



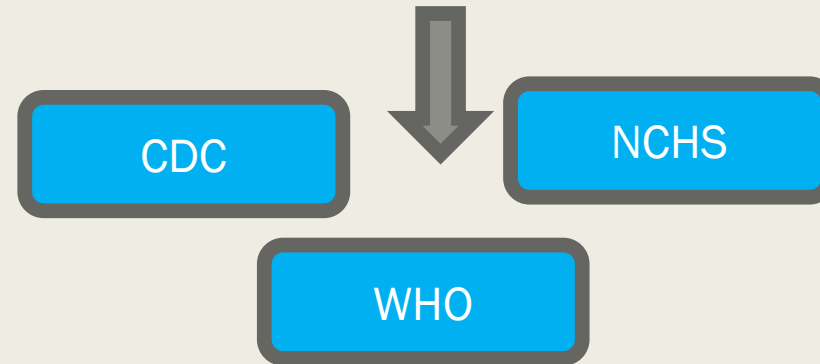
OBESITY IN CHILDREN

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Pediatriation
Guilan university of medical science
BAHMAN 1400

Indicators used to diagnose Obesity in children:

- **AGE >2 Y :BMI** : $\text{WEIGHT}(\text{kg})/\text{HEIGHT}(\text{ m})^2$

Obesity refers to children with **BMI \geq 95th** percentile for age and sex



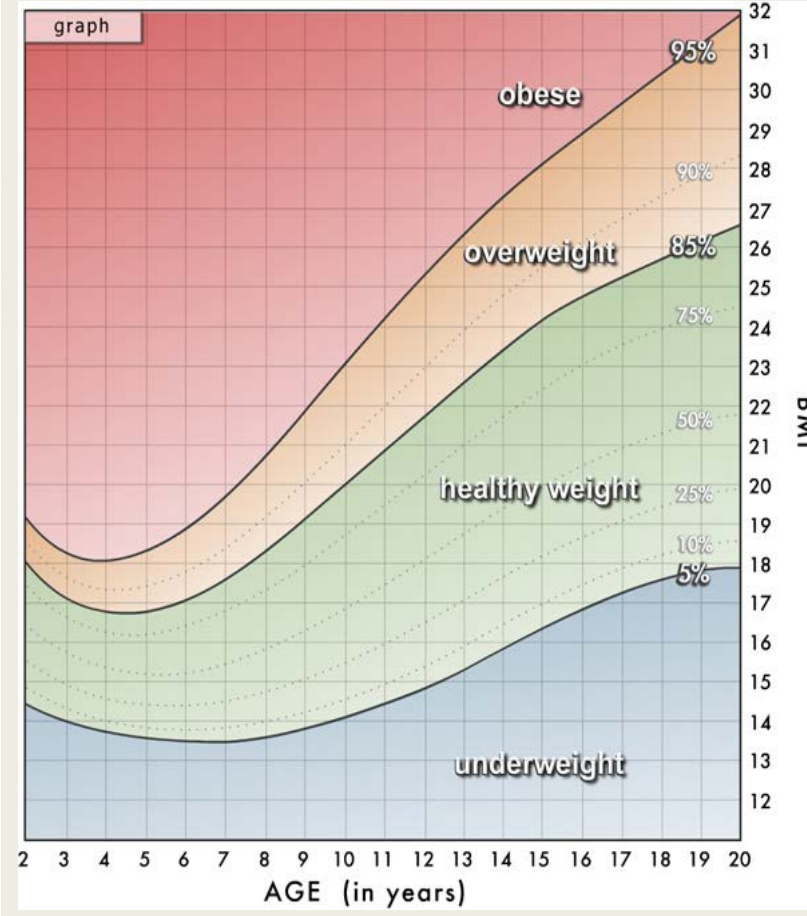
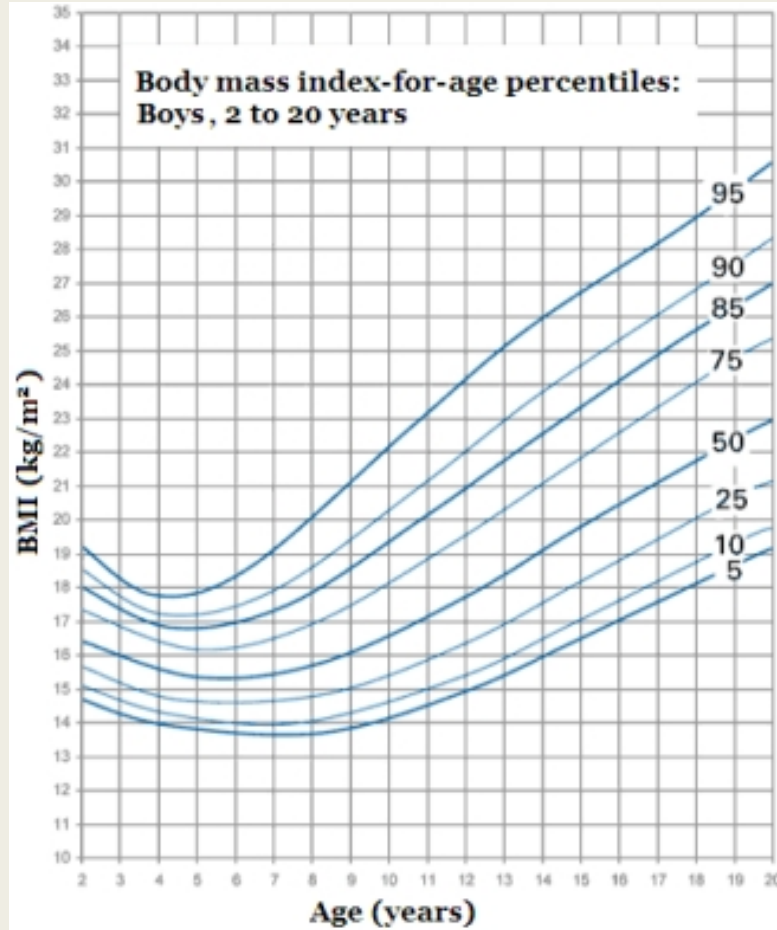
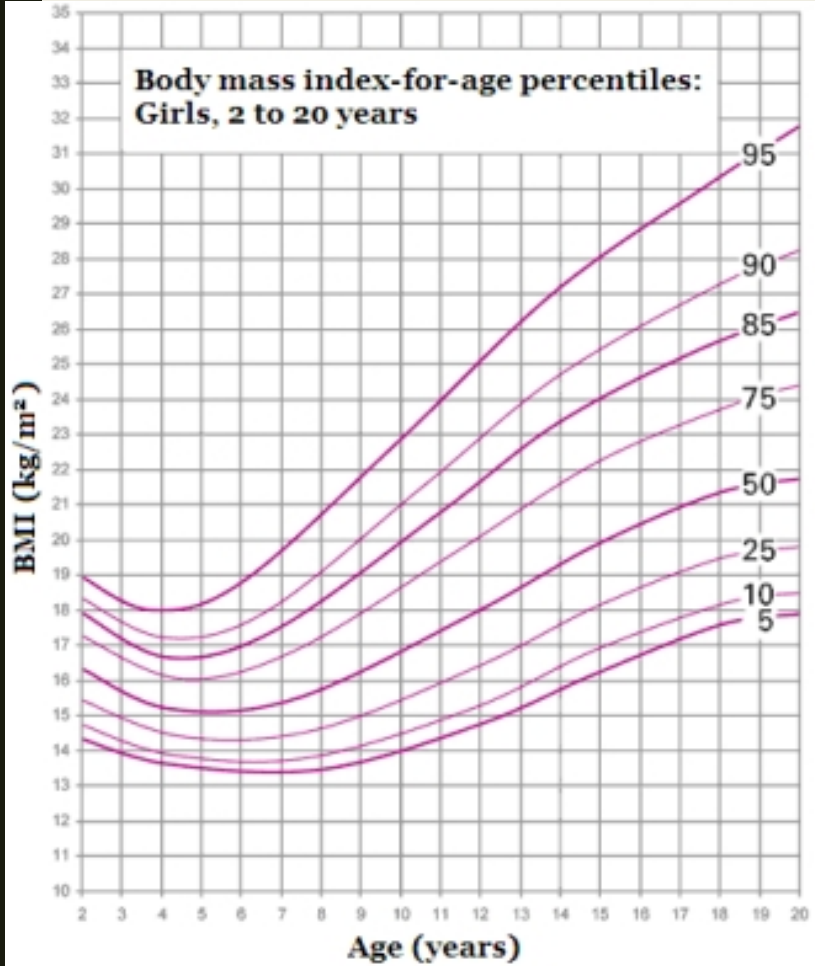
standard

