Fermented Foods and Live Microorganisms in the Swiss Diet: Consumption, Health Benefits & Sustainability

Eugenia Pertziger
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Role of the gut microbiota

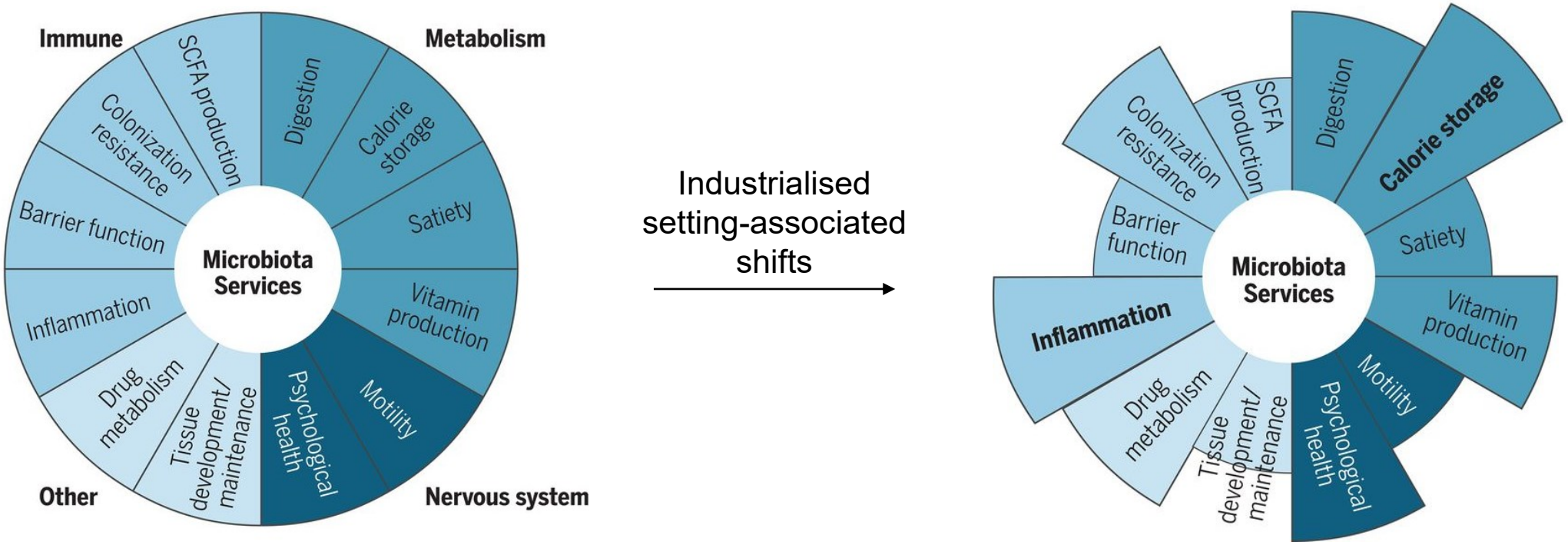

Figure: Sonnenburg & Sonnenburg, Science. 2019;366(6464)
Sonnenburg & Sonnenburg, Nat Rev Microbiol. 2019;17(6):383-390

Benefits of live microbes intake: Cardiometabolic health

The Journal of Nutrition 153 (2023) 1143–1149

ASN EST. 1928 American Society for Nutrition Excellence in Nutrition Research and Practice

JN THE JOURNAL OF NUTRITION

journal homepage: www.journals.elsevier.com/the-journal-of-nutrition

Nutritional Epidemiology

Positive Health Outcomes Associated with Live Microbe Intake from Foods, Including Fermented Foods, Assessed using the NHANES Database

Colin Hill [1,†], Daniel J. Tancredi [2,†], Christopher J. Cifelli [3], Joanne L. Slavin [4], Jaime Gahche [5], Maria L. Marco [6], Robert Hutkins [7], Victor L. Fulgoni III [8], Daniel Merenstein [9], Mary Ellen Sanders [10,*]

- In the NHANES study, an **additional 100-g intake of microbe-containing foods** was associated with a **lower systolic blood pressure**, **C-reactive protein**, **plasma glucose**, **plasma insulin**, **triglyceride**, **waist circumference**, and **BMI** levels and a **higher** level of **HDL cholesterol**

Hill et al., J Nutr. 2023;153(4):1143-1149
NHANES, National Health and Nutrition Examination Survey (USA)

Benefits of live microbes intake: Depression symptoms

Journal of Affective Disorders 347 (2024) 108–114

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Effect of dietary living microbe intake on depression symptom in American adult: An opinion from NHANES study

