Centrum pro výzkum výživy, metabolismu a diabetu
Oddělení klinického výzkumu Interní kliniky
3. lékařské fakulty UK v Praze a
Fakultní nemocnice Královské Vinohrady

Mikrobiom: mezi stravou a zdravím

Jan Gojda

17.10. Ministerstvo zemědělství

Research disclosures

Multi-omics signatures in new-onset diabetes predict metabolic response to dietary inulin: findings from an observational study followed by an interventional trial

Dásková, N; Modos, I; (...); Gojda, J

Apr 21 2023 | NUTRITION & DIABETES 13 (1)

Protective Effect of Vegan Microbiota on Liver Steatosis Is Conveyed by Dietary Fiber: Implications for Fecal Microbiota Transfer Therapy

Daskova, N; Heczkova, M; (...); Cahova, M

Jan 2023 | NUTRIENTS 15 (2)

Microbiome and Metabolome Profiles Associated With Different Types of Short Bowel Syndrome: Implications for Treatment

Budinska, E; Gojda, J; (...); Cahova, M

Jan 2020 | JOURNAL OF PARENTERAL AND ENTERAL NUTRITION 44 (1) , pp.105-118

Gut Microbiota as the Link between Elevated BCAA Serum Levels and Insulin Resistance

Gojda, J and Cahova, M

Oct 2021 | BIOMOLECULES 11 (10)

Vegan Diet Is Associated With Favorable Effects on the Metabolic Performance of Intestinal Microbiota: A Cross-Sectional Multi-Omics Study

Prochazkova, M; Budinska, E; (...); Cahova, M

Jan 7 2022 | FRONTIERS IN NUTRITION 8

Determination of Butyrate Synthesis Capacity in Gut Microbiota: Quantification of *but* Gene Abundance by qPCR in Fecal Samples

Daskova, N; Heczkova, M; (...); Cahova, M

Sep 2021 | BIOMOLECULES 11 (9)

Health aspects of vegan diets among children and adolescents: a systematic review and meta-analyses

Alina Koller, Sabine Rohrmann, Maria Wakolbinger, Jan Gojda, Eliška Selinger, Monika Cahova, ...show all

Published online: 09 Oct 2023

Cite this article https://doi.org/10.1080/10408398.2023.2263574 Check for updates

Evidence of a vegan diet for health benefits and risks – an umbrella review of meta-analyses of observational and clinical studies

Eliška Selinger, Manuela Neuenschwander, Alina Koller, Jan Gojda, Tilman Kühn, Lukas Schwingshackl, ...show all

Published online: 16 May 2022

Cite this article https://doi.org/10.1080/10408398.2022.2075311 Check for updates

Prevalence of iodine deficiency among vegan compared to vegetarian and omnivore children in the Czech Republic: cross-sectional study

Svetnicka, M; Henikova, M; (...); El-Lababidi, E

Jul 2023 (Early Access) | EUROPEAN JOURNAL OF CLINICAL NUTRITION

Increased vitamin B6 turnover is associated with greater mortality risk in the general US population: A prospective biomarker study

Schorgg, P; Karavasiloglou, N; (...); Kühn, T

Jun 2022 | May 2022 (Early Access) | CLINICAL NUTRITION 41 (6)

Cross-Sectional Study of the Prevalence of Cobalamin Deficiency and Vitamin B12 Supplementation Habits among Vegetarian and Vegan Children in the Czech Republic

Svetnicka, M; Sigal, A; (...); Gojda, J

Feb 2022 | NUTRIENTS 14 (3)

Differences in Bone Mineral Density between Adult Vegetarians and Nonvegetarians Become Marginal when Accounting for Differences in Anthropometric Factors

Karavasiloglou, N; Selinger, E; (...); Kühn, T

May 2020 | JOURNAL OF NUTRITION 150 (5) , pp.1266-1271

Vitamin B12 Deficiency Is Prevalent Among Czech Vegans Who Do Not Use Vitamin B12 Supplements

Selinger, E; Kühn, T; (...); Gojda, J

Dec 2019 | NUTRIENTS 11 (12)

Chronic dietary exposure to branched chain amino acids impairs glucose disposal in vegans but not in omnivores

Gojda, J; Rossmeislová, L; (...); Andel, M

May 2017 | EUROPEAN JOURNAL OF CLINICAL NUTRITION 71 (5) , pp.594-601

Personal disclosures

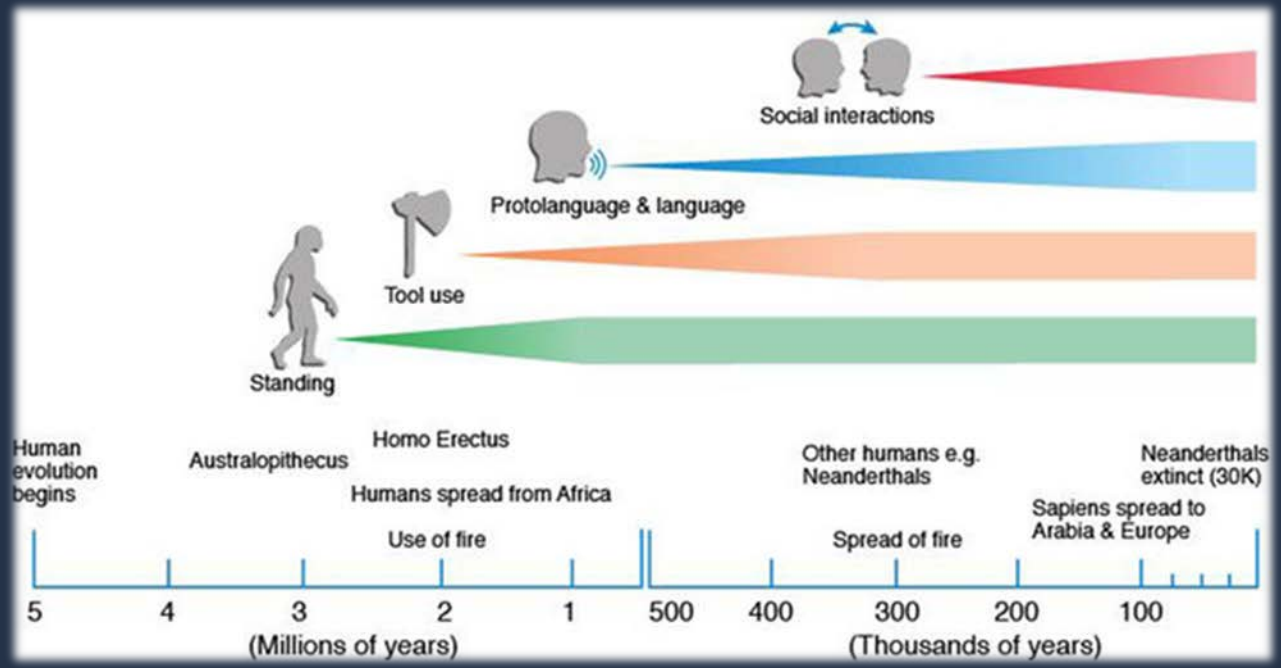
I am large, I contain multitudes.

- Walt Whitman, Song of Myself

VOLUME 87, No. 4 *THE QUARTERLY REVIEW OF BIOLOGY* DECEMBER 2012

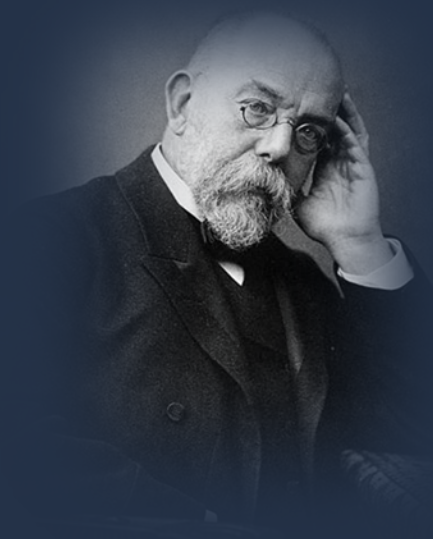
A SYMBIOTIC VIEW OF LIFE: WE HAVE NEVER BEEN INDIVIDUALS

SCOTT F. GILBERT
Department of Biology, Swarthmore College
Swarthmore, Pennsylvania 19081 USA
Biotechnology Institute, University of Helsinki
00014 Helsinki, Finland
E-MAIL: SGILBER1@SWARTHMORE.EDU



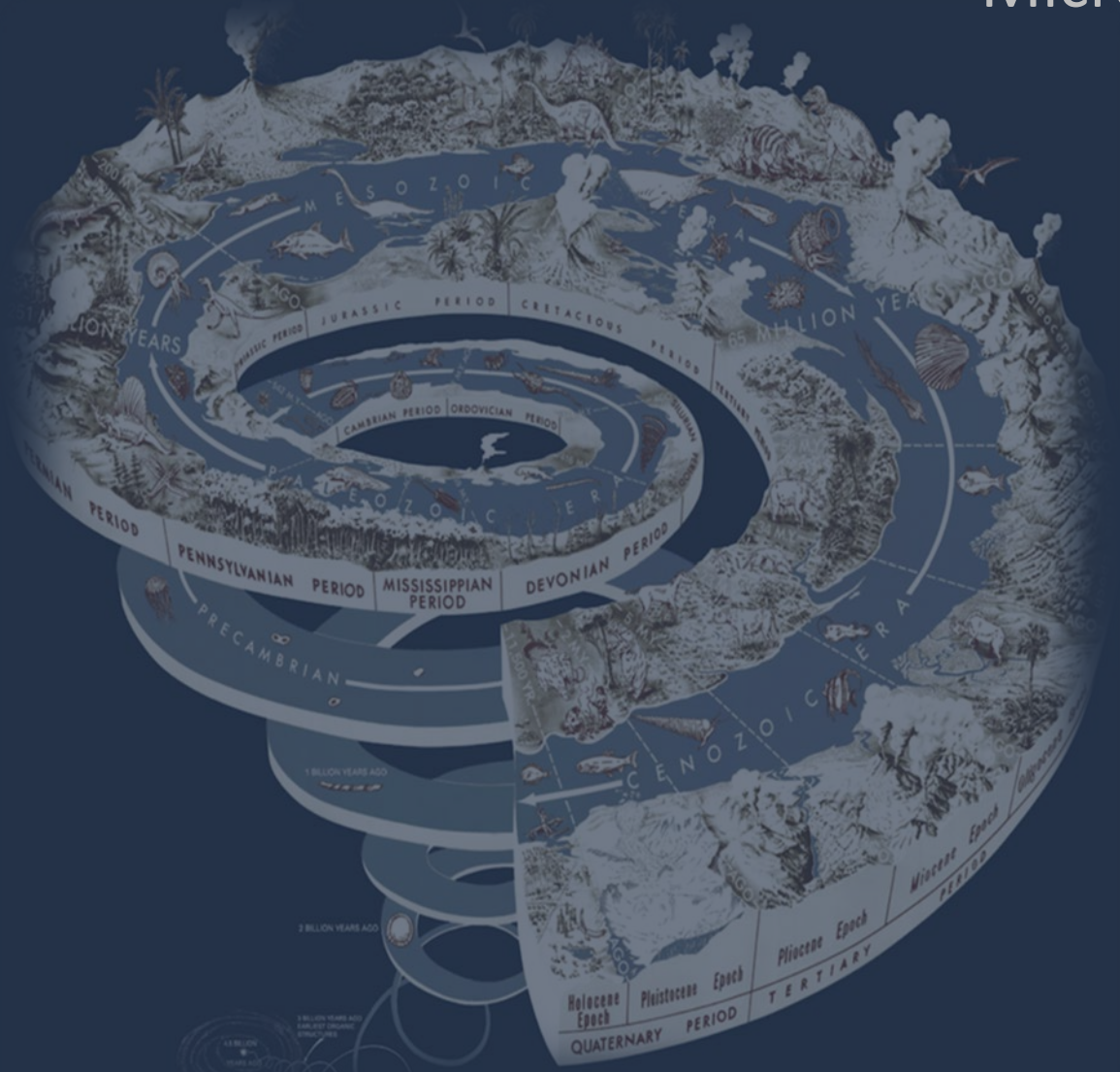
Journal of Neurology, Neurosurgery, and Psychiatry 90(5):jnnp-2017-317245; DOI: 10.1136/jnnp-2017-317245