- **AGE <2 Y** : weight for height

- **Regional fat distribution**: waist circumference, waist to hip ratio

>0.5

CDC BMI charts



NOTE :REBOUND ADIPOSITY at 5.5 Y

DEFINITION of Obesity in children:

UNDER WEIGHT	BMI < 5 TH
NORMAL WIGHT	BMI 5 TH --- < 85 TH
OVER WEIGHT	BMI ≥ 85 TH ---- < 95 TH
OBESE	BMI ≥ 95 TH
Class 1	BMI ≥ 95 TH to < 120% of the 95 th percentile
SEVER OBESITY CLASS 2	BMI ≥ 120 % of the 95 th percentile Or BMI ≥ 35 (whichever is lower)
SEVER OBESITY CLASS 3	BMI ≥ 140 % of the 95 th percentile Or BMI ≥ 40 (whichever is lower)

CASE:

7 Y Girl , BMI :25

95% 7 Y :20

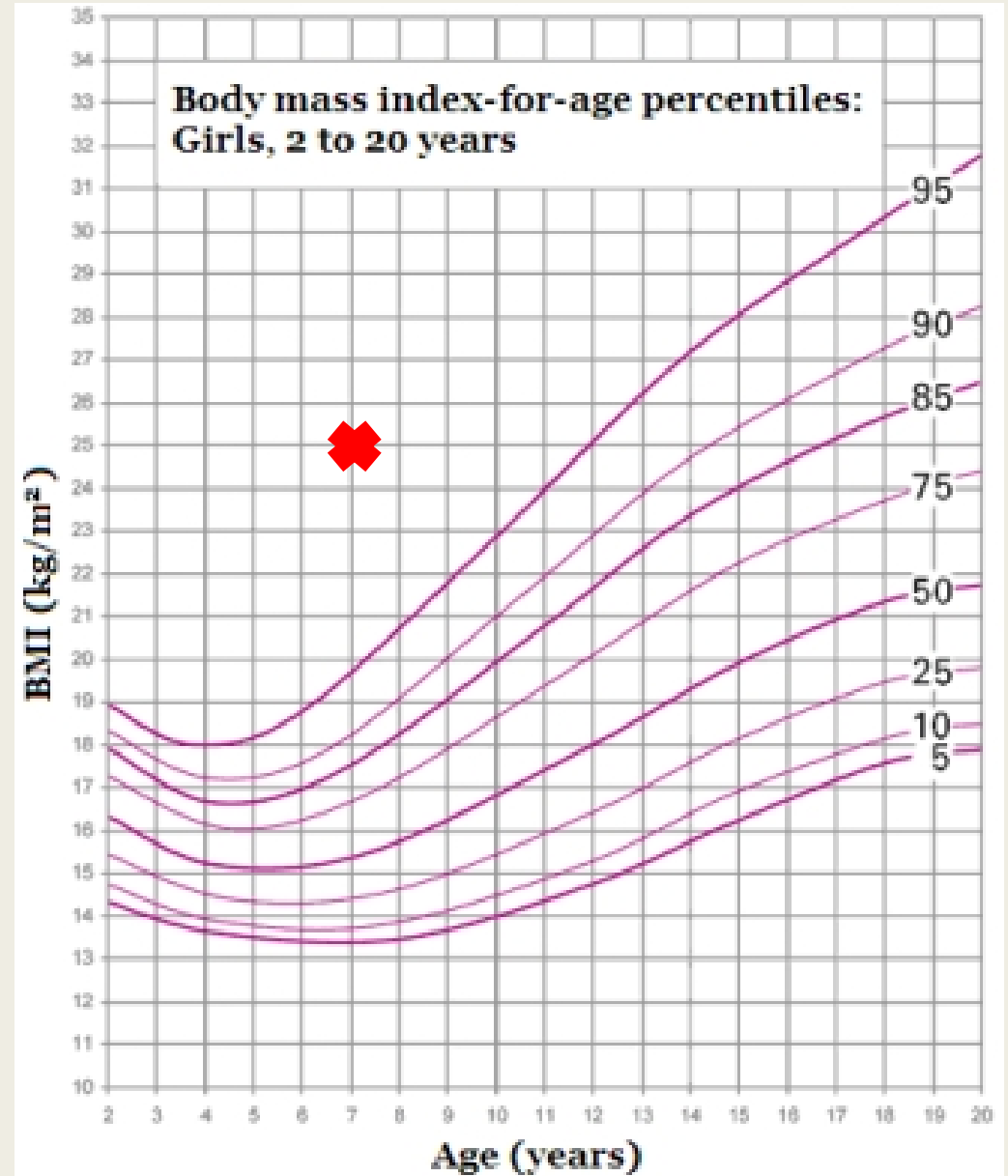
120 % × 20 =24

140 % × 20 =28

20-24:CLASS 1

24-28: CLASS 2

>28 : CLASS 3



Morbid obesity:

