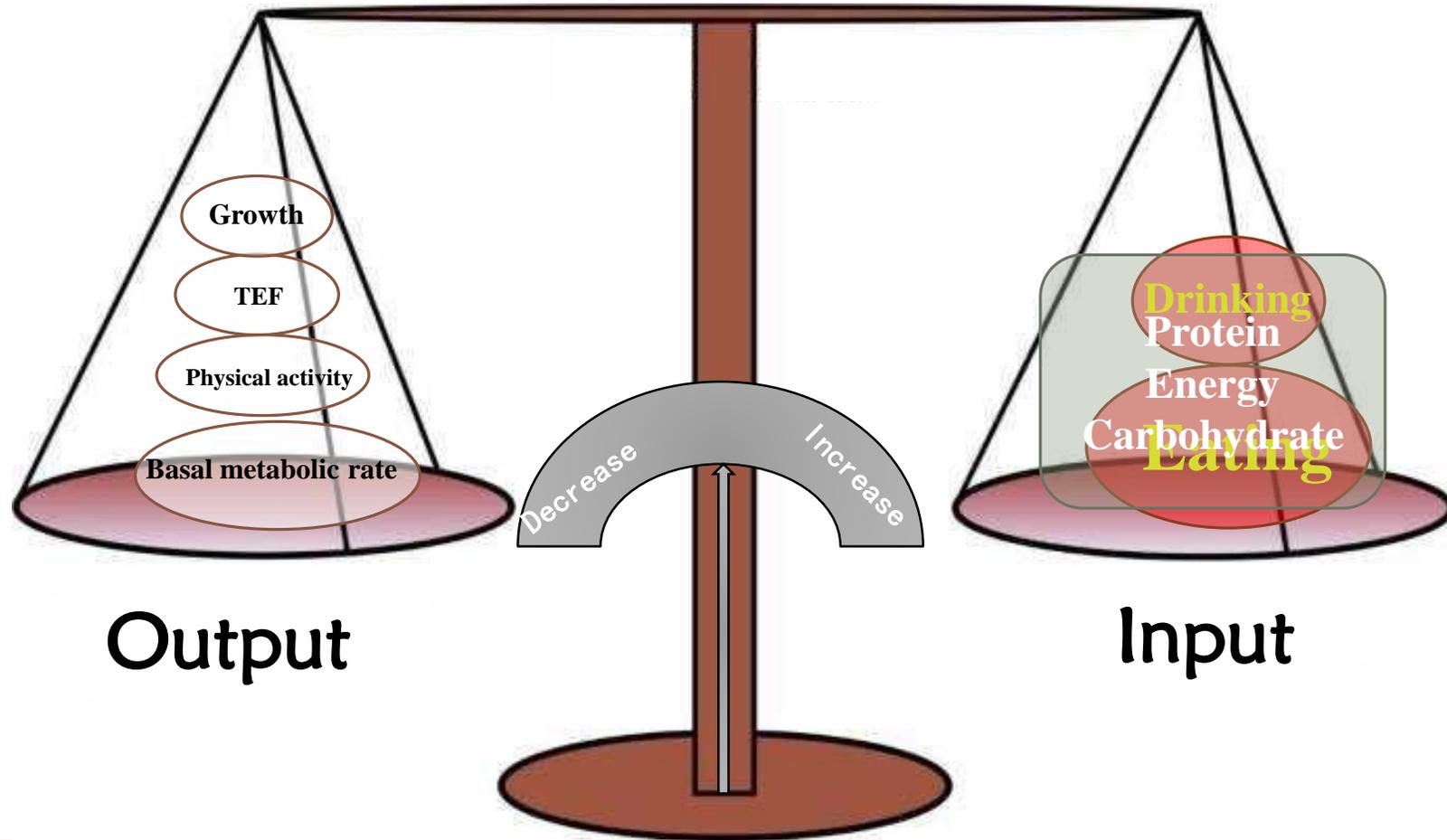
Underweight
Body fat%:
20.2%

Childhood Obesity--Risk factors

- Genetics are one of the biggest factors examined as a cause of obesity.
- Studies of twins have revealed that genetic factors account for between 30% and 70% of variation in BMI between individuals;
- Concordance rates among monozygotic twins for fat mass are ~80% while only ~40% in dizygotic twins