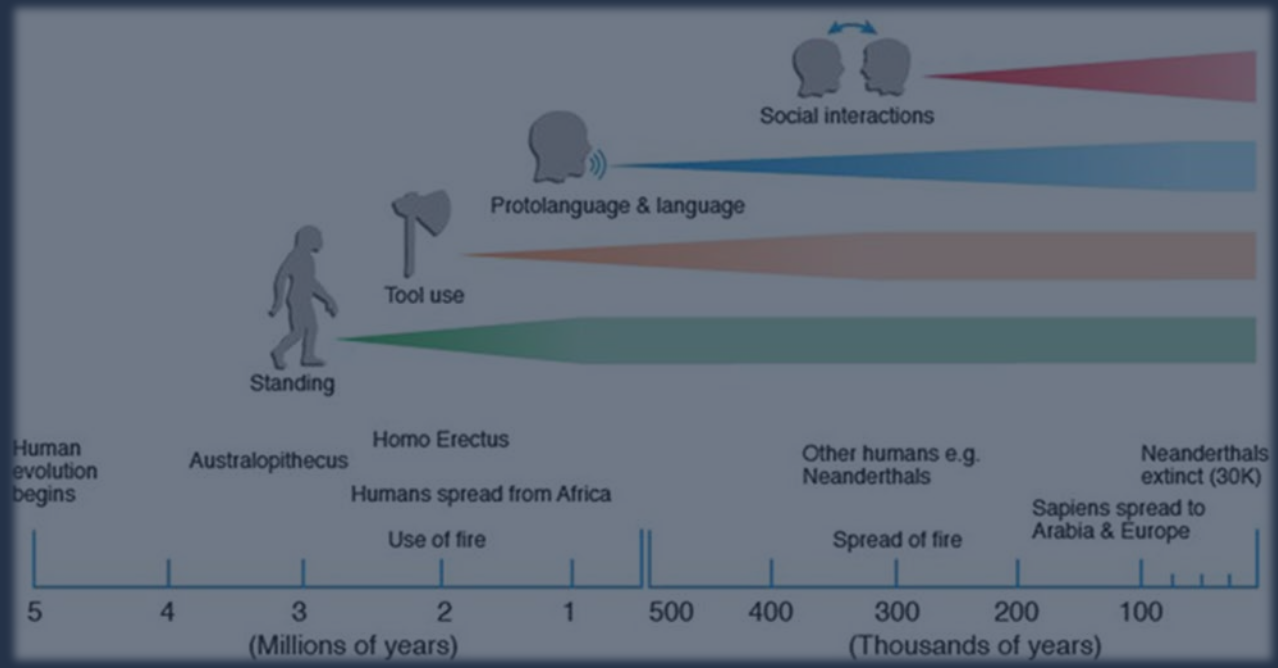
Od Kochova patogenu k dávnému mikrobiálnímu příteli



Microbial old friend hypothesis

Gut. 2005 Mar; 54(3): 317–320.





Journal of Neurology, Neurosurgery, and Psychiatry 90(5):jnnp-2017-317245; DOI: 10.1136/jnnp-2017-317245

Hadza, Tanzania, Africa

(Nat Commun. 2014 Apr15;5:3654.)

Yanomami, Orinoco, Venezuela

(Sci Adv. 2015 Apr 3;1(3). pii: e1500183.)

Subsistence strategy	Hunter-gatherer	Agriculturalist	Industrialized
Lifestyle/Dietary characteristics	Tubers, Settlement, Wild berries, Wild animals	Antibiotics, Settlement, Legumes, Vegetables, Cereals, Fruits	Cities, Antibiotics, Sugary drinks, Animal fat and protein, Prepackaged foods
Enriched taxa	*Prevotella* *Succinivibrio* *Treponema* *Eubacterium* Proteobacteria Spirochaetes Clostridiaceae	*Prevotella* *Succinivibrio* *Treponema* *Eubacterium* *Ruminococcus* Firmicutes Clostridiaceae	*Bacteroides* *Bifidobacterium* *Blautia* *Ruminococcus* Firmicutes
Functional features	• Complex carbohydrate metabolism • Propionate SCFA production • Aromatic amino acid biosynthesis • Vitamin and co-factor synthesis	• Complex carbohydrate metabolism • Propionate SCFA production • Xenobiotic metabolism	• Simple sugar metabolism • Lipid and fat metabolism • Xenobiotic metabolism • Branched chain amino acid metabolism
Relative alpha diversity	High	High	Low

Trends in Microbiolog

Trends in microbiology, 2019, DOI:https://doi.org/10.1016/j.tim.2019.05.006

MICROBIOME DEVELOPMENT

UTERUS

Sparse colonization of placental tissue and amniotic fluid with the commensal bacteria from the mother.
Influence of maternal health conditions and immune status: obesity, gestational diabetes mellitus, atopic diseases.

DELIVERY

Determines the composition of the pioneering microbes:
- Vaginal delivery: *Lactobacillus, Prevotella, Enterobacteriaceae.* Resembles the vaginal microbiota
- C-section: *Staphylococcus, Corynebacterium, Propionibacterium.* Resembles the skin microbiota and show delayed *Bacteroidetes* and *Bifidobacterium* colonization.

BREASTFEEDING

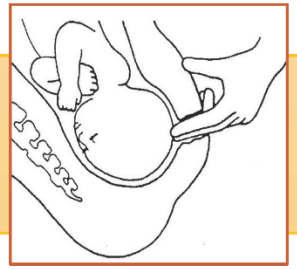
Microbial transfer from BM: *Staphylococcus, Streptococcus, Propionibacterium, etc.*
- **Increases anaerobic organisms**: *Bifidobacterium, Lactobacillus, Veillonella, etc.*

HMO support the growth of beneficial bacteria in the colon.

ENVIRONMENT

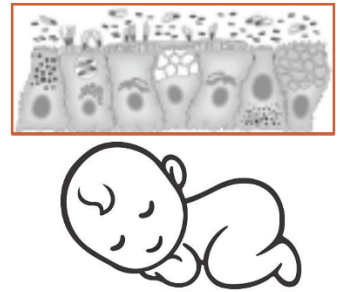
- Number of **siblings**
- Furred **pet** exposure
- Rural vs urban **living areas**
- Household **size**
- **Daycare** attendance

Antibiotics intake: microbial depletion and altered immune system development



Probiotics intake: selective bacterial enrichment

GUT IMMUNITY MATURATION



IMMUNE MATURATION

Molecular signals from the mother contribute to the expansion of intestinal innate immune populations and the secretion of antibodies into the intestinal lumen, as shown in mice models. The information about these mechanisms in human studies is still lacking.

C-section associated to immune system disorders in the child: atopic diseases, obesity, diabetes, etc.
Effect of the delivery mode on the immune system maturation is still not well described.

- **BM bacteria**: maintain colonization resistance against pathogens.
- **IgA, IgM and IgG:** protect the neonatal intestinal mucosal surface and limit inflammation.
- **Antimicrobial proteins**: lactalbumin, lysozyme, lactoferrin.
- **Cytokines** that modulate inflammatory responses.
- **HMOs** inhibit pathogen binding to gut mucosa
- Other **protective/immune** modulating **compounds**: leukocytes, glysosilated proteins, CD14, etc.

- **Favors bacterial diversity** → appropriate immune maturation
- **Innate immune responsiveness**
- Specific allergen **sensitization/tolerance**

Med. Sci. **2018**, *6*(3), 56

Treatment of Insulin Resistance by Modification of Gut Microbiota (ClinicalTrials.gov Identifier: NCT03710850)

Existují diet-specific s rostlinné diety?

Lze je využít k predikc metabolických účinků

Personalizovaná nutri intervence

Cross-

odel

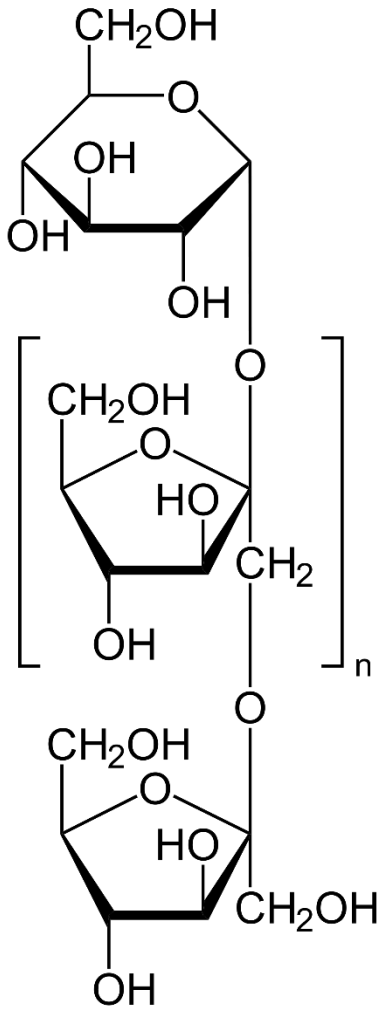
Vegan Diet Is Associated With Favorable Effects on the Metabolic Performance of Intestinal Microbiota: A Cross-Sectional Multi-Omics Study

Magdalena Prochazkova[1], Eva Budinska[2], Marek Kuzma[3], Helena Pelantova[3], Jaromir Hradecky[4], Marie Heczkova[5], Nikola Daskova[5,6], Miriam Bratova[5], Istvan Modos[5], Petra Videnska[2], Petra Splichalova[2], Solomon A. Sowah[7,8], Maria Kralova[9], Marina Henikova[1], Eliska Selinger[1], Krystof Klima[10], Karel Chalupsky[10], Radislav Sedlacek[10], Rikard Landberg[11], Tilman Kühn[12,13†], Jan Gojda[1†] and Monika Cahova[5†]*

frontiers in Nutrition

ORIGINAL RESEARCH
published: 07 January 2022
doi: 10.3389/fnut.2021.783302

Treatment of Insulin Resistance by Modification of Gut Microbiota (ClinicalTrials.gov Identifier: NCT03710850)