Individuals with obesity related comorbidities

Cardiovascular

Dyslipidemia
HTN

ENDOCRINE

DM 2
Metabolic syndrome
PCO

GI

Gallbladder stone
Non alcoholic fatty liver
(NAFLD)

NEUROLOGIC

Pseudotumor cerebri
migranes

ORTHOPEDIC

Blount disease
Back pain
Hip pain
Slipped capital femoral epiphysis

pulmonary

Asthma
Obstructive sleep apnea

PSYCHOLOGIC

Anxiety
Depression
Low self esteem
bullimia

Epidemiology:

37%

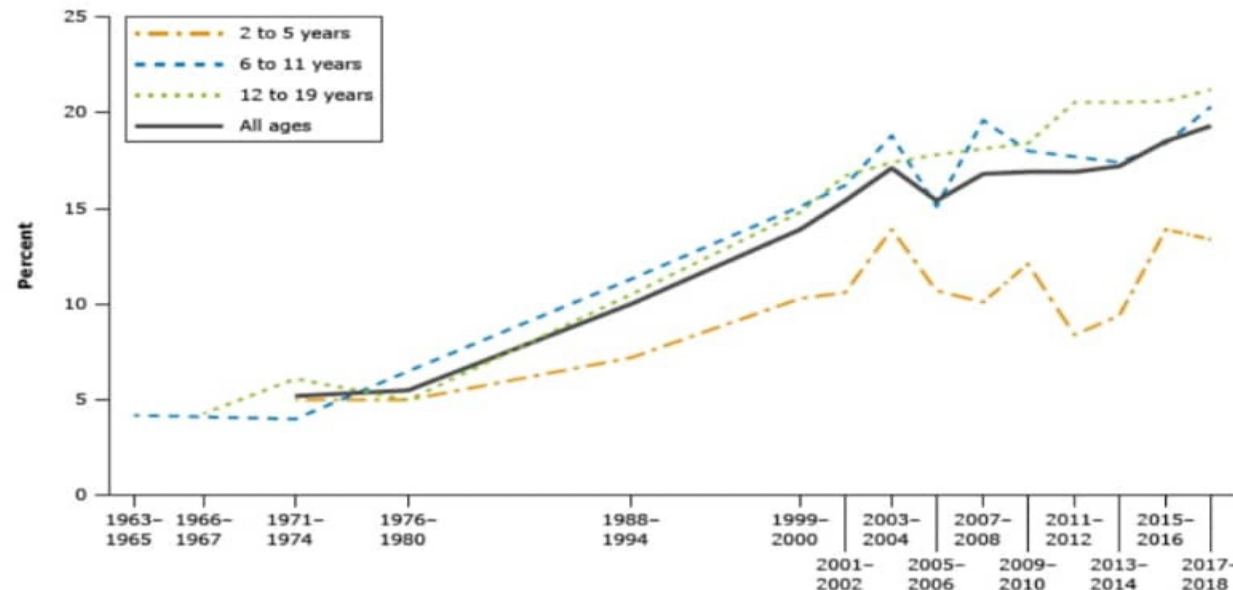
- **USA** : one third of children and adolescents are overweight or obese.
- **WHO** : >1.9 BILION person >20 Y are overweight or obese.
- **12.3%** of preschool aged children and **15.4%** of school aged children and **19.4%** of adolescents are overweight.
- **11.7%** of preschool aged children and **12.3%** of school aged children and **8.9%** of adolescents are in class 1 obesity group.
- **2%** of preschool aged children and **6.4%** of school aged children and **10.1%** of adolescent females and **13.2%** of adolescent males are in class 2 or 3 obesity group.

Overall Prevalence of **overweight** and **obesity** are 15 and 5 %

Trends in obesity among children and adolescents aged 2 to 19 years, by age: United States, 1963 to 1965 through 2015 to 2018

Trends in obesity among children and adolescents aged 2 to 19 years, by age: United States, 1963 to 1965 through 2015 to 2018

Prevalence of obesity increased 300% over 40 year



Sever obesity among children 2-19 y increased from 2.6% (1994) to 6% (2016)

Epidemiology:

- **Race** :black-Mexican /American-non Hispanic white
- **Have an obese parent** : increase risk 2-3 folds
- **Have 2 obese parents** : increase risk 15 folds
- **Social** : low-income, less educated, rural population



30% higher

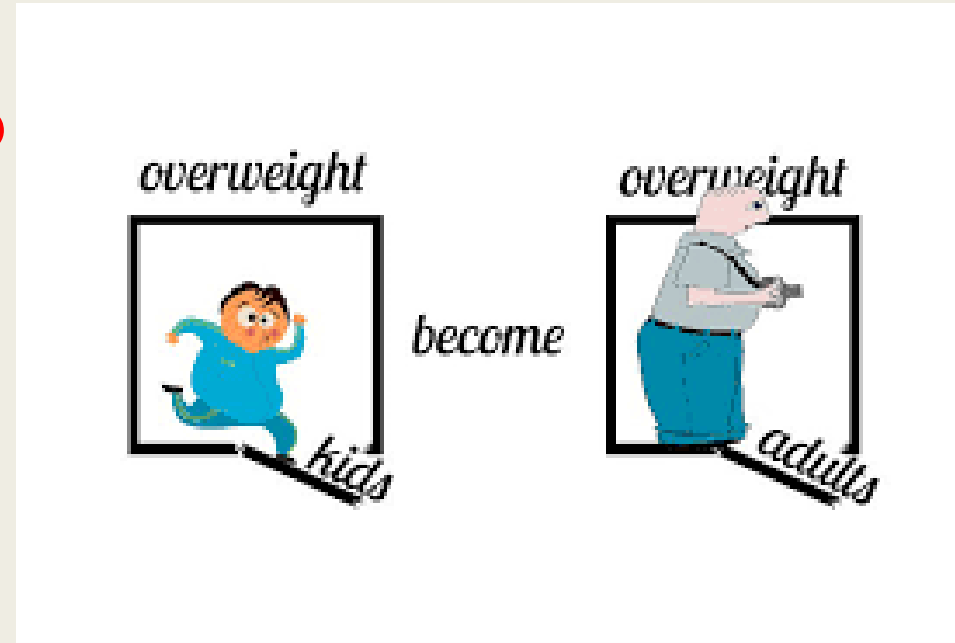
Persistence to adulthood?

age

Severity of obesity

Obese parent

BMI trajectory



age

PubMed.gov



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Acceleration of BMI in Early Childhood and Risk of Sustained Obesity

Mandy Geserick et al. N Engl J Med. 2018.



Children who were **overweight** at entry to **kindergarten** were 4 times as likely to become obese by 8th grade as compared with who were not overweight

age

5 y

Obesity at 5 y was associated with higher BMI (6.5 kg/m²) in mid-adulthood.