Childhood Obesity--Risk factors



Childhood Obesity--Risk factors

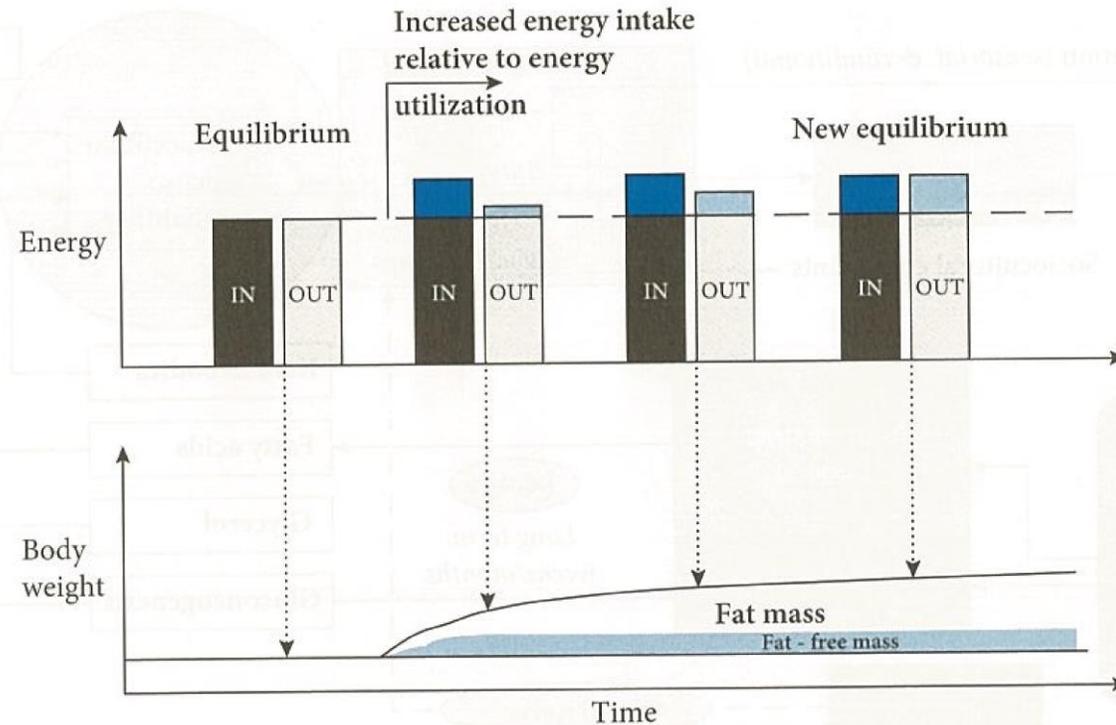
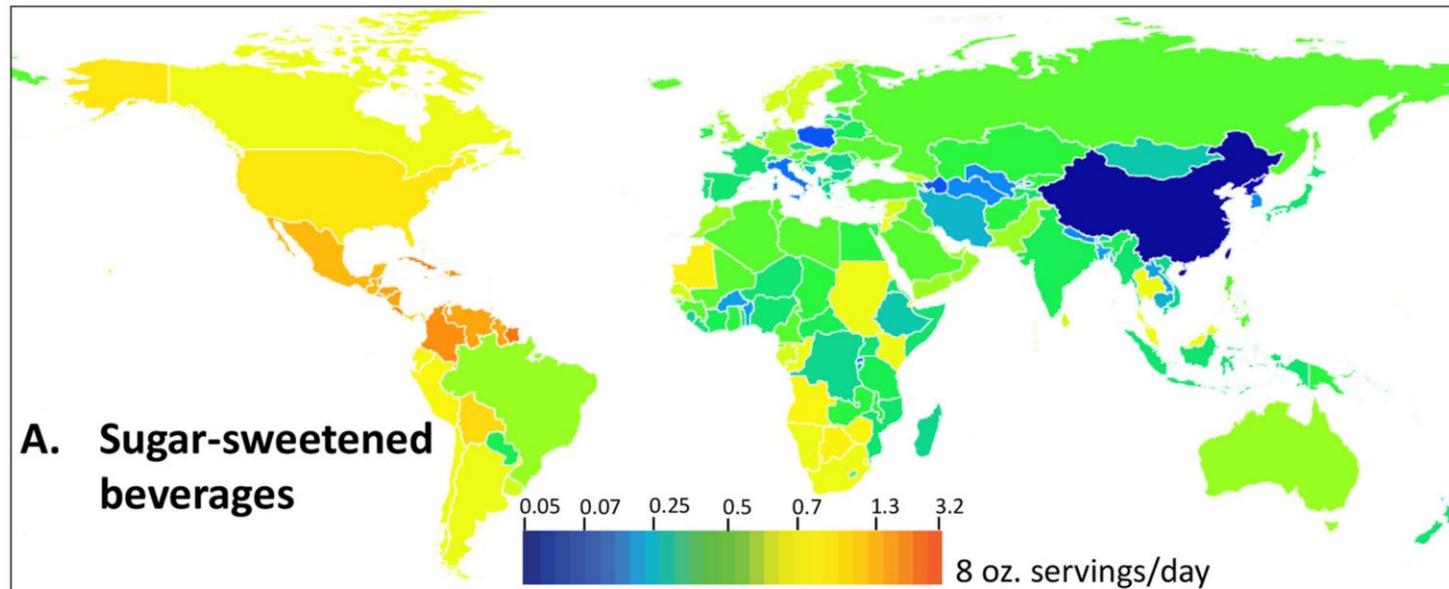


FIGURE 6.7 Effect of a step increase in energy intake on energy balance and fat balance
Adapted with permission from Y. Schutz (2004). Dietary fat, lipogenesis and energy balance. *Physiology & Behaviour*, 83, 557–64.