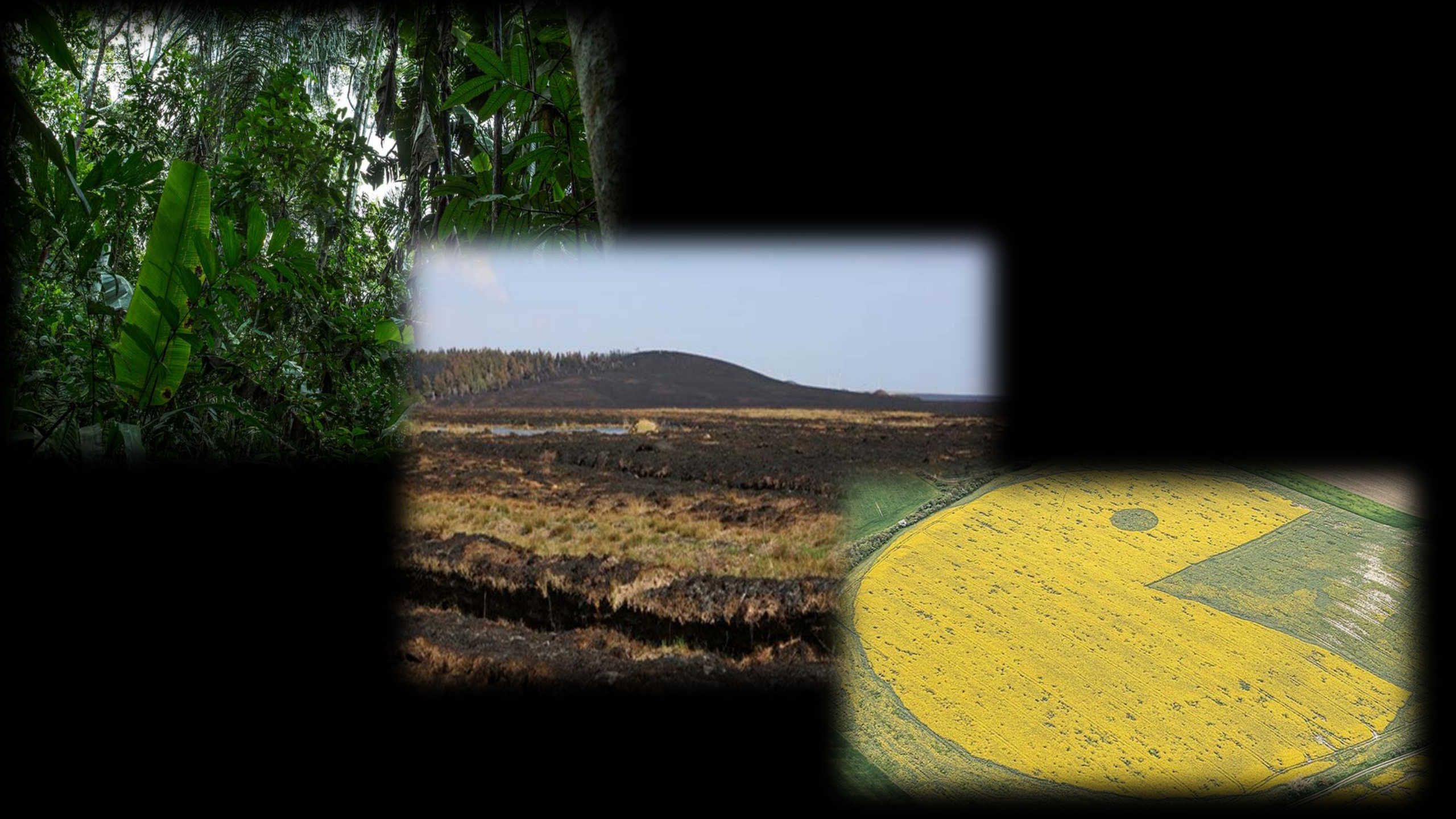
Prediktivní multi-omické vzorce metabolické odpovědi na dlouhodobou dietní intervenci inulinem: personalizace dietní intervence u nově vzniklého diabetu

nature publishing group npg

ARTICLE OPEN

Multi-omics signatures in new-onset diabetes predict metabolic response to dietary inulin: findings from an observational study followed by an interventional trial

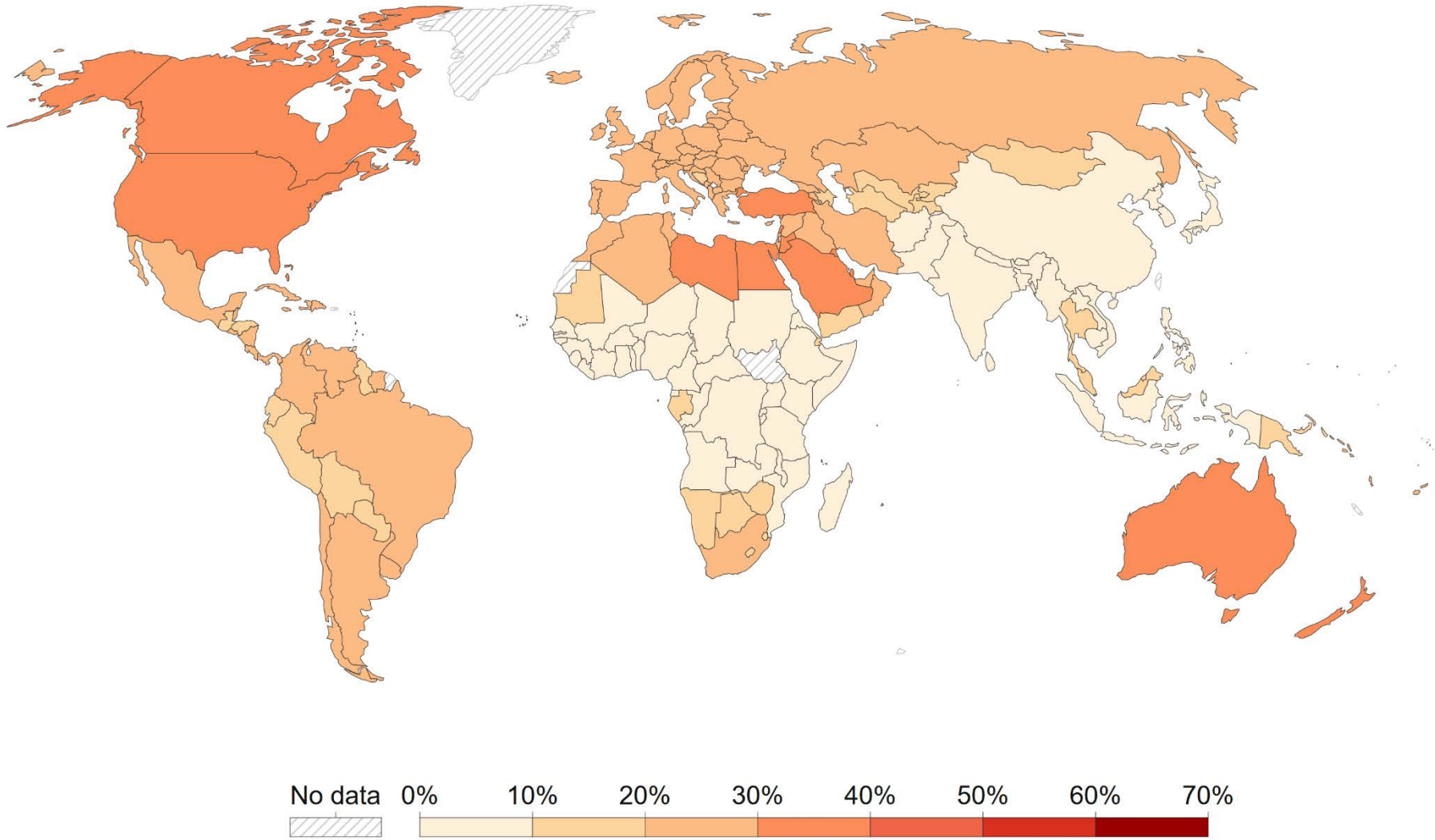
N. Ďásková[1,12], I. Modos[2], M. Krbcová[3], M. Kuzma[4], H. Pelantová[4], J. Hradecký[5], M. Heczková[2], M. Bratová[2], P. Videňská[6], P. Šplíchalová[7], M. Králová[8,12], M. Heniková[3], J. Potočková[3], A. Ouřadová[3], R. Landberg[9], T. Kühn[10,11,13], M. Cahová[2,13]✉ and J. Gojda[3,13]



Share of adults that are obese, 2016

Obesity is defined as having a body-mass index (BMI) equal to, or greater than, 30. BMI is a person's weight (in kilograms) divided by their height (in meters) squared.

Our World in Data

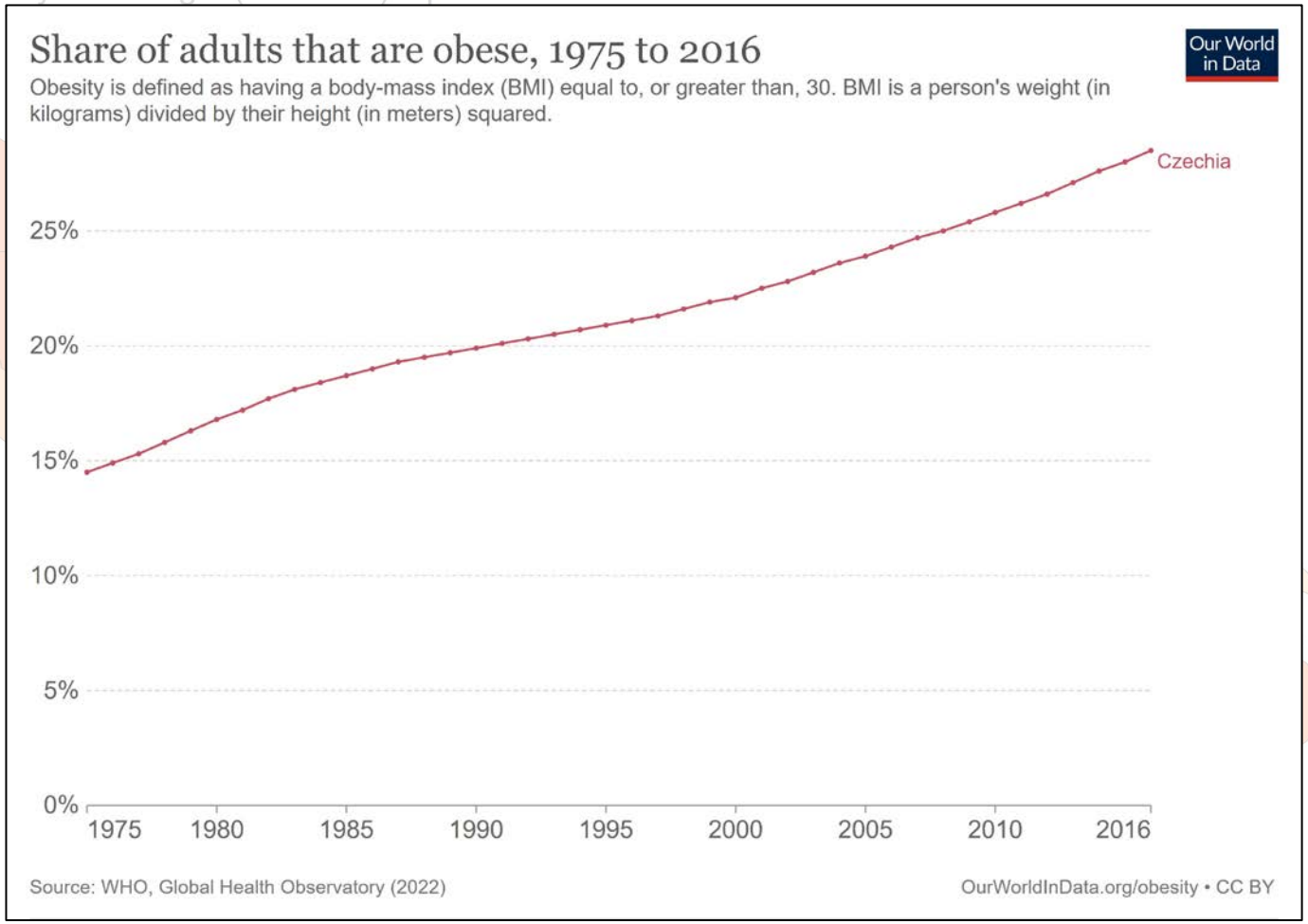


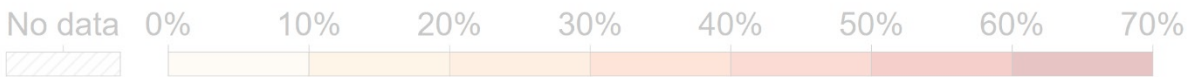
Source: WHO, Global Health Observatory (2022)