National Library of Medicine
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Tracking of Obesity in Childhood into Adulthood: Effects on Body Mass Index and Fat Mass Index at Age 50

Andrew G Rundle et al. Child Obes. 2020 Apr.

[Free PMC article](#)

Severity of obesity

Comment

Incidence of childhood obesity in the United States

Solveig A Cunningham et al. N Engl J Med. 2014.

Mild obesity



47% obese in 8th grade

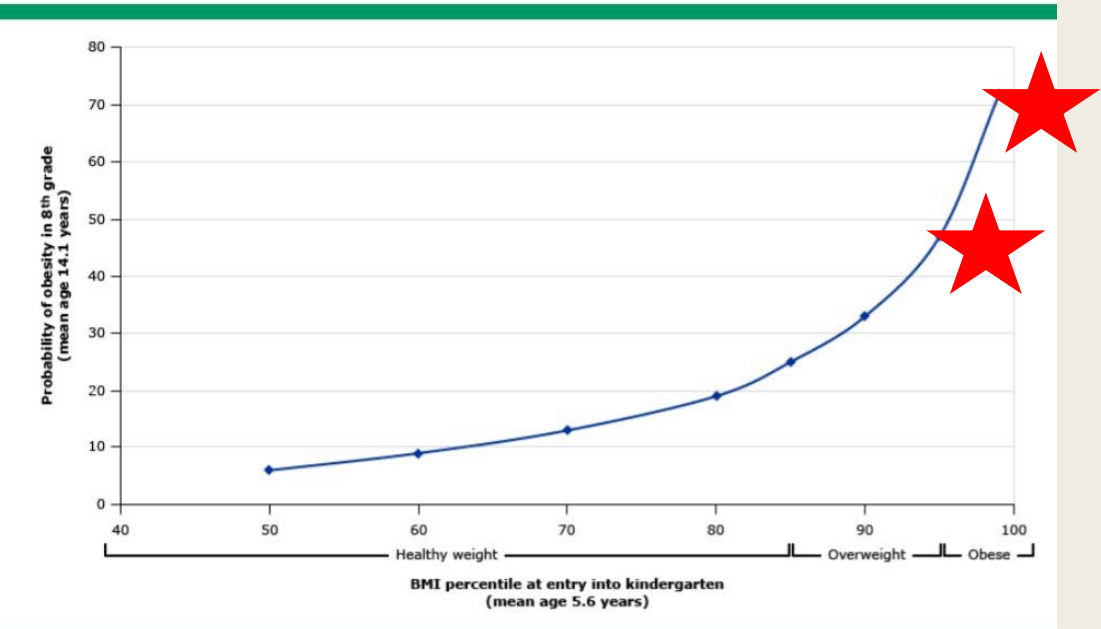
Sever obesity



90% obese in 8th grade



Tracking of obesity during childhood (ages 5 to 14 years)



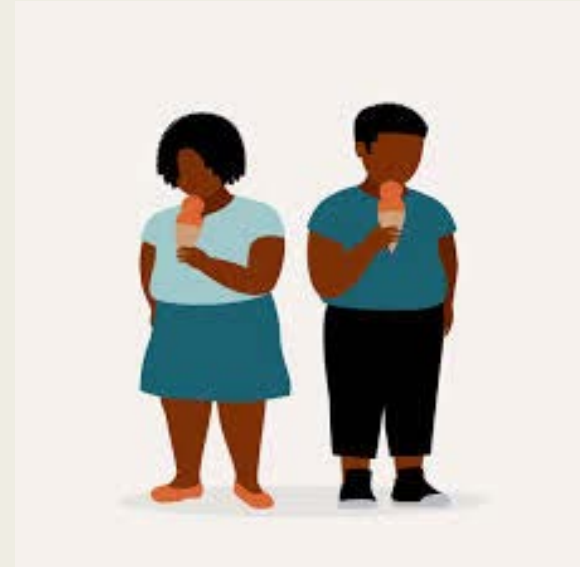
Obese parent

Studies reveal that :

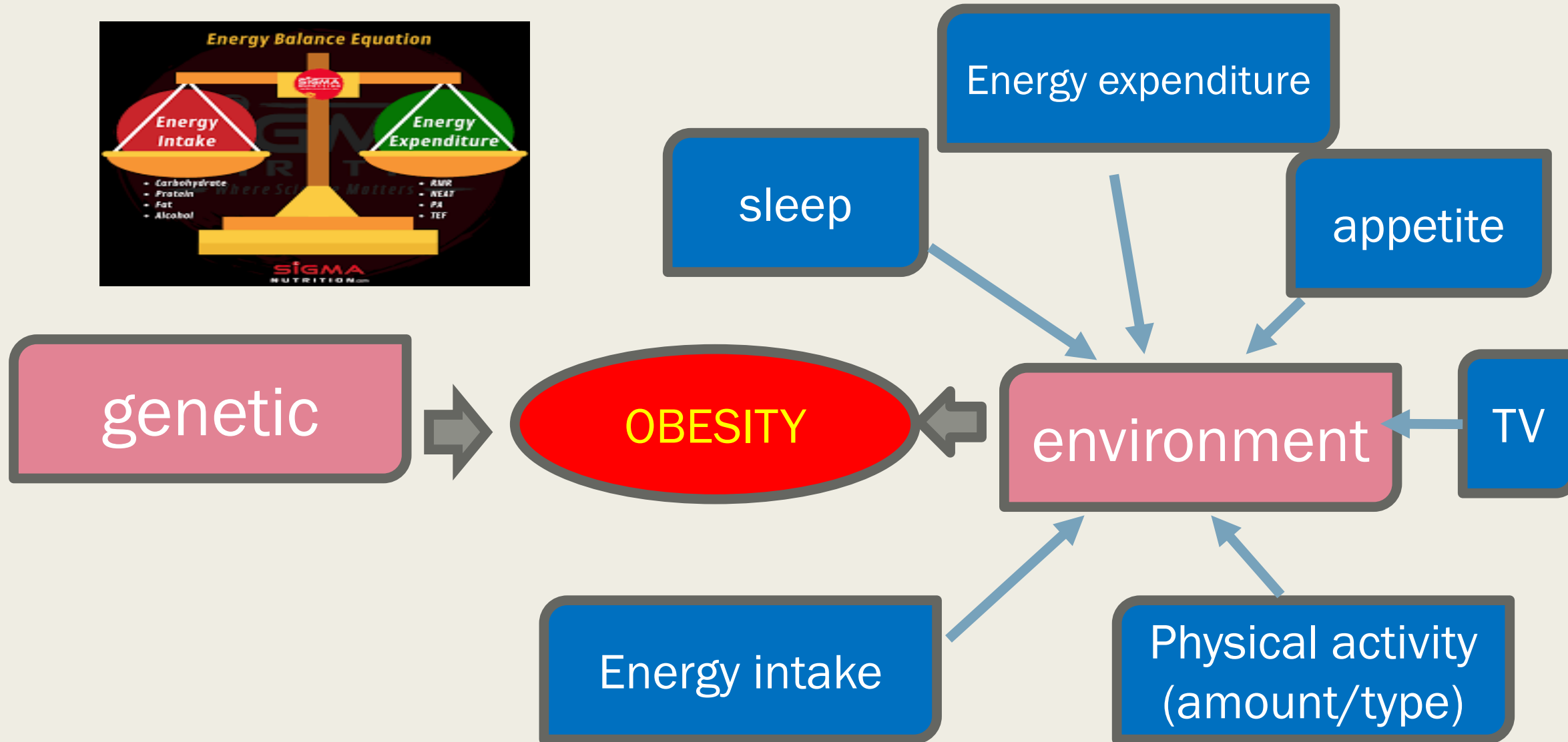
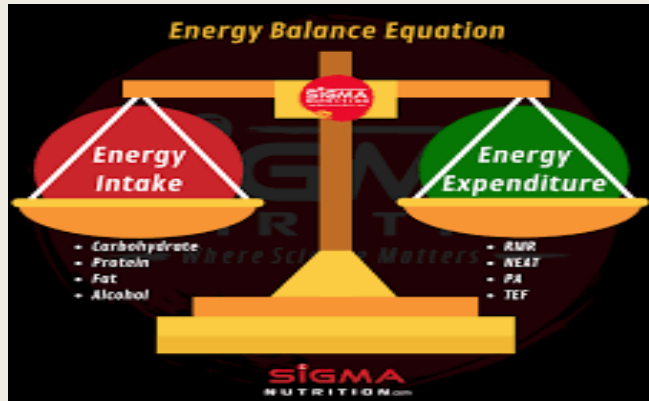
- Childhood obesity typically persists into adulthood particularly for children with an obese parent.