Yumeng Shi [a,c,d], Chao Yu [a,b,c,d,*]

- In the NHANES study, patients with **Med and High dietary live microbe intake** exhibited a significant **reduction in depression symptoms prevalence** by **28%** (OR, 0.72; 95 % CI: 0.64–0.81) and **26%** (OR, 0.74; 95 % CI: 0.63–0.85), respectively, compared to those with low dietary live microbe intake

Shi & Yu, J Affect Disord. 2024;15:347:108-114
NHANES, National Health and Nutrition Examination Survey (USA)

Health benefits of live microbes intake: first Adequate Intake (AI) value estimation

Journal of Food Science
A Publication of the Institute of Food Technologists

REVIEW ARTICLE | Open Access

The impact of live dietary microbes on health: A scoping review

Ajay Iyer, Arghya Mukherjee, Beatriz Gómez-Sala, Eibhlís M. O'Connor, John G. Kenny, Paul D. Cotter

- A **median intake** value of **2×10^9 CFU/day** of dietary microbes was associated with non-negative outcomes

Iyer et al., J Food Sci. 2024 (online ahead of print)

Metabolic nutrient profiling project

menuCH Survey

Population
Healthy adults (n = 2086)
Nationwide study across 3 linguistic regions

Dietary assessment
2x 24h recalls (n = 2057)

Health assessment
Anthropometrics, BMI

Biological sampling
NA

Swiss Kidney Stone Cohort (SKSC)

Population
Patients with kidney stones (n = 760)
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- Protocol for classifying and estimating live microbes and fermented foods intake in the Swiss adult population

menuCH data classification

- **3,826** unique food items: Foods, Recipes, and Ingredients

- **1,519** unique Foods and Ingredients

- **Stage 1**: Fermented foods classification
  - Fermented or non-fermented (n = 1,519)
  - For fermented foods, core microbiota composition (n = 266)
  - For fermented foods, live microorganisms presence or absence at consumption, including methods of inactivation or removal (n = 266)
  - For composite foods containing fermented ingredients, proportion of fermented ingredients (n = 379)

- **Stage 2**: Live microorganisms levels
  - Low, Medium, High (n = 1,519)

- **Stage 3: Cooking or processing method**
  - 1,519 Foods and Ingredients
    - e.g. dried or peeled fruit
  - 2,306 unique Recipes
    - e.g. sandwich with several ingredients
  - 3,341 unique Food-Ingredient pairs
    - e.g. potato and cooking fat

Agroscope

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Classification example: fermented foods

Bread, 36.8 g

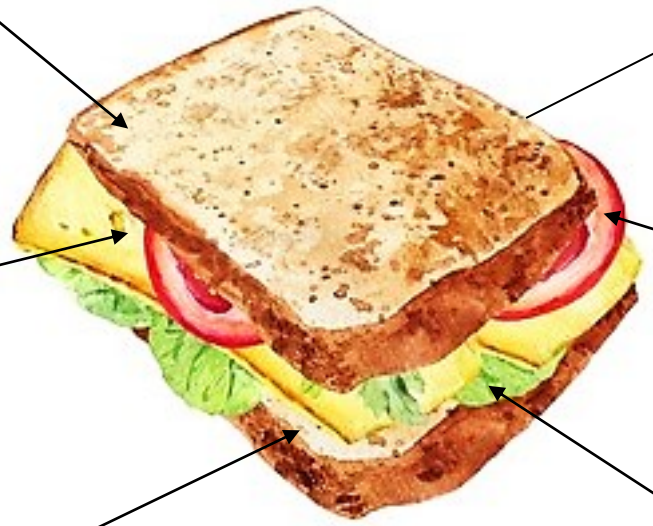
- Fermented food
- Microbiota: Saccharomyces cerevisiae (De Vuystet al., 2017)
- Microorganisms at consumption: inactive (heat)

Gruyère cheese (CH), 11 g

- Fermented food
- Microbiota: Streptococcus thermophilus, Lactobacillus delbrueckiissplactis, Lb. helveticus (Hartmann et al., 2017)
- Microorganisms at consumption: live

Mayonnaise, 4.4 g

- Non-fermented food



Cucumber, pickled, 18.3 g

- Fermented ingredient: Vinegar, 5.6 g
- Microbiota: Komagataeibactereuropaeus, K. oboediens, K. intermedius, Acetobacter pomorum, Gluconacetobacterentanii (Gullo & Giudici, 2008)
- Microorganisms at consumption: absent (filtration, pasteurisation)