OurWorldInData.org/obesity • CC BY

Share of adults that are obese, 2016

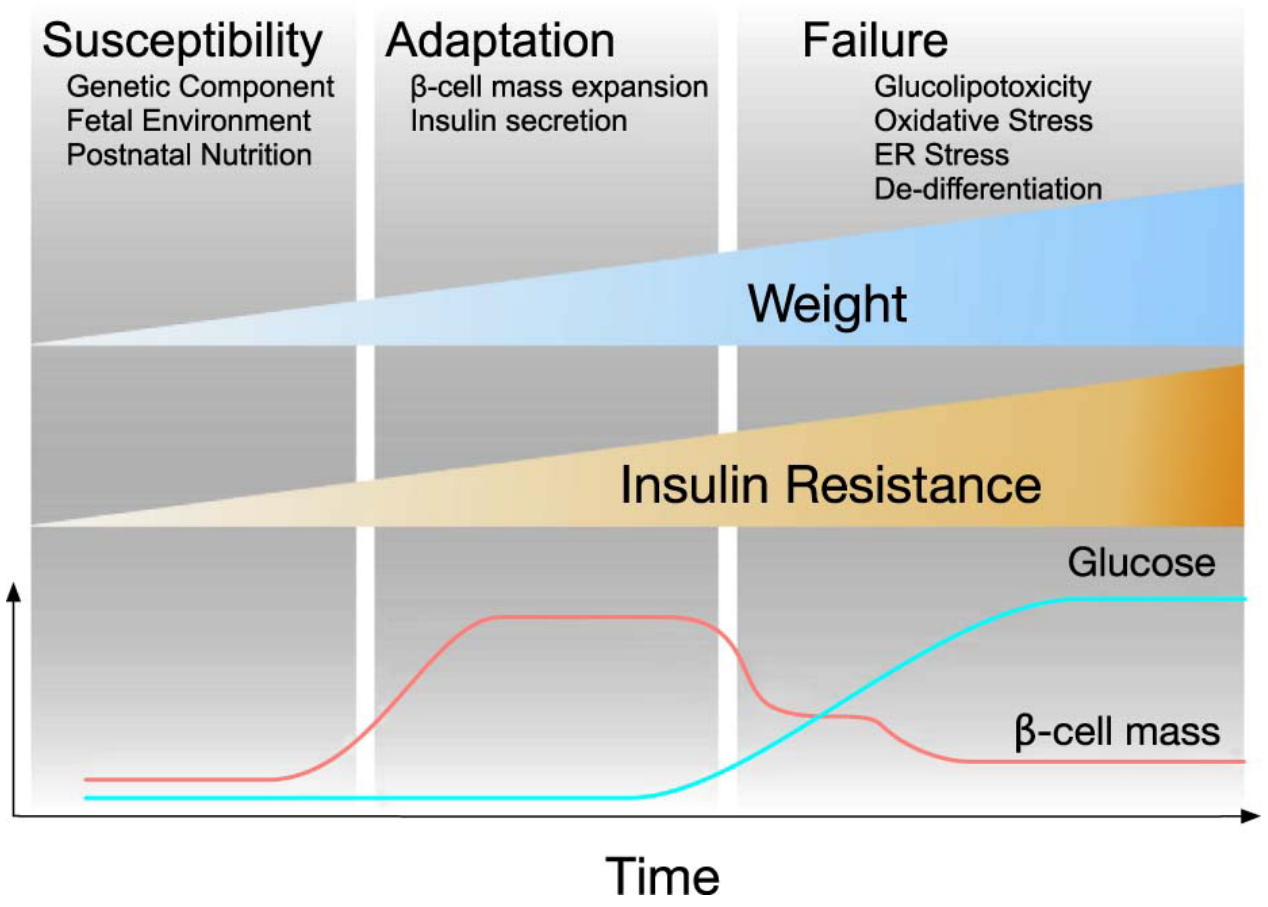
Obesity is defined as having a body-mass index (BMI) equal to, or greater than, 30. BMI is a person's weight (in kilograms) divided by their height (in meters) squared.

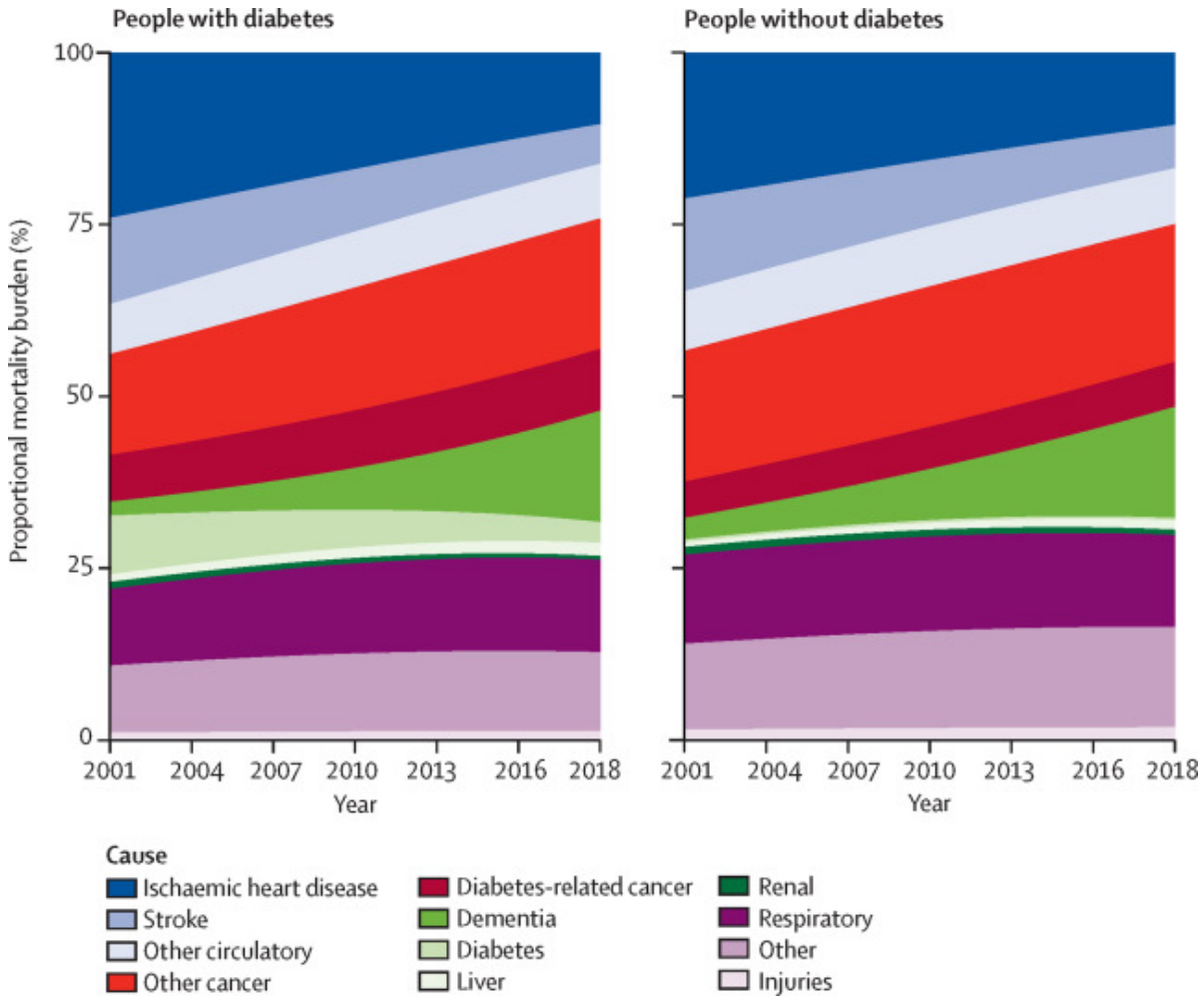




Source: WHO, Global Health Observatory (2022)

OurWorldInData.org/obesity • CC BY





Molecular Aspects of Medicine Volume 42, April 2015, Pages 19-41

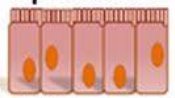
Trends in predominant causes of death in individuals with and without diabetes in England from 2001 to 2018: an epidemiological analysis of linked primary care records. The Lancet. Volume 9, ISSUE 3, P165-173, 2021

Healthy Gut Microbiota

Composition

Bacteroidetes : Firmicutes

Epithelium



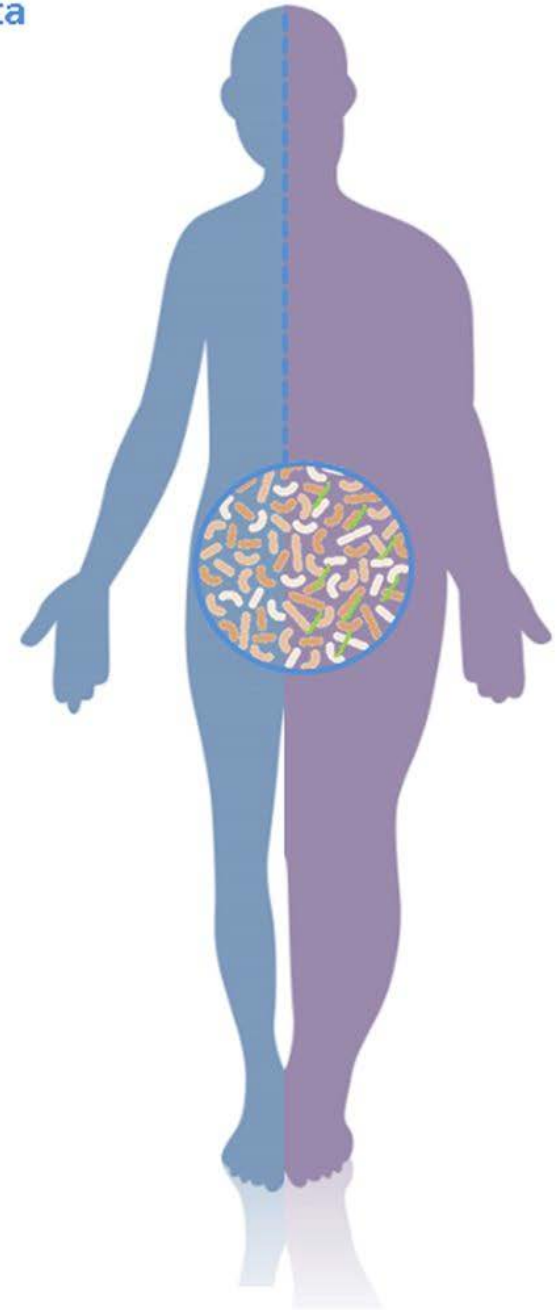
IEC differentiation
Tight junction function
Intestinal barrier integrity
Energy harvest
Vitamin K synthesis
SCFA production