Whether sex affects the
risk of obesity
persistence?



Etiology of obesity



Environmental factors

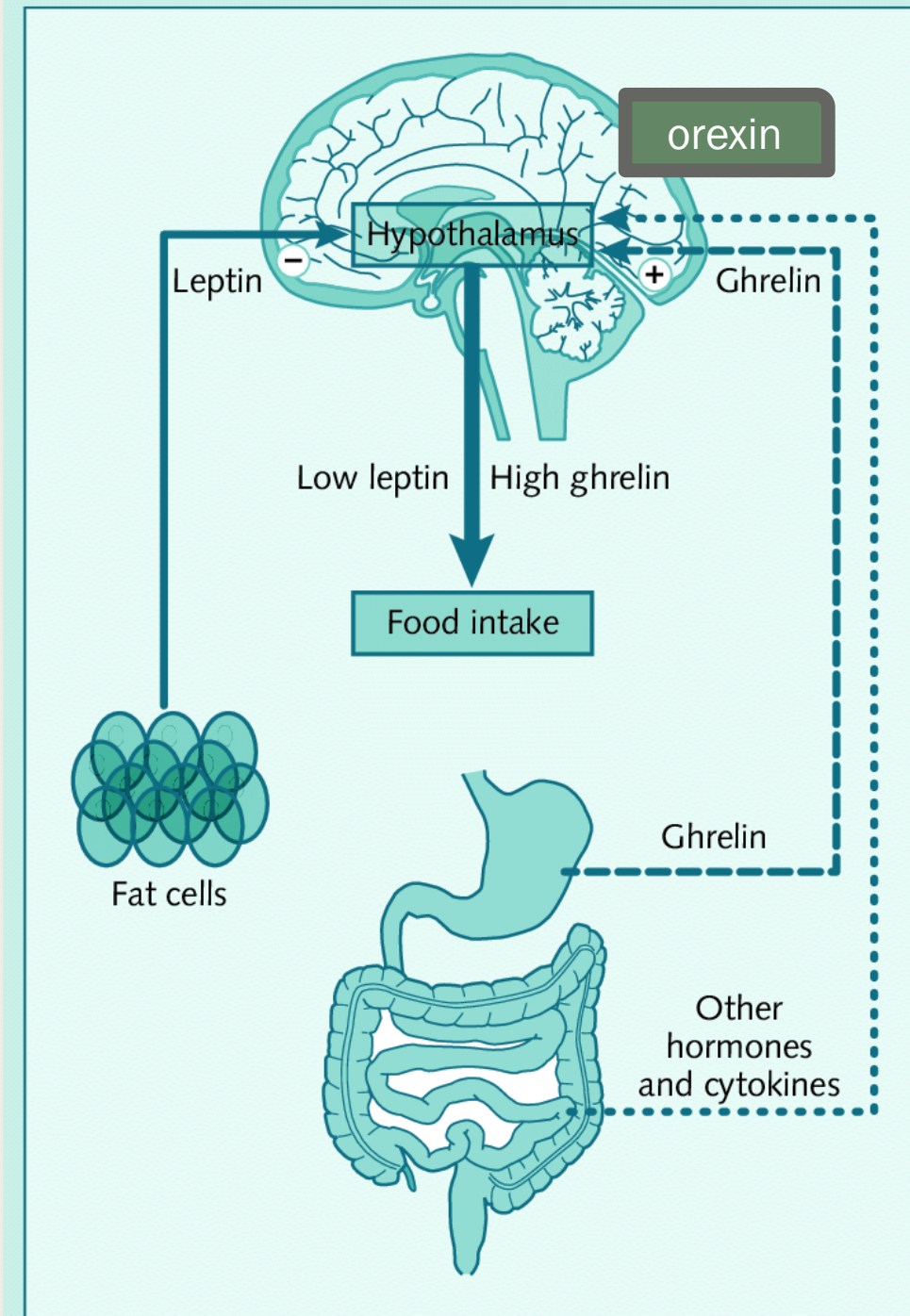
NHANES GUIDELINE
60 min/day

- 4 CUP COLA: 560 Kcal
- Fast food : 2000 kcal





- lower leptin level (the satiety hormone)
- Higher ghrelin level (the hunger hormone)
- Increase hunger and appetite
- High intake of calories (increase neural reward)
- Increase insulin resistance (orexin ↑)
- Reduce physical activity
- Sympathetic activity
- Neuropeptide Y activity