Childhood Obesity--Risk factors

1. Dietary factors

□ Sugar beverage



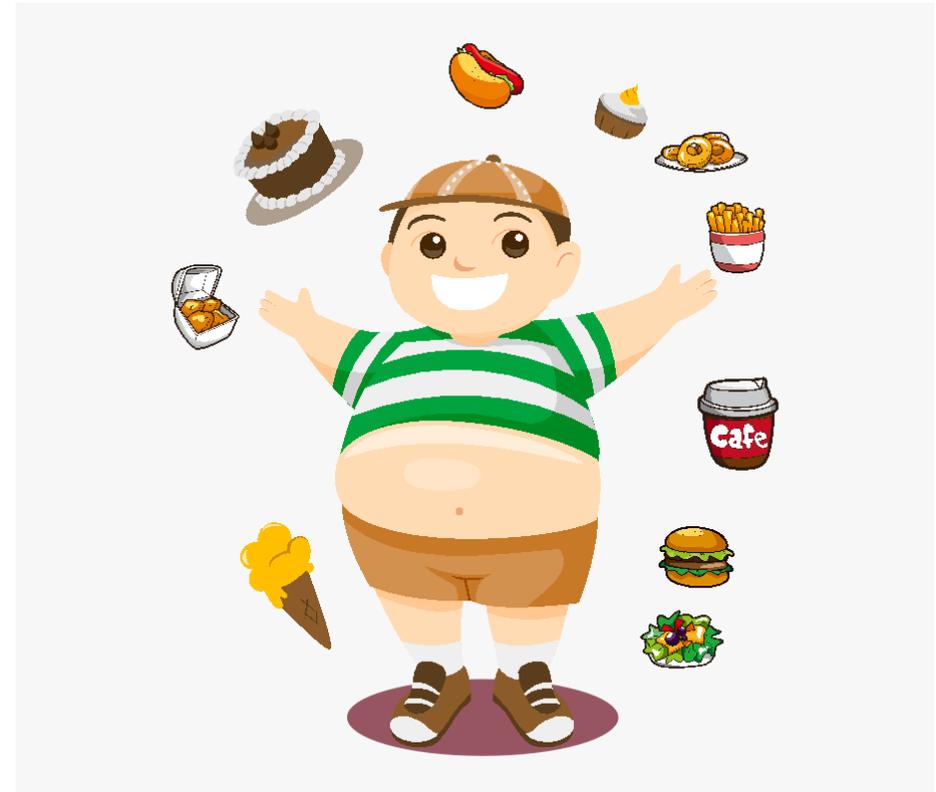
Consumption of non-alcoholic caloric beverages in 187 countries worldwide.

Singh et al. PLoS One. 2015; 10(8): e0124845

Childhood Obesity--Risk factors

1. Dietary factors

- ❑ Snack food
- ❑ Breakfast Skipping
- ❑ Eating out



Childhood Obesity--Risk factors

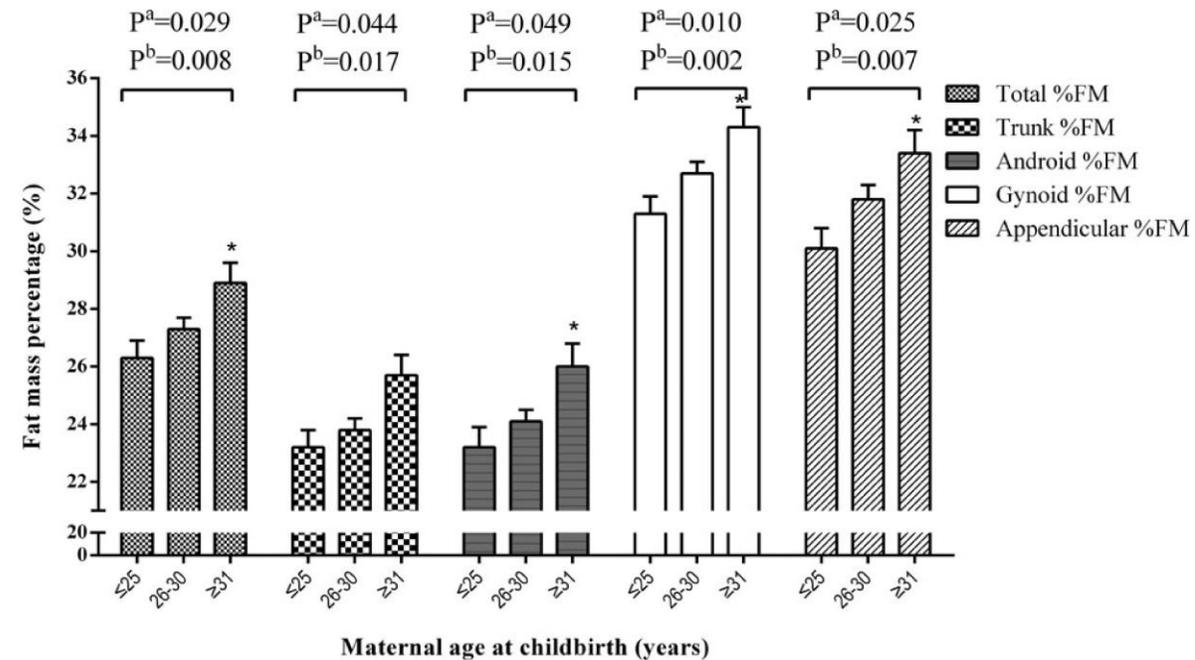
2. Physical Activity level

- ❑ Longer screen time
- ❑ Drove children to school
- ❑ Lack of access to facilities in which to be active and urban environments designed for vehicular transportation

Childhood Obesity--Risk factors

Parental factors

Our findings: An increasing maternal age at childbirth was associated with increased body fat accumulation in offspring, whereas paternal age at childbirth appeared to have no such association