Tomato, raw, 22.1 g

- Non-fermented food

Leafy salad, raw, 7.4 g

- Non-fermented food

Sandwich, 100 g

Composition estimated with the Swiss FCDB, Food ID 1560
Amount of vinegar estimated with the Australian FCDB, Food ID F004206

Image: shutterstock.com

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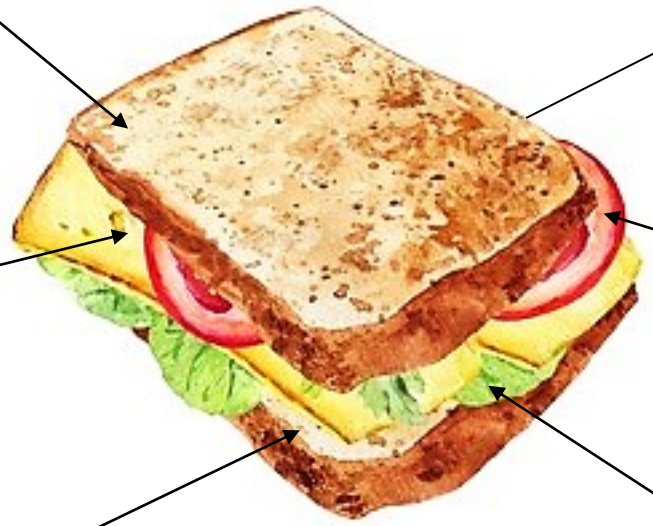

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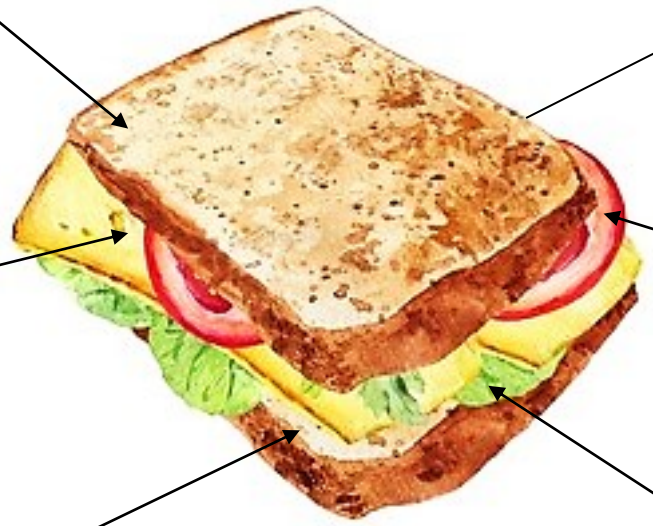

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Sandwich, 100 g

Composition estimated with the Swiss FCDB, Food ID 1560
Amount of vinegar estimated with the Australian FCDB, Food ID F004206

Image: shutterstock.com

Classification example: live microorganisms

Bread, 36.8 g

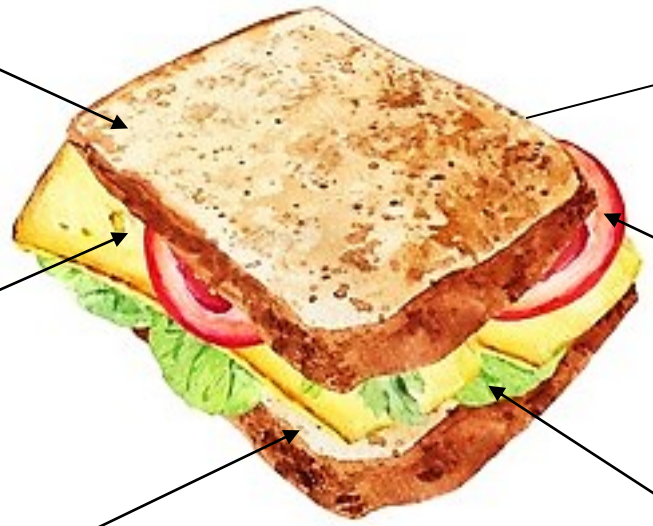
- Level of live microbes:
  Low (<10^4 CFU/g)

Gruyère cheese (CH), 11 g

- Level of live microbes:
  High (>10^7 CFU/g)

Mayonnaise, 4.4 g

- Level of live microbes:
  Low (<10^4 CFU/g)



Cucumber, pickled, 18.3 g

- Level of live microbes:
  Low (<10^4 CFU/g)

Tomato, raw, 22.1 g

- Level of live microbes:
  Medium (10^4–10^7 CFU/g)