LEPTIN & GHRELIN

Ghrelin  Leptin

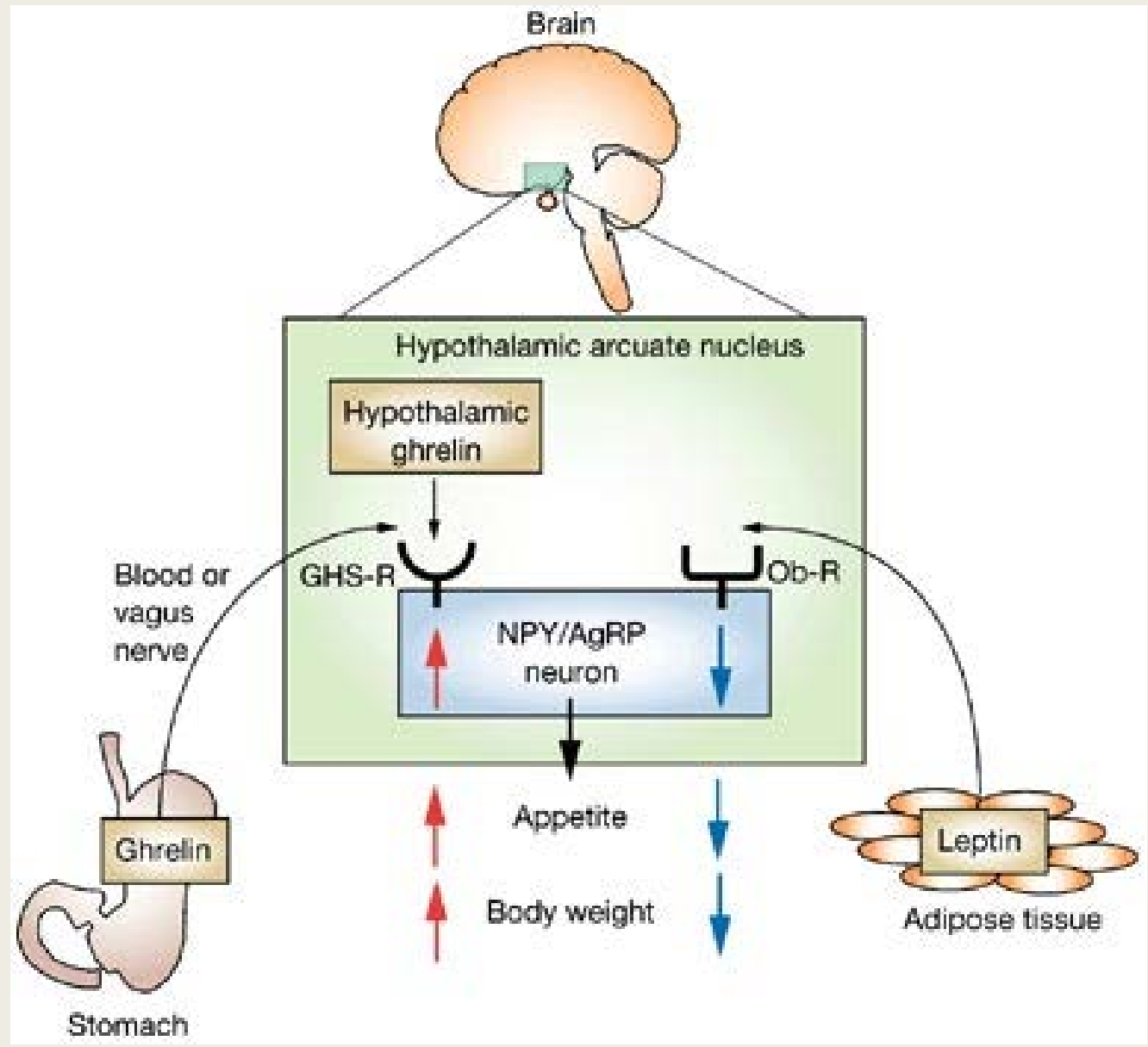
Ghrelin  Leptin



BEFORE EATING



AFTER EATING



Medications and obesity?



Produce weight gain

Antidepressants: monoamine oxidase inhibitors, tricyclic antidepressants (nortriptyline, amitriptyline, doxepin), paroxetine, citalopram, escitalopram, imipramine, mirtazapine

Antipsychotics: thioridazine, olanzapine, risperidone, clozapine, quetiapine

Diabetes medications: eg, insulin, sulfonylureas, thiazolidinediones, meglitinides

Glucocorticoids: eg, prednisone

Hormonal agents: especially progestins, eg, medroxyprogesterone

Anticonvulsants: e Valporate. Carbamazepin.gabapentin

Neurologic and mood-stabilizing agents: eg, lithium, carbamazepine, gabapentin, valproate

Antihistamines: cyproheptadine

Alpha blockers: especially terazosin

Beta blockers: especially propranolol

Gut microbiome and obesity??

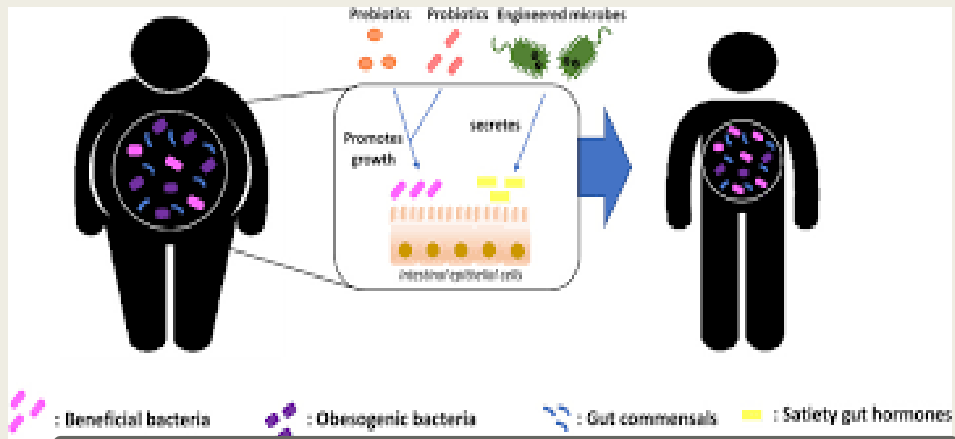
Probiotic roles????