Immune System

Innate and adaptive immune response stimulation

Liver

Acetate and propionate
(Gluconeogenesis / lipogenesis)

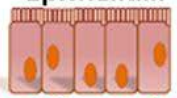


Obese-Diabetic Microbiota

Composition

Bacteroidetes : Firmicutes

Epithelium



IEC differentiation
Tight junction function
Intestinal barrier integrity
Leaky gut
Pathogen colonisation
Energy harvest
SCFA production

Circulatory System

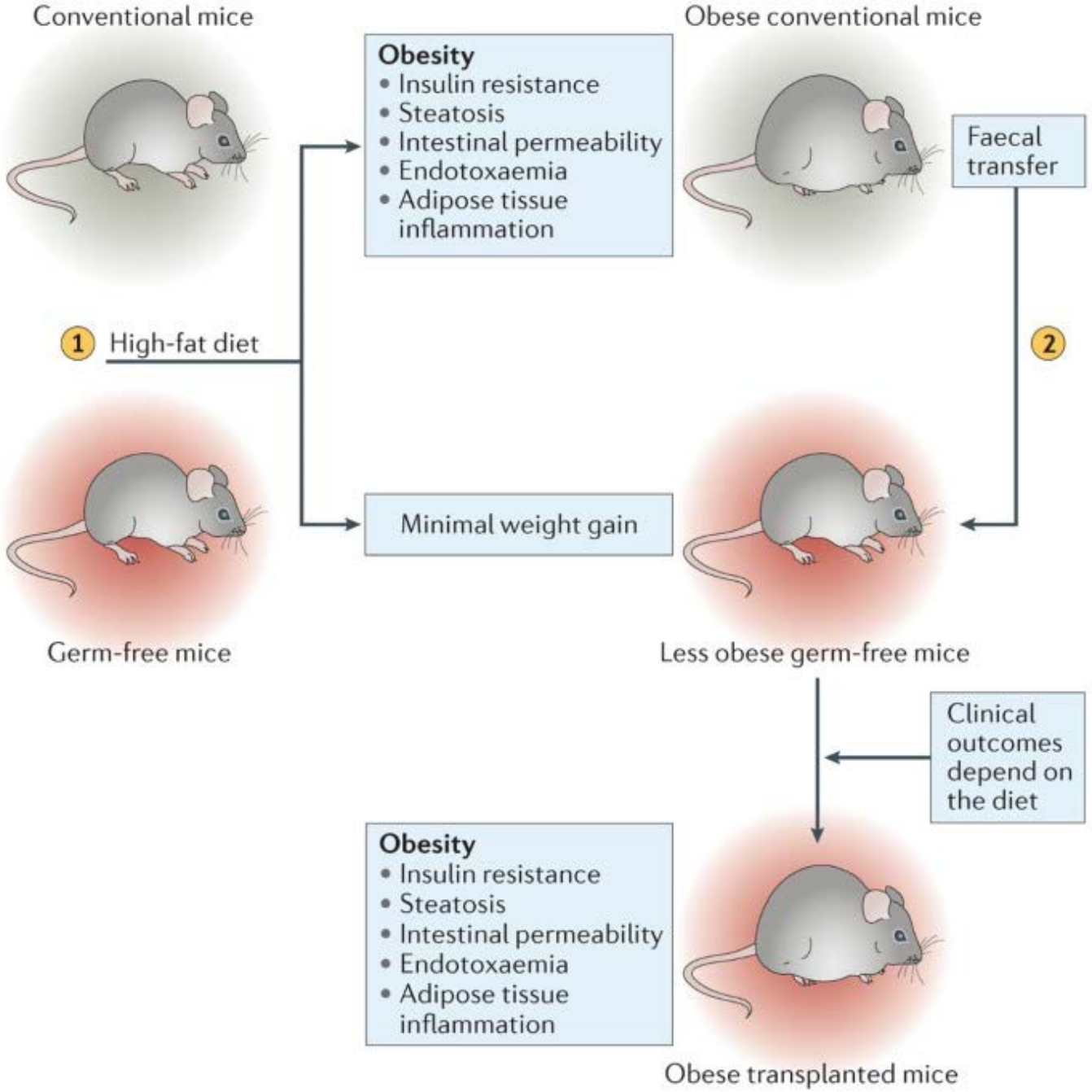
Metabolic endotoxemia (LPS)