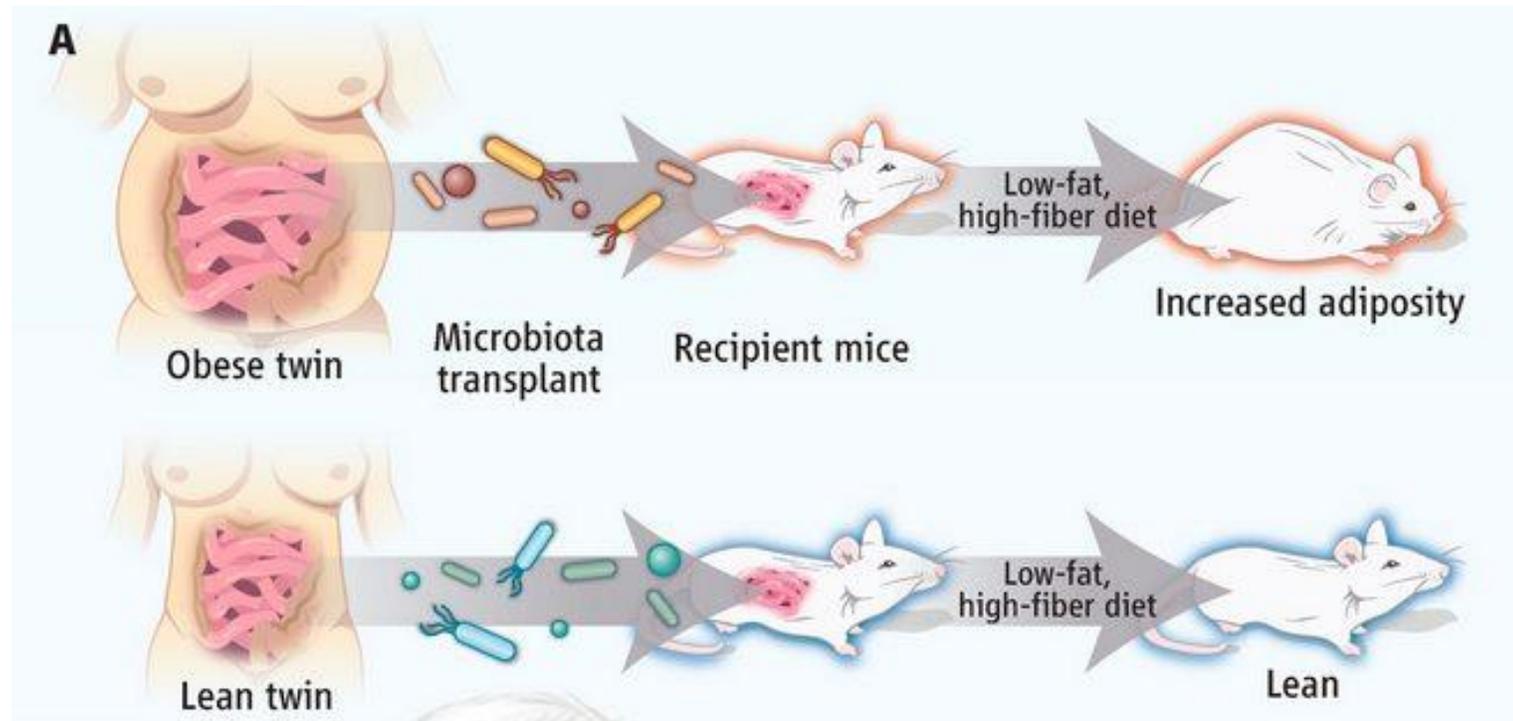
Childhood Obesity--Risk factors

Psychological factors

- Depression and anxiety
- Self-esteem
- Body dissatisfaction
- Eating disorder symptoms
- Emotional problems

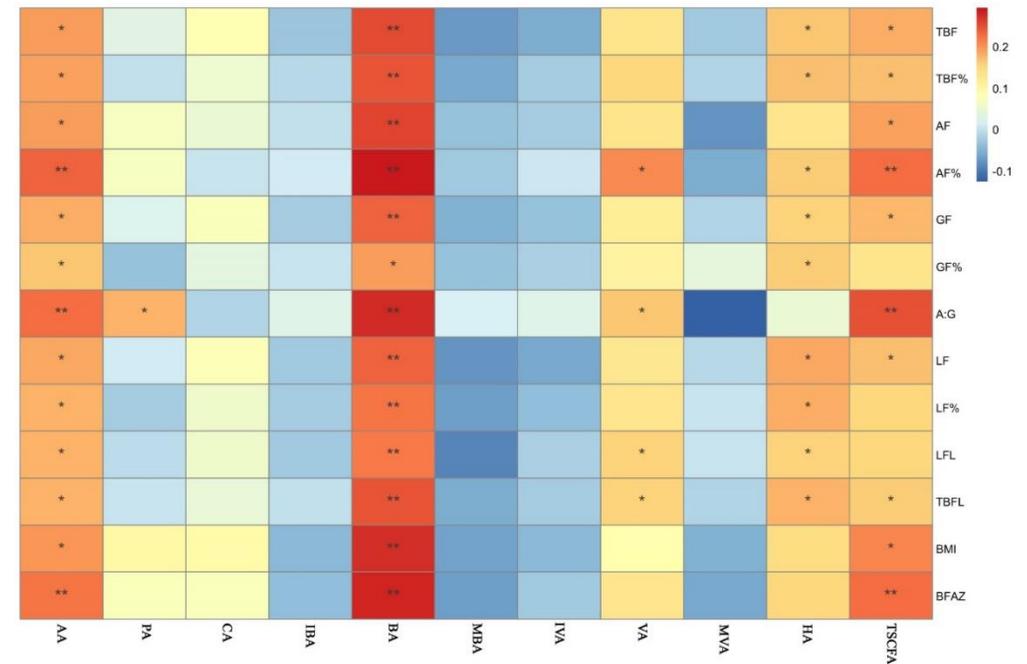
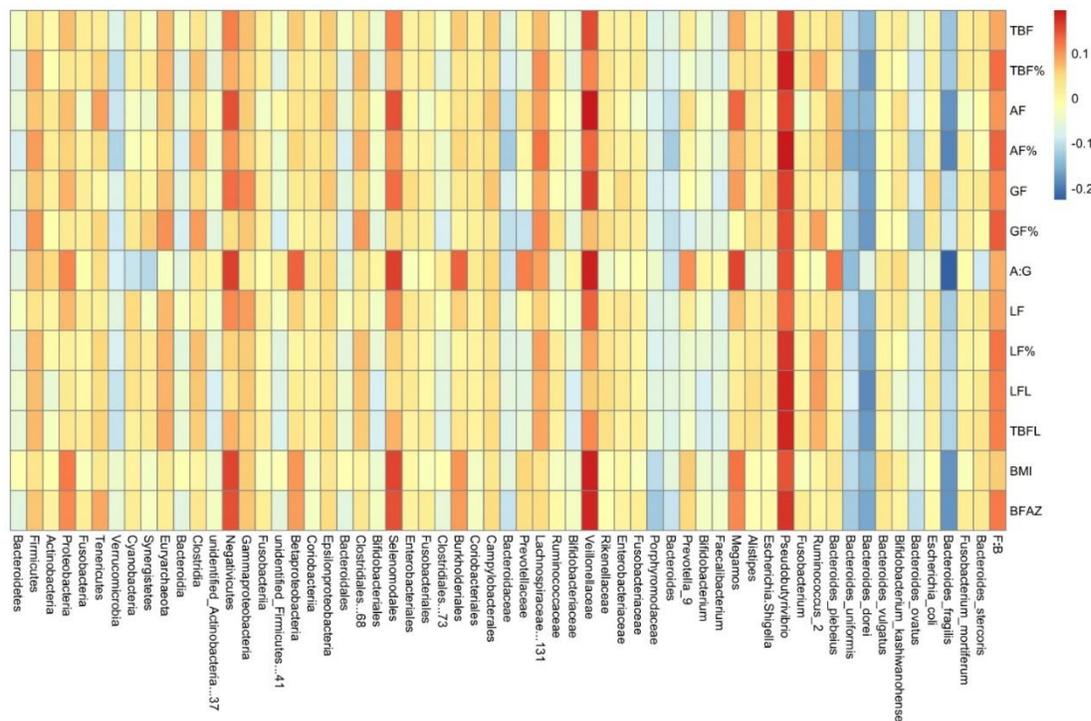
Childhood Obesity--Risk factors