The Influence of the Gut Microbiome on Obesity in Adults and the Role of Probiotics, Prebiotics, and Synbiotics for Weight Loss

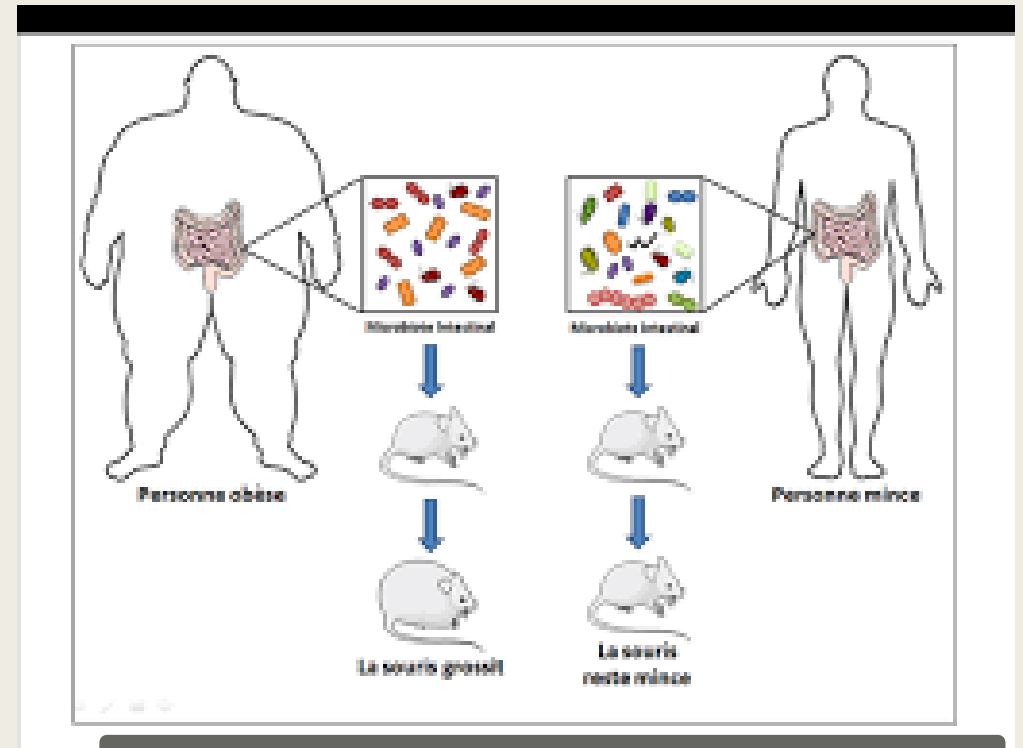
[Antoine Aoun](#), [Fatima Darwish](#), and [Natacha Hamod](#)

Published online 2020 Jun

30. doi: [10.3746/pnf.2020.25.2.113](https://doi.org/10.3746/pnf.2020.25.2.113)



absorption, breakdown, and storage of
nutrients



brain signals, influencing stimulants for
hunger and appetite

Gut Microbiota and Overweight in 3-year Old Children

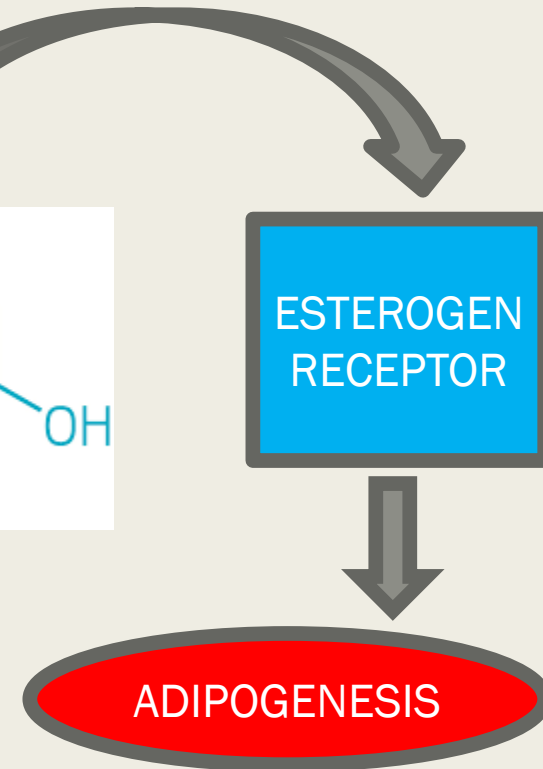
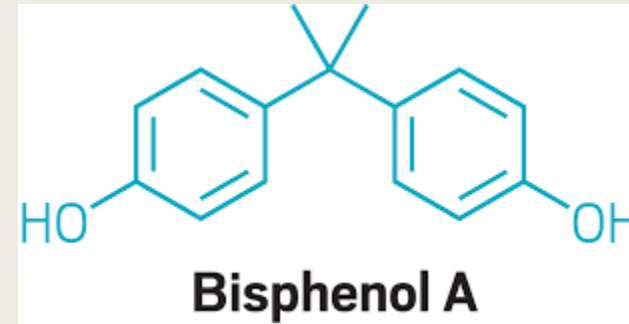
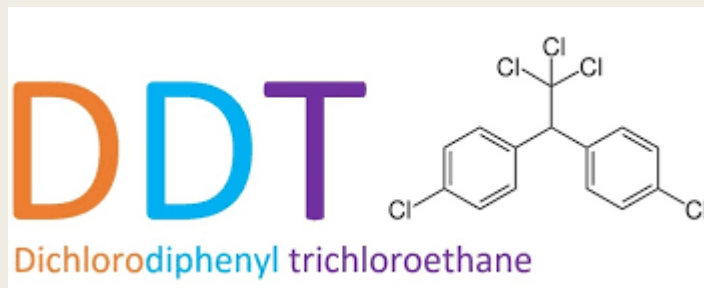
Anne M. Karvonen, PhD,^{1,2} Joanne E. Sordillo, ScD,³

- Published online 2018 Dec 19. doi: [10.1038/s41366-018-0290-z](https://doi.org/10.1038/s41366-018-0290-z)

suggest that some of the **differences in gut composition** of bacteria between obese and non-obese adults can already be observed in 3-year old children

toxins and obesity?

- Pesticide dichlorodiphenyltrichloroethane(DDT)
- Bisphenol A(BPA)



DDT and Obesity in Humans: Exploring the Evidence in a New Way

Julia R. Barrett¹

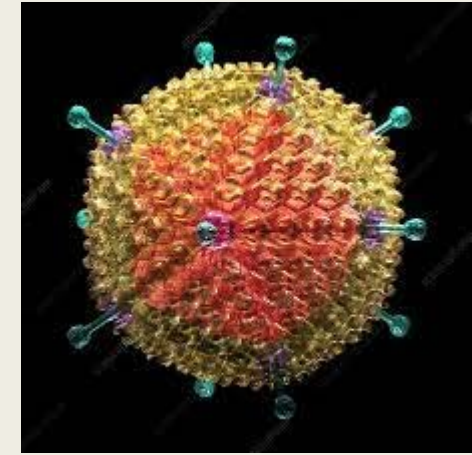
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See the article "[Association between Exposure to *p,p'*-DDT and Its Metabolite *p,p'*-DDE with Obesity: Integrated Systematic Review and Meta-Analysis](#)" in volume 125, 096002.

This article has been [cited by other articles in PMC](#).



VIRUSES and obesity?



■ ADENOVIRUS 36

ANIMAL MODELS ONLY
NOT PROVEN IN HUMAN

Article | [Published: 22 March 2021](#)

Epidemiology and Population Health

Adenovirus 36 prevalence and association with human obesity: a systematic review

[Jaime da Silva Fernandes](#), [Fabiana Schuelter-Trevisol](#)

[✉](#), [...] [Daisson José Trevisol](#)

[International Journal of Obesity](#) **45**, 1342–1356

(2021) | [Cite this article](#)



VITAMIN D DEFICIENCY AND OBESITY?