Liver

Lipogenesis
Inflammation
Oxidative stress
Insulin resistance

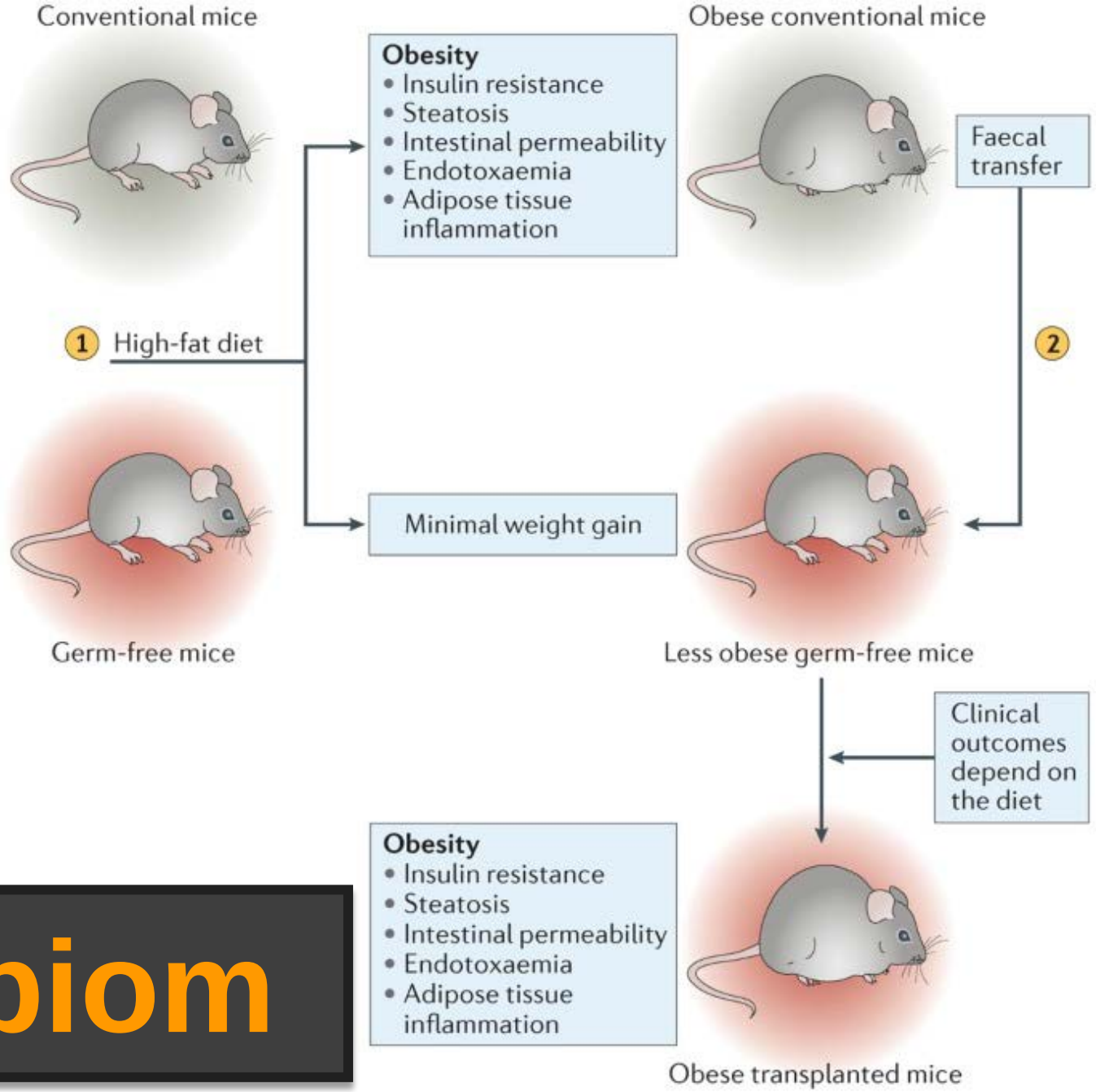
Adipose Tissue

Inflammation
Oxidative stress
Macrophage infiltration
Insulin resistance

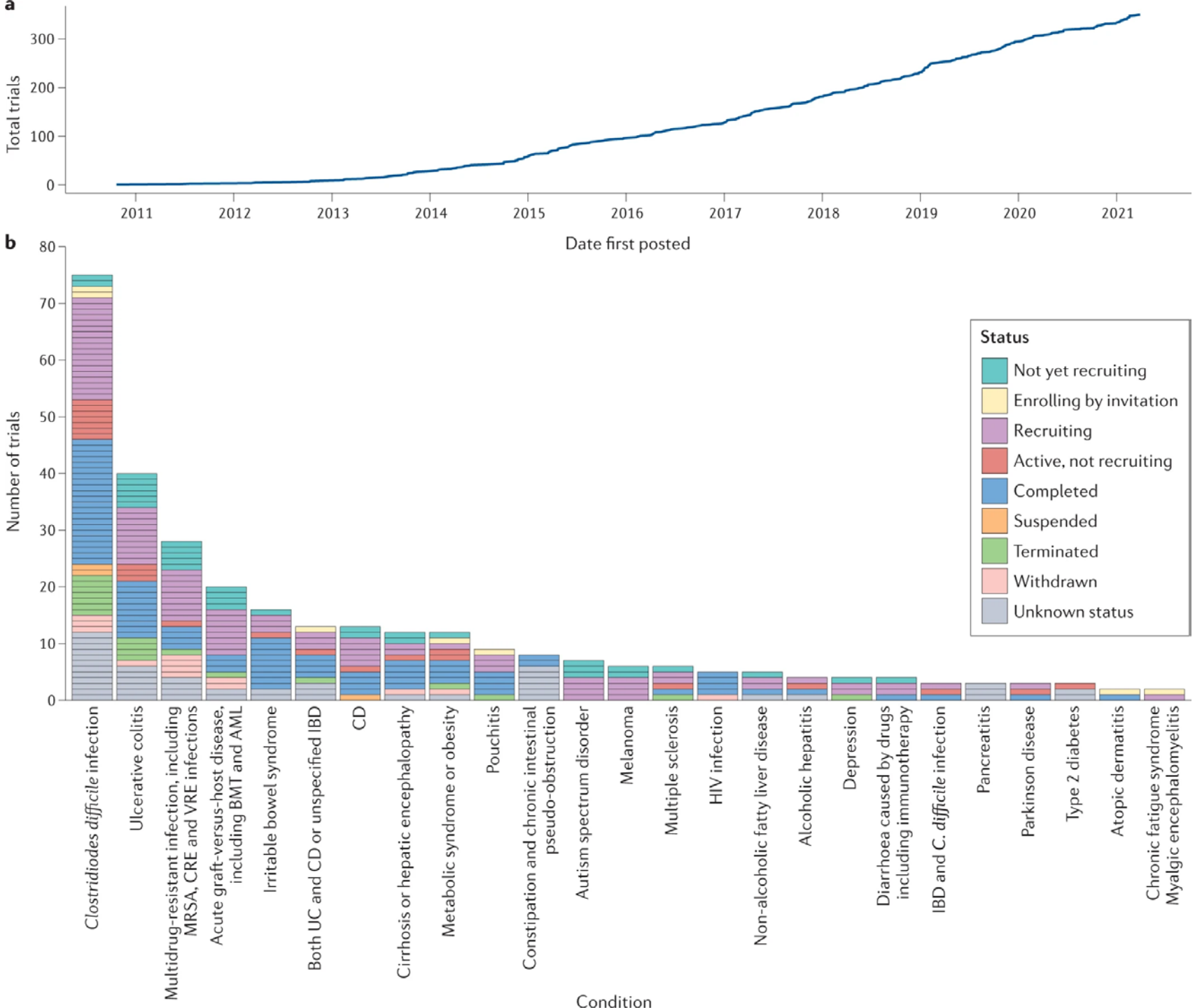


Turnbaugh et al., 2006, Nature 444: 1027-1031

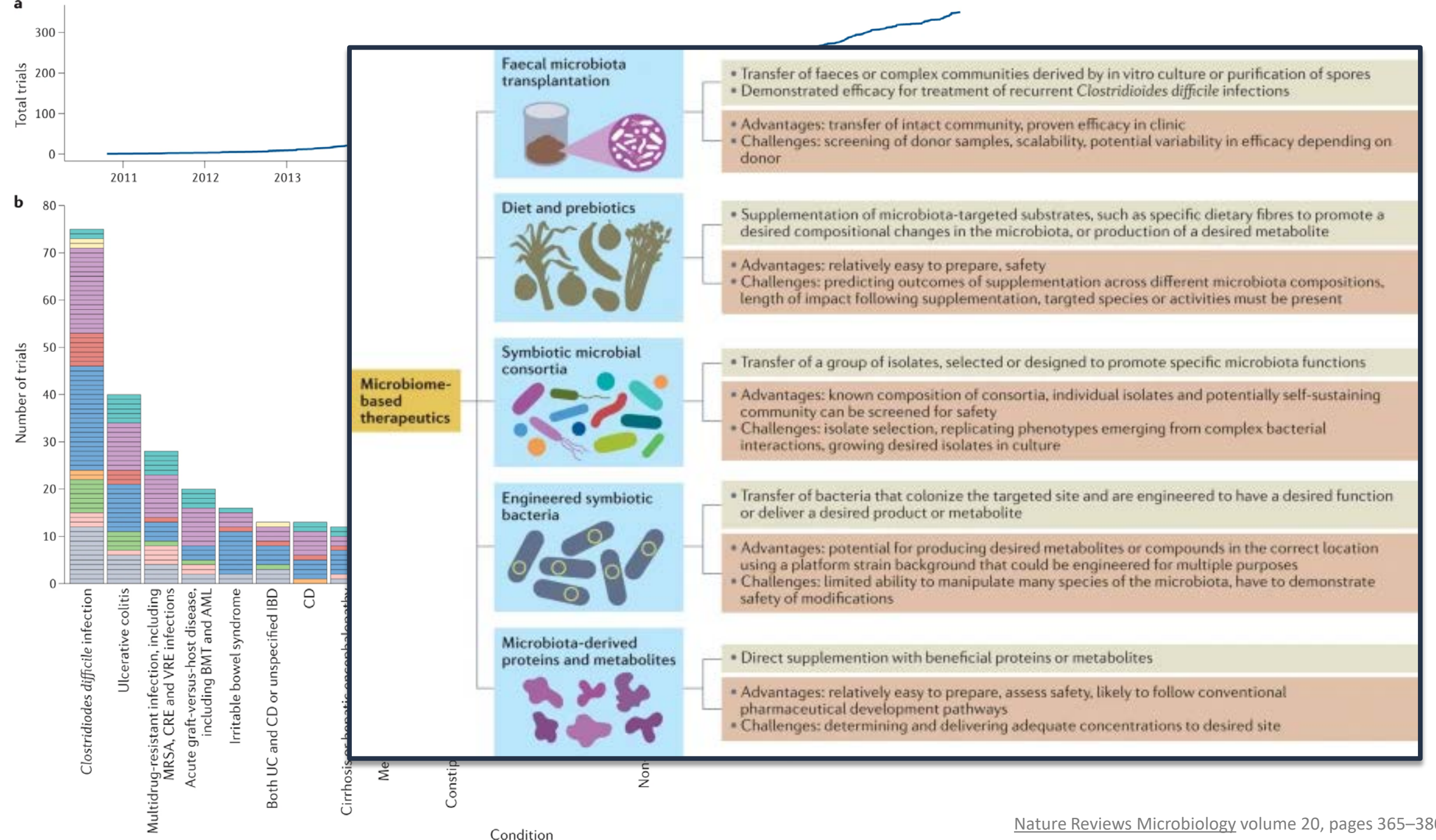
Obézní mikrobiom



Turnbaugh et al., 2006, Nature 444: 1027-1031



Nature Reviews Microbiology volume 20, pages 365–380 (2022)



Nature Reviews Microbiology volume 20, pages 365–380 (2022)

GUIDELINES

Diabetologia (2023) 66:965–985
https://doi.org/10.1007/s00125-023-05894-8

Evidence-based European recommendations for the dietary management of diabetes

The Diabetes and Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD)

https://www.easd.org/academy/academy-activities.html

Food-based approaches in diabetes management

Recommendations

Although enjoying a variety of nutritious foods is encouraged, there are key foods to base meals and snacks around:

- Minimally processed whole grains and wholegrain foods are recommended to improve blood glucose control, cardiovascular risk factors and body weight. ⊕⊕⊕⊖ Moderate
- Whole vegetables and fruit are recommended to improve blood glucose control and other cardiometabolic risk factors. ⊕⊕⊕⊖ Moderate
- Legumes are recommended to improve blood glucose control and other cardiometabolic risk factors. ⊕⊕⊖⊖ Low
- Nuts and seeds are recommended to improve blood glucose control and other cardiometabolic risk factors without increasing risk of obesity. ⊕⊕⊕⊖ Moderate

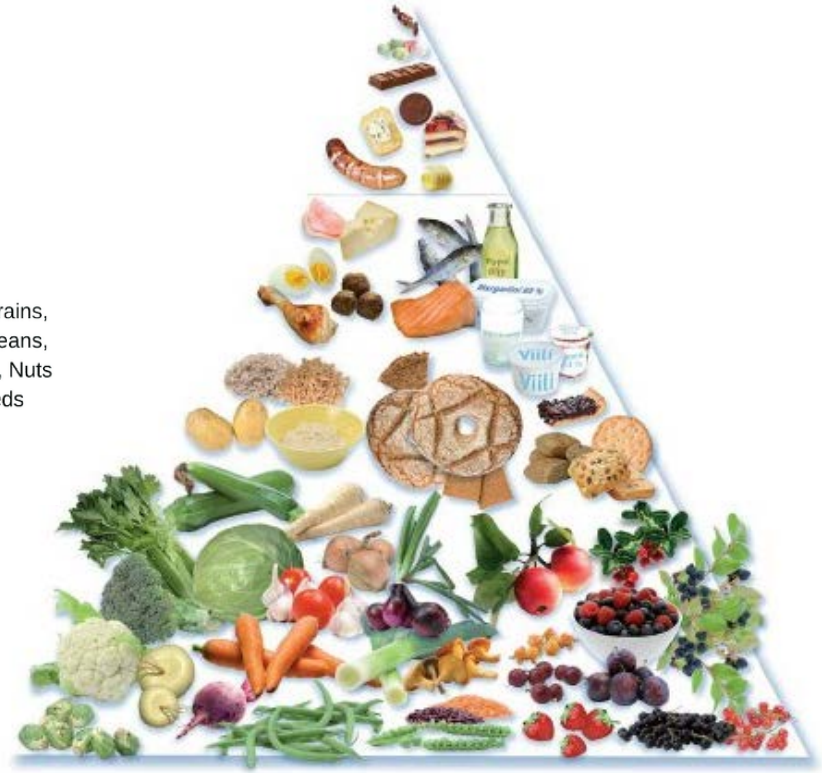
Recommendations

- A variety of dietary patterns emphasising the consumption of whole grains, whole vegetables and fruit, legumes, nuts, seeds and non-hydrogenated non-tropical vegetable oils, while minimising the consumption of meat (especially red and processed meat), sugar-sweetened beverages, sweets and refined grains are recommended. These patterns include:
  - Mediterranean dietary pattern to improve glycaemia and other cardiometabolic risk factors (⊕⊕⊕⊖ Moderate) and reduce risk of CVDs and all-cause mortality (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate).
  - Nordic dietary pattern to improve BMI (⊕⊕⊕⊕ High) and other cardiometabolic risk factors (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate) and reduce the risk of CVDs (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate).
  - Vegetarian dietary pattern to improve glycaemia and other cardiometabolic risk factors (⊕⊕⊕⊖ Moderate).