Leafy salad, raw, 7.4 g

- Level of live microbes:
  Medium (10^4–10^7 CFU/g)

Sandwich, 100 g

Estimated levels of live microbes were adapted from Marco et al., 2022, J Nutr.;152(7):1729-1736, accounting for food processing techniques in Switzerland

Image: shutterstock.com

menuCH: further analyses

- Adjustment for age, sex, and linguistic region and investigation of differences in fermented foods and live microbes intake
- Nutrient contribution from fermented foods and foods with live microbes
- Characterisation of microbes consumed with fermented foods
- Associations between live microbes and fermented foods intake and health parameters (waist-to-hip ratio, BMI)

Metabolic nutrient profiling project

Swiss Kidney Stone Cohort (SKSC)

KIDNEY CONTROL OF HOMEOSTASIS
SWISS NATIONAL CENTRE OF COMPETENCE IN RESEARCH

Population
Patients with kidney stones (n= 760)
Healthy controls (n = 195)

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2x 24h recalls (n = 590)

Health assessment
Anthropometrics, BMI
Clinical biochemistry, Renal health

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Plasma

- Associations between live microbes and fermented foods intake and health parameters
- Metabolomics, 24h urine samples
  - 3 platforms (Agroscope) →
  - Biomarkers of live microbes and fermented foods intake
  - Biomarkers of kidney stones

Agroscope

Fermentation and sustainability

- Preservation of food and increased shelf life
  - Formation of organic acids (lowering of pH), alcohols and bacteriocins as well competitive advantage of fermentation-associated microorganisms against pathogens
- Synthesis or increased bioavailability of proteins, vitamins, antioxidants, and bioactive compounds
- Relatively small environmental footprint of microbial biomass production

Choi et al., 2022, Microb Biotechnol.;15(1):18-25

Fermentation and sustainability: collaboration with the Agroscope LCA group

- Comparison of LCA, nutritional quality, and protein digestibility (DIAAS) of protein sources:
  - animal-based
  - plant-based (non-fermented vs fermented)
  - microorganism-derived

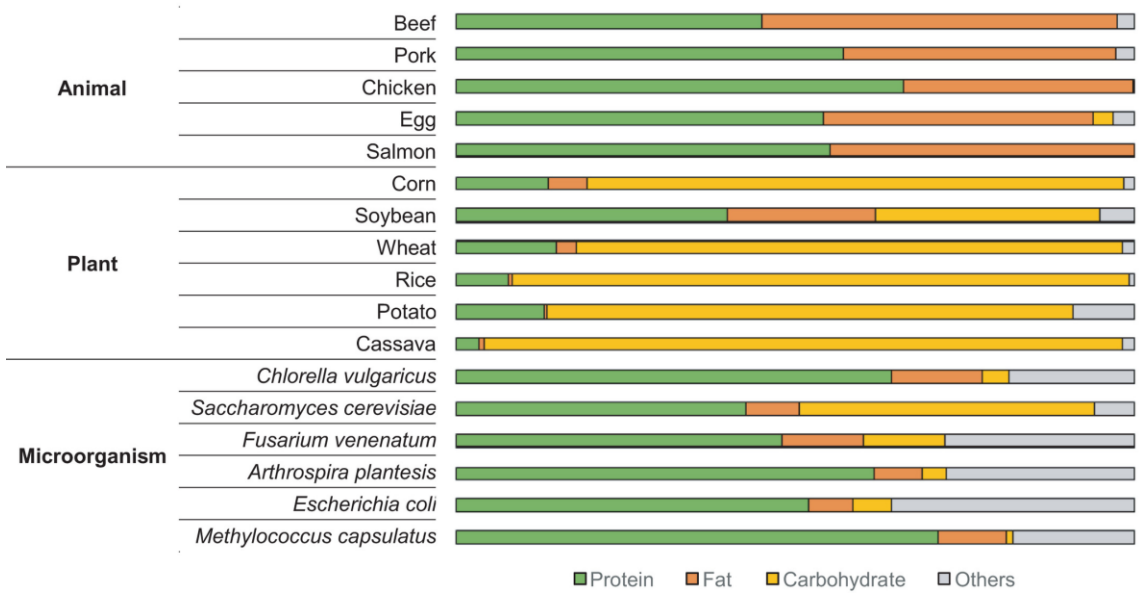

Figure: Choi et al., 2022, Microb Biotechnol.;15(1):18-25

Next…

- If you would like to follow the results of the study, connect with Eugenia Pertziger on LinkedIn: https://www.linkedin.com/in/eugenia-pertziger

Agroscope

Project team and collaborators

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