REVIEW ARTICLE

Vitamin D deficiency in children and adolescents with obesity: a meta-analysis

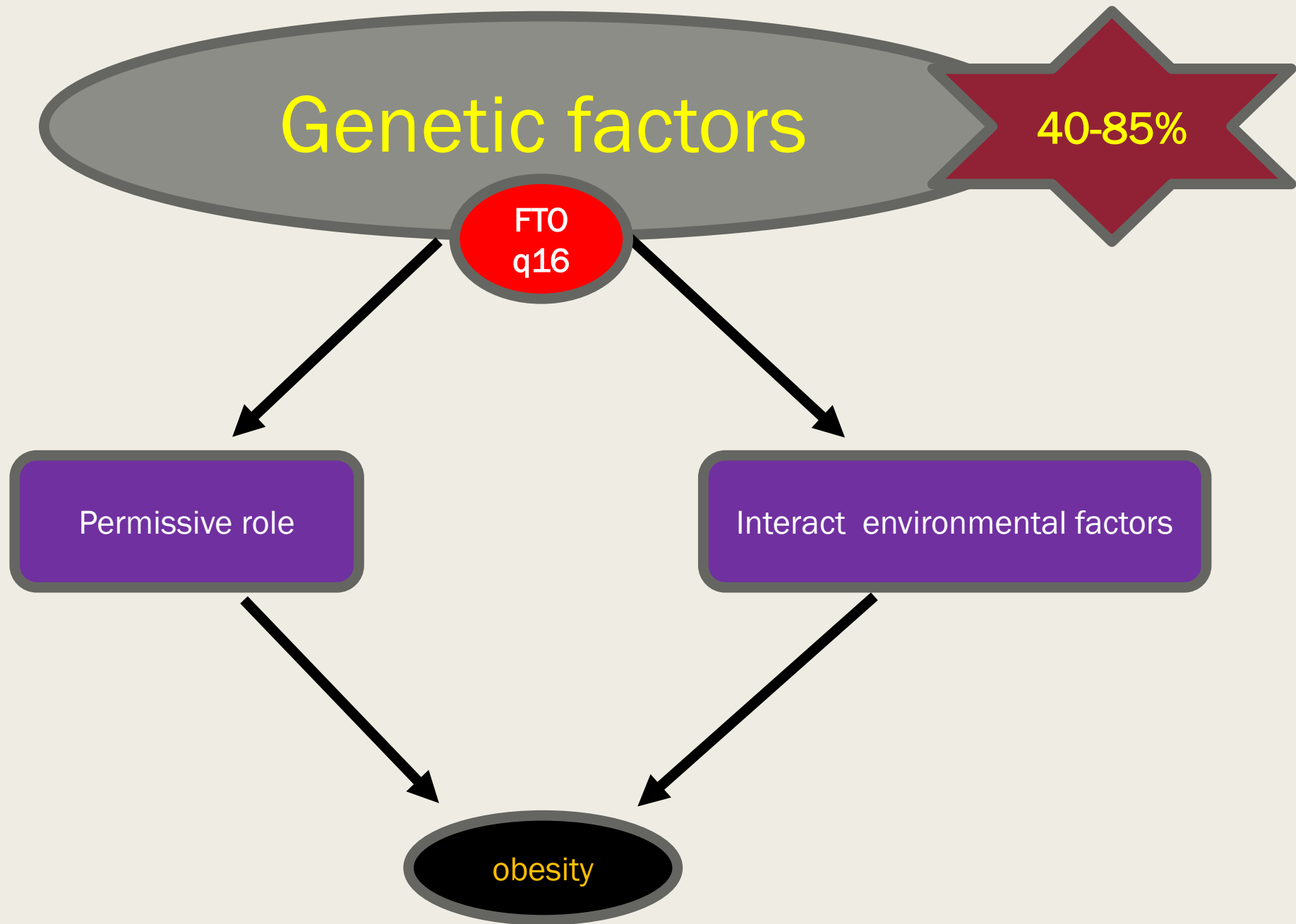
Verônica Indicatti Fiamenghi *, Elza Daniel de Mello

Received 14 May 2020; accepted 3 August 2020 Available online 3 October 2020



Children and adolescents with obesity **have higher risk** of vitamin D deficiency.





Monogenic obesity

- Single-gene defects
- 2-6% of Early onset obesity
- rare

1-Melanocortin 4 receptor mutation (MC4R)(most common)

2-Leptin gene mutation

3-Leptin receptor gene mutation

4-proopimelanocortin (POMC) deficiency

Early onset obesity

Food seeking

Hyperphagia
Light skin
Adrenal insufficiency
Red hair

Syndromic obesity

- Early onset obesity
- Characteristic findings on physical exam.



Endocrine disorder and obesity

1%

mild obesity > sever obesity

Cushing-GH deficiency-hyperinsulinism-hypothyroidism-pseudohypoparathyroidism

Maternal/gestational factors

- Metabolic programming
- Maternal preconceptual weight
- Maternal gestational weight gain
- Nutrition during pregnancy
- Famine exposure



Article | [Open Access](#) | [Published: 10 May 2021](#)

Epidemiology and population health

Overweight and obesity at age 19 after pre-natal famine exposure

L. H. Lumey , Peter Ekamper, Govert Bijwaard, Gabriella Conti & Frans van Poppel

International Journal of Obesity **45**, 1668–1676 (2021) | [Cite this article](#)

1376 Accesses | **70** Altmetric | [Metrics](#)

Insulin-
resistance

Maternal/gestational factors

- Maternal DM during gestation???
- Maternal preeclampsia ???
- Maternal smoking???



Infancy / early childhood



First 1000 days of life

*High birth weight(macrozomia)

*Rates of weight gain during infancy or early childhood → subsequent obesity or metabolic syndrome

*Breast feeding → protective effect against childhood obesity

3.6gr protein/100 kcal

*LBW (or IUGR neonates) and EARLY catch-up growth → increase metabolic disease risk

EVALUATION:

- History(time of onset/acute new onset/diet/appetite/activity/sleep/TV/OSA/menstrual cycle/bulimia/development/hypotonia /radiation/seizure)
- Parental or sibling obesity
- Drug history
- Socioeconomic status
- Psychological status
- Physical exam(weight/height/HC/BMI/ EENT/tanner stage/hirsutism /acanthosis nigricans /Syndromic dysmorphism/Acral edema/hair/skin/poly-syndactyly/IQ/cardiac/steriae /fat distribution/genital)
- Severity of obesity
- Rule out of medical and endocrine disorders (laboratory test-imaging.....)



I
THANK
YOU! ☺