Středomořská dieta

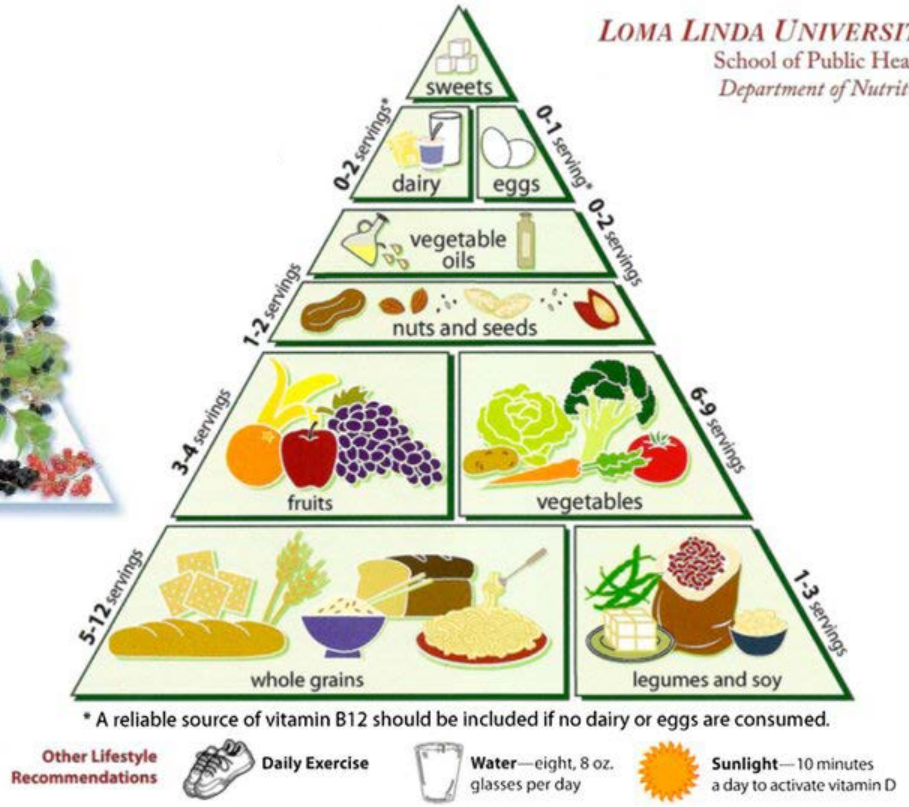
DOI: 10.3390/nu12092693

Severská dieta



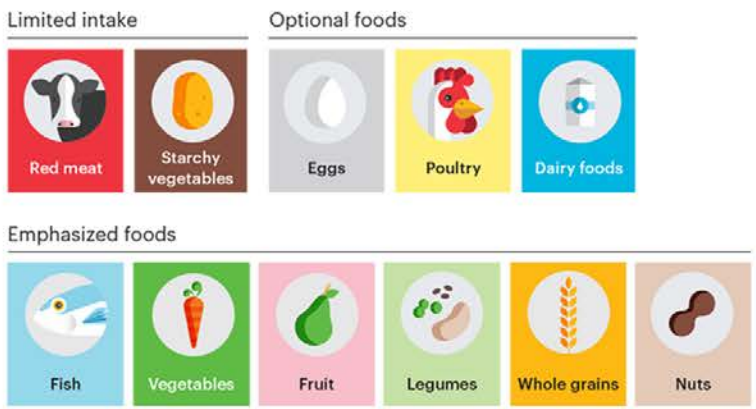
DOI: 10.1017/S1368980013002395

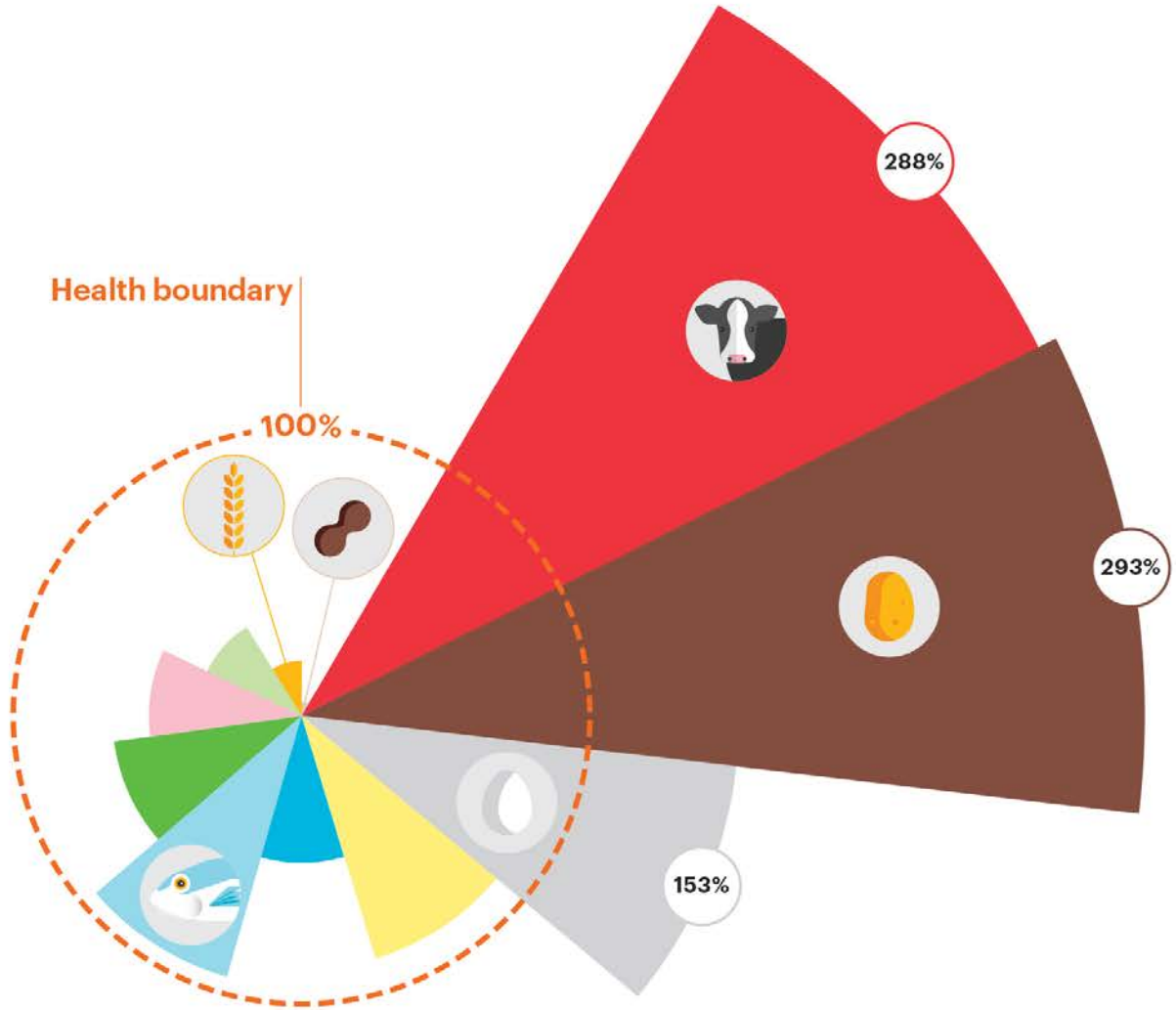
Vegetariánská dieta



Current Diets vs Planetary Health Diet

Global





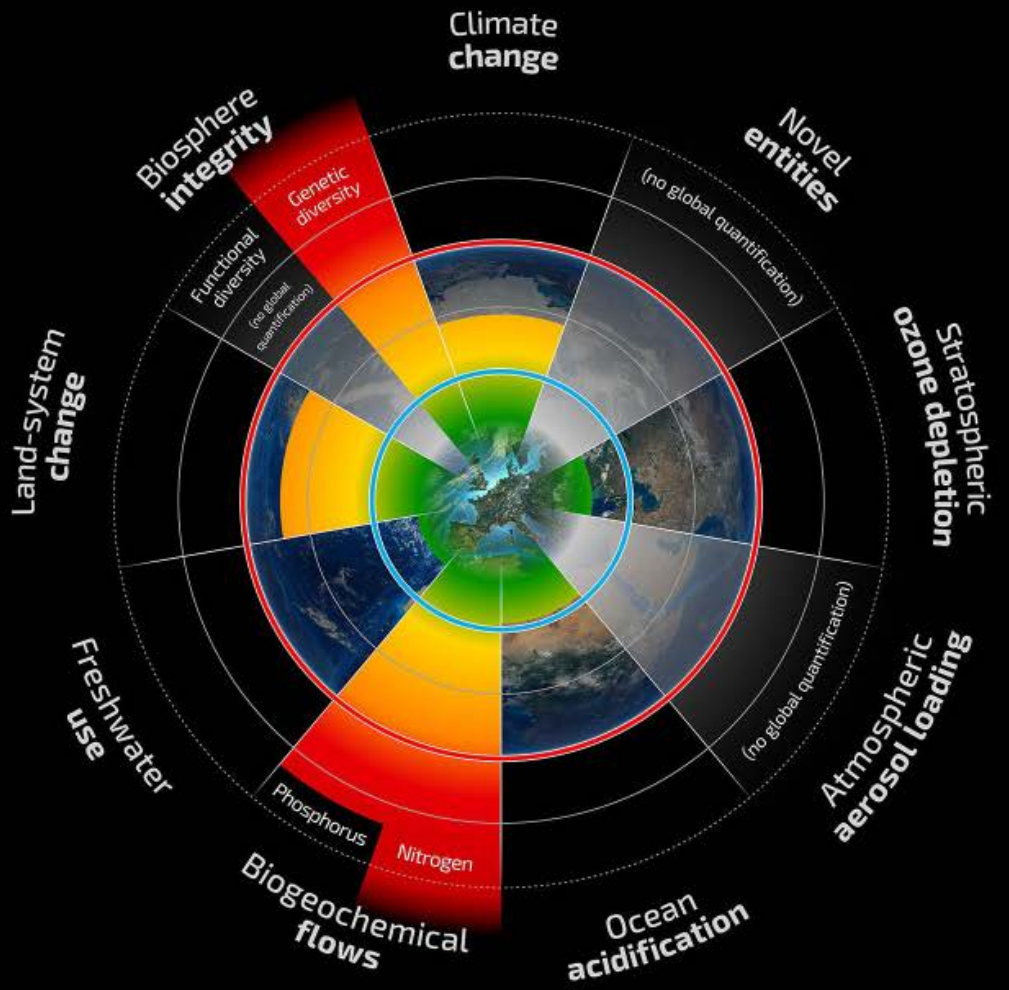
EAT

Anthropocene: Healthy Diets From Sustainable Food Systems

https://eatforum.org/eat-lancet-commission/the-planetary-health-diet-and-you/

Planetary Boundaries

A safe operating space for humanity



- **Beyond zone of uncertainty** (high risk)
- **In zone of uncertainty** (increasing risk)
- **Below boundary** (safe)
- **Boundary not yet quantified**