New aspect--Microbiome



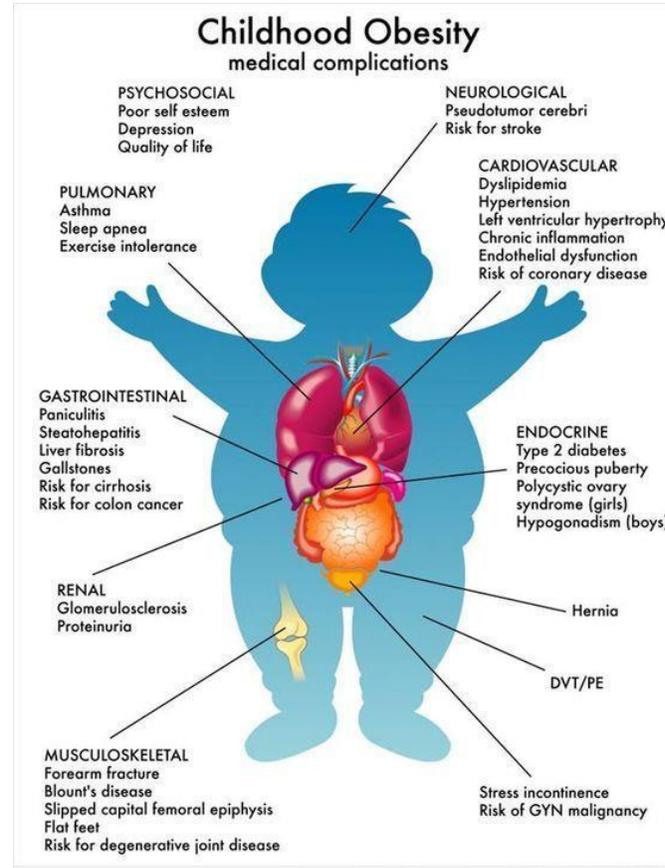
Childhood Obesity--Risk factors

Our findings: The gut microbiome exerts no apparent influence on the susceptibility to obesity or body fat accumulation during childhood. However, we uncovered a link between increased SCFA concentrations and adiposity in children



Childhood Obesity--Consequences

1. Medical consequences



Childhood Obesity--Consequences

2. Socio-emotional consequences

Overweight and obese children are often teased and/or bullied for their weight.

They also face numerous other hardships including negative stereotypes, discrimination, and social marginalization

Obese children are often excluded from activities, particularly competitive activities that require physical activity.

Childhood Obesity--Consequences

3. Academic consequences

- **Overweight and obese children were four times more likely to report having problems at school than their normal weight peers.**
- **They are also more likely to miss school more frequently, especially those with chronic health conditions such as diabetes and asthma, which can also affect academic performance**

Childhood Obesity--Management

□ Dietary interventions

Use of balanced-macronutrient/low-energy diets

□ Physical activity

Reducing sedentary activities

Structured versus nonstructured physical activity

□ Behavioral approaches

□ Weight loss medications

Childhood Obesity--Management

How much physical activity do children need?

ages 3 through 5 years

- Preschool-aged children should be physically active throughout the day for growth and development.
- Adult caregivers should encourage preschool-aged children to be active when they play.

ages 6 through 17 years

- Children and adolescents ages 6 through 17 years should do 60 minutes or more of moderate-to-vigorous intensity physical activity each day, including daily aerobic – and activities that strengthen bones (like running or jumping) – 3 days each week, and that build muscles (like climbing or doing push-ups) – 3 days each week.

Food allergy--Definition

Food allergy

A food allergy is an abnormal immune response to food



Food allergy--Definition

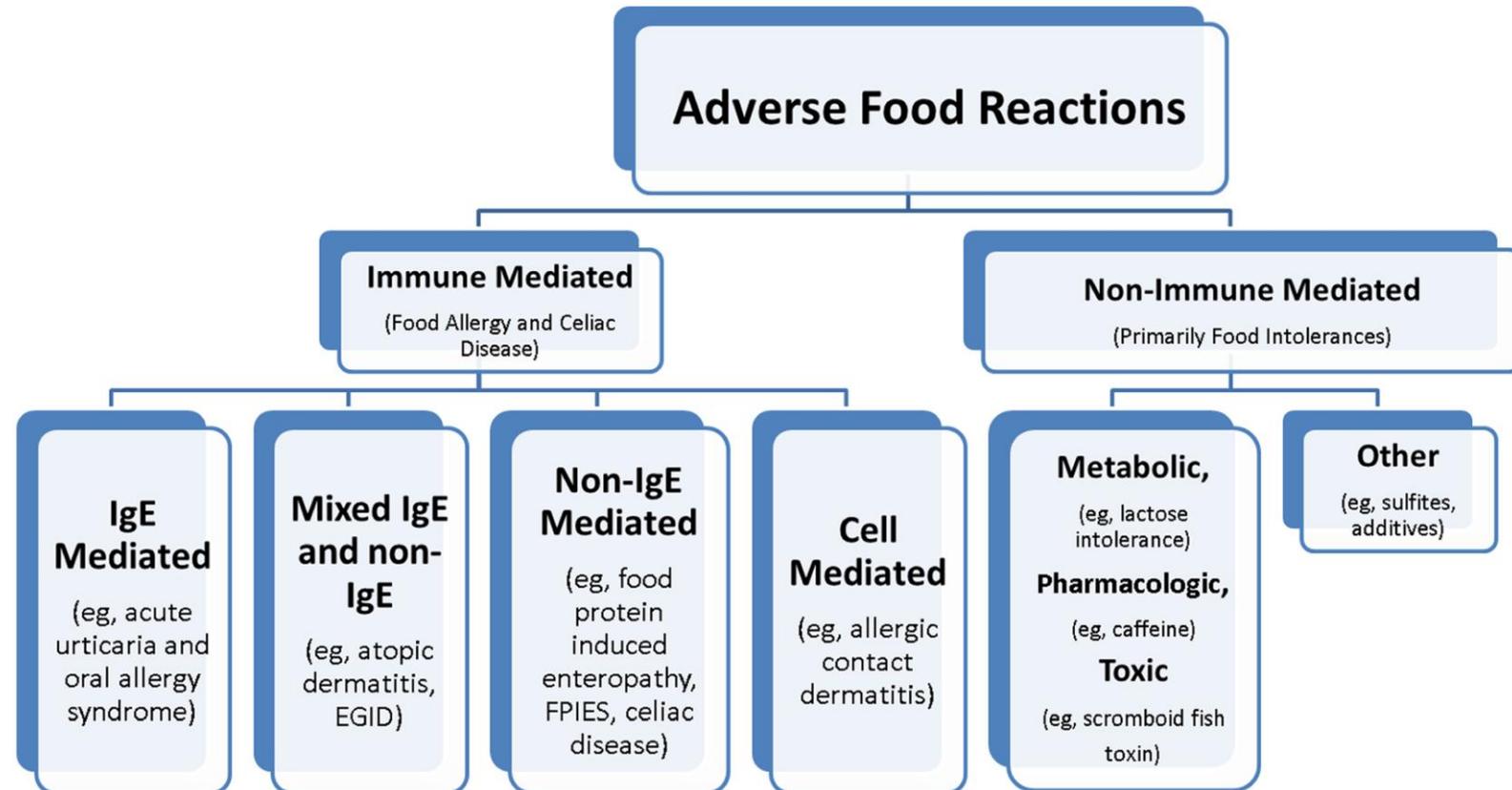


Fig. 1 Classification of adverse reactions to food (adapted from Sampson et al. [2])

Food allergy--Definition

IgE mediated food allergies

- * Risk of anaphylaxis.**
- * Hives.**
- * Swelling of mouth, lips or throat.**
- * Difficulty breathing.**
- * Could be fatal.**
- * Treat with epipen.**

Non-IgE mediated allergic reaction

- * Mostly gut related symptoms (diarrhea, vomiting).**
- * Does not lead to anaphylaxis.**
- * Does not involve hives.**
- * FPIES (food protein induced enterocolitis).**
- * Severe FPIES leads to vomiting till shock.**
- * Cow's milk protein allergy (non-IgE).**
- * Malabsorption and failure to thrive**

Food allergy--Definition

Table 3 World allergy organization grading and definition of types of anaphylaxis

Grade	Definition
Anaphylaxis	
Grade I	Only 1 organ system is involved—including cutaneous, respiratory, ocular
Grade II	2 organ systems involved or lower respiratory tract, gastrointestinal involvement, or uterine cramping
Grade III	Symptoms of laryngeal, uvular, or tongue tissue edema occur with or without stridor or when the FEV1 drops by 40% with no bronchodilator response.
Grade IV	Respiratory failure or hypotension
Grade V	Death
Biphasic anaphylaxis	New or worsening anaphylactic symptoms after resolution of the primary/first reaction. Usually occurs within 6 h after the resolution of the primary reaction.
Refractory anaphylaxis	Anaphylactic reaction that does not respond to initial treatment

Food allergy—Prevalence

Figure 1. Percentage of children under age 18 years who had a reported food or digestive allergy in the past 12 months, by age, sex, and race and ethnicity group: United States, 2007