EAT

Cancer: Carcinogenicity of the consumption of red meat and processed meat

26 October 2015 | Q&A

World Health Organization

Red Meat Consumption, CVD, and Diabetes

AMERICAN COLLEGE of CARDIOLOGY

EASD

European Association for the Study of Diabetes

GUIDELINES

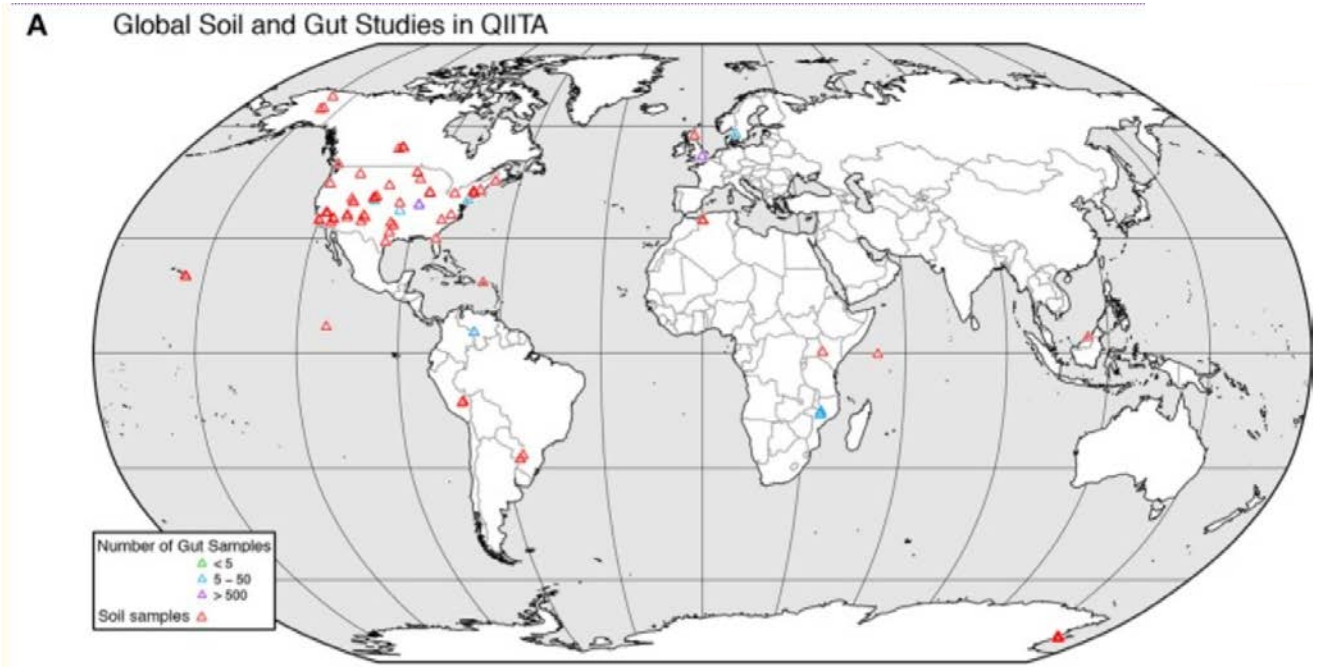
Diabetologia (2023) 66:965–985
https://doi.org/10.1007/s00125-023-05894-8

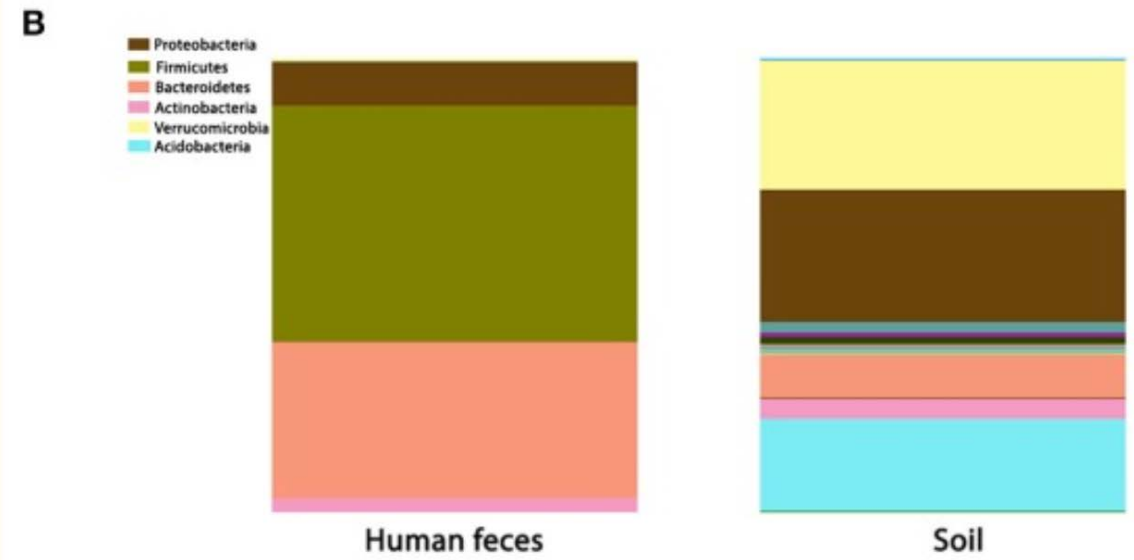
Evidence-based European recommendations for the dietary management of diabetes

The Diabetes and Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD)

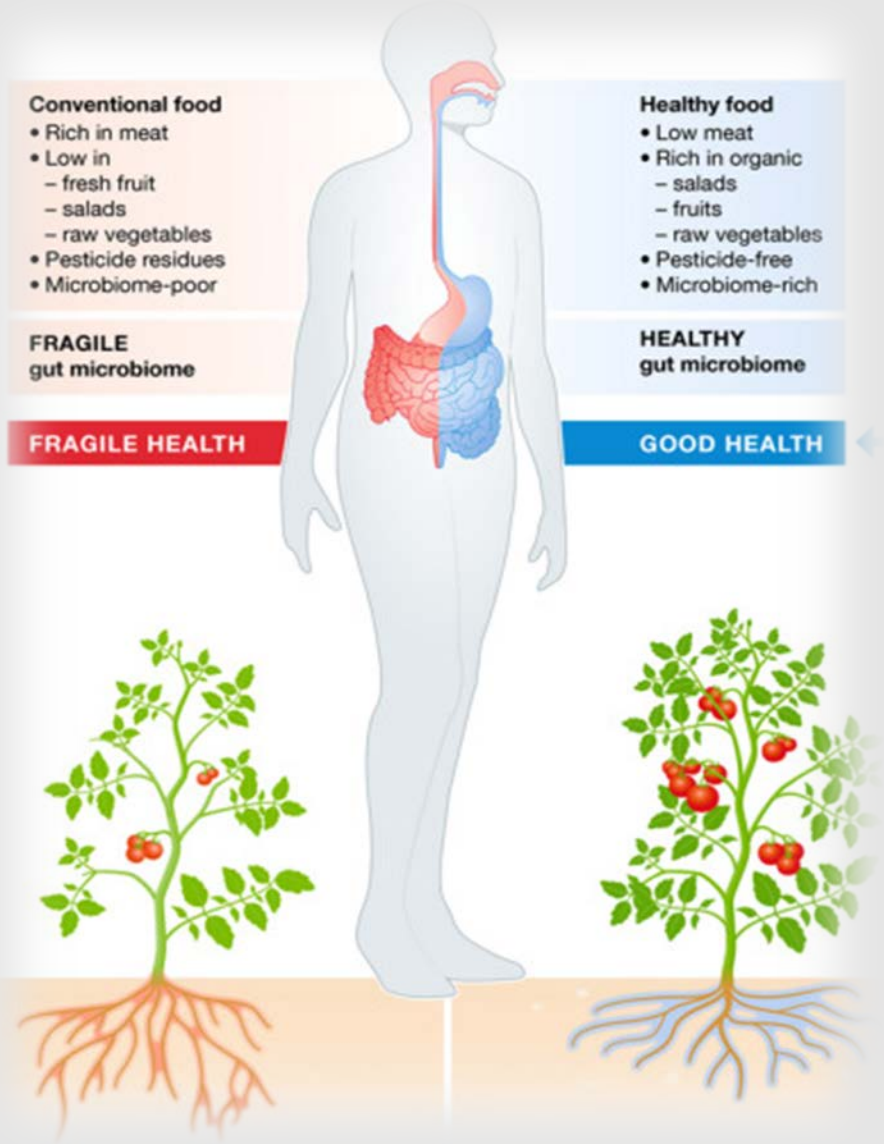
Soil-gut axis

- Horizontlní přenos půdních bakterií
- Obousměrná závislost mezi střevním a půdním mikrobiomem
- Expozice půdním bakteriím zvyšuje střevní diverzitu
- *Streptomyces* produkují protizánětlivé/antiproliferativní substance, jsou v půdě a střevech lovců (*FEMS Microbiology Ecology*, Volume 94, Issue 8, 1 August 2018)





Front Microbiol. 2017; 8: 1935.



EMBO Rep. 2020 Aug 5; 21(8): e51069. doi: 10.15252/embr.202051069

ČMS

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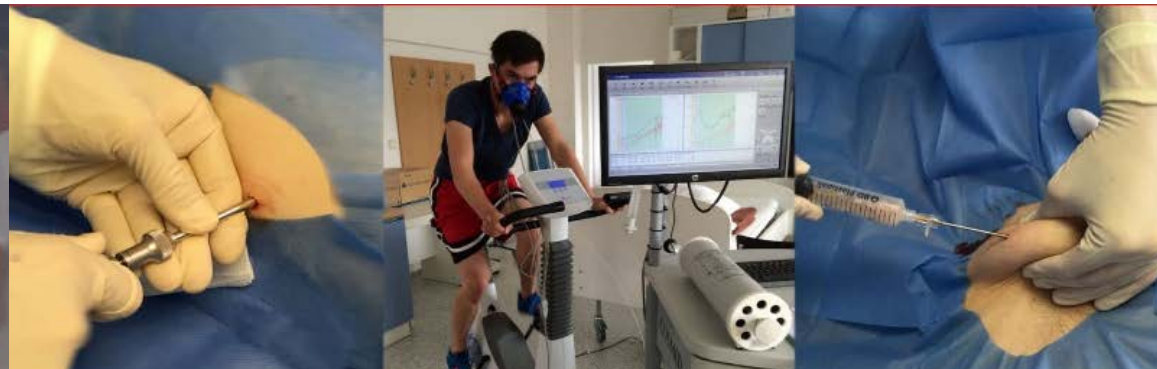

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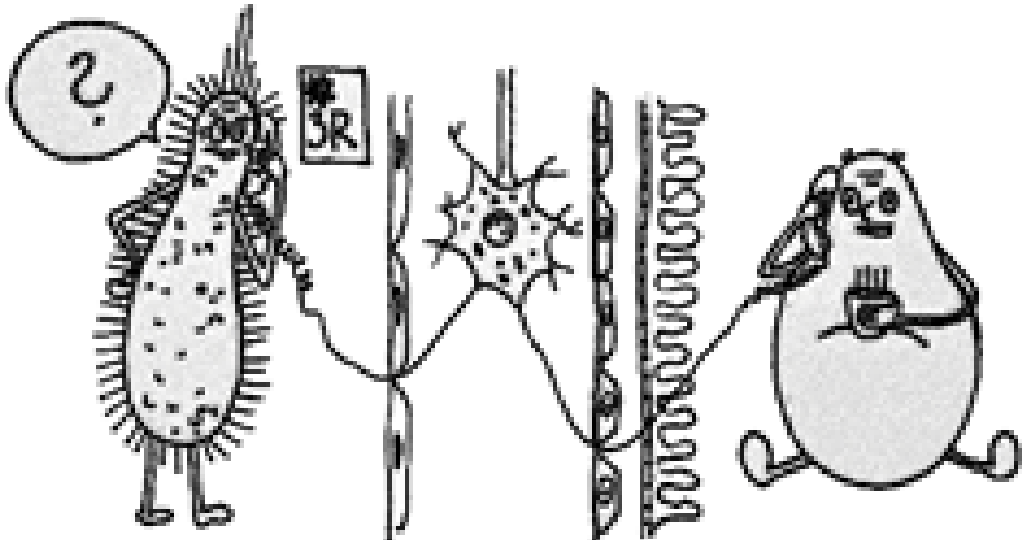

Jak se do střeva volá, tak se ze střeva ozývá

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