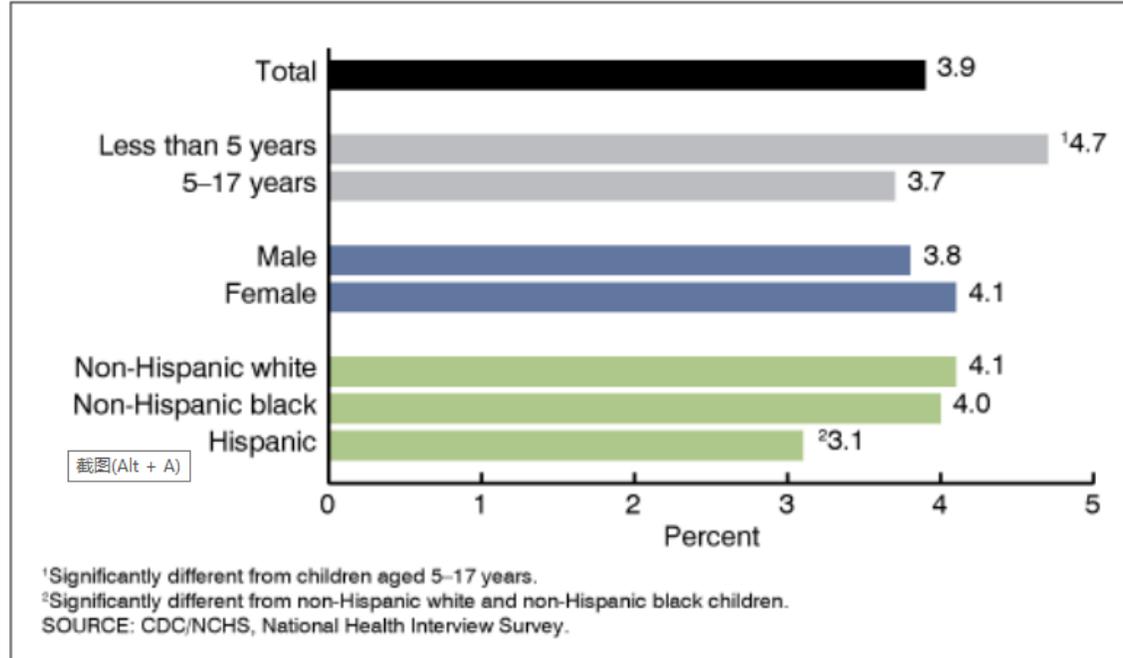
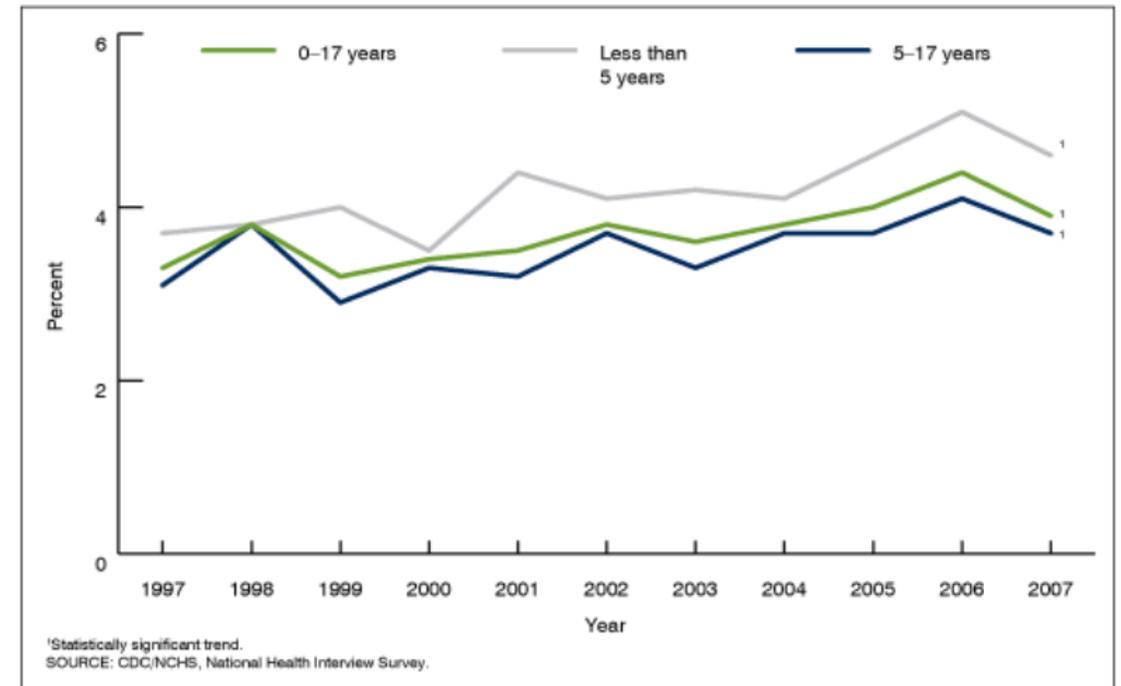


Figure 2. Percentage of children under age 18 years who had a reported food or digestive allergy in the past 12 months, by age group: United States, 1997–2007

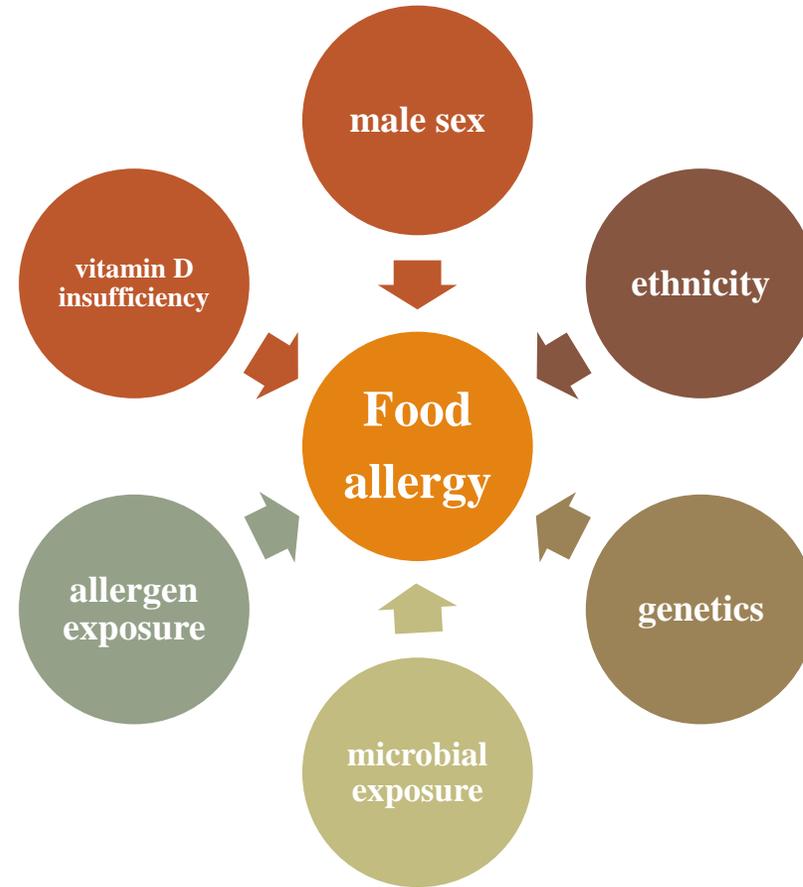


Food allergy—Common foods

Table 1. Summary of prevalence of allergy to individual food allergens

Allergen	Prevalence in young children, %	Prognosis
Cow's milk	0.3 - 3.5 (<0.5 in adults)	>80% outgrown by 16 y
Hen's eggs	0.5 - 8.0 (<0.5 in adults)	>80% outgrown by 16 y
Wheat	<1	Majority outgrow – 65% by 12 y
Fish	<0.2 (children) and <0.5 (adults)	Usually allergic for life
Shellfish	<0.5 (children) and <2.5 (adults)	Usually allergic for life
Peanut	0.06 - 5.90	20% outgrown
Tree nut	0.2 - 1.4	10% outgrown
Plant food	0.1 - 4.3	

Food Allergy--Risk Factors



Food Allergy--Management

Treatment of IgE-Mediated Food Allergies

□ Acute Management

- ✓ a. Recognize anaphylaxis
- ✓ b. Epinephrine
- ✓ c. Anti-histamines and glucocorticoids

□ Long-term Management

- ✓ a. Diagnosis of reaction (skin-prick testing)
- ✓ b. Avoidance of the food
 - i. Reading labels
 - ii. Eating out
 - iii. School attendance
 - iv. Transition of pediatric care into adulthood
- ✓ c. Dietician consultation

Non-IgE-mediated gastrointestinal food allergy

TABLE IV. Empiric recommendations for dietary management of FPIES (modified from Jarvinen and Nowak-Węgrzyn⁹)

Age	Milk/soy-induced FPIES	Solid food-induced FPIES	Milk/soy- and solid food-induced FPIES
0-6 mo			
Avoid CM/soy*	X		X
Preferably exclusive breast-feeding [†] or extensively hydrolyzed formula [‡] ; soy introduction in case of milk FPIES can be considered, although soy formula is not preferred ^{5,94} ; OFC or home introduction at the discretion of the treating physician	X		X
Introduce yellow vegetables fruits or vegetables, which are unlikely to cause FPIES (eg, carrot and squash), followed by others, as tolerated	X	X	X
Avoid grains, [§] legumes, poultry		X	X
6-12 mo			
Consider CM introduction in case of soy-induced FPIES; OFC or home introduction at discretion of the treating physician	X		X
Consider soy introduction in case of CM-induced FPIES; OFC or home introduction at discretion of the treating physician	X		X
Consider introduction of grains, legumes, or poultry if not tried; OFC or home introduction at discretion of the treating physician	X	X	X
>12 mo			
Avoid trigger foods, OFC with reactive food every 12-18 mo at discretion of the treating physician	X	X	X
Exclusive breast-feeding, [†] extensively hydrolyzed formula, [‡] or consider soy introduction in case of CM-induced FPIES; OFC or home introduction at discretion of the treating physician	X		X
Consider introduction of CM or soy if not tried previously; OFC or home introduction at discretion of the treating physician	X	X	X
Consider introduction of grains, legumes, or poultry if not tried previously; OFC or home introduction at discretion of the treating physician		X	X
Consider OFC with individual fish in case of FPIES to another fish or avoid all fish		X	

No controlled trials have been performed to determine the optimal timing of food introduction in infants and toddlers with FPIES.

*In infants with milk-induced FPIES, soy formula introduction can be considered at the discretion of the treating physician.

[†]No maternal elimination diet is recommended unless reactions to food initially occurred through breast milk.

[‡]If not tolerated, an amino acid-based formula should be initiated.

[§]Including oat, rice, wheat, barley, and rye.

||OFCs might be necessary to introduce new solid foods to children with multiple food-induced FPIES, especially those who are exclusively breast-fed.

Thank you
