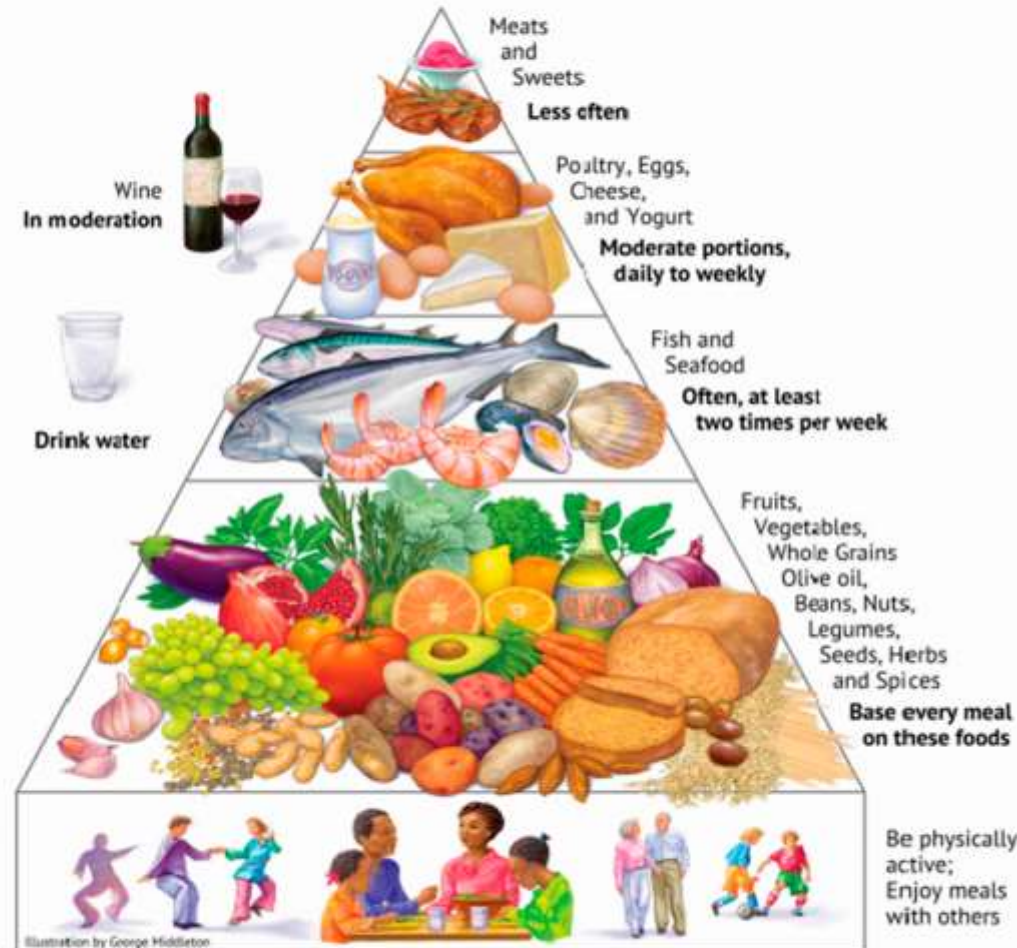


Mediterranean Diet and Microbiota gut.

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Mediterranean Diet Pyramid



Microbiota gut

Human gut consists of a hundred dynamic complex of microbes and its synthesis contains bacteria, viruses, fungi and parasites. They help human body take the necessary vitamins from food and balance the beneficial gut synthesis and structures neurotransmitters, such as serotonin, enzymes and vitamins (Arumugam, et. al., 2011).

The gut microbiota is a symbiotic factor that influences human health and participates in a variety of bodily processes, including vitamin biosynthesis, production of short chain fatty acids (SCFAs), such as acetate, propionate and butyrate, preservation of gastrointestinal (GI) and immune function regulation.



<https://wexnermedical.osu.edu/departments/innovations/rheumatology/gut-microbiota-research>

Role of Microbiota gut

The gut microbiota keeps a constant composition through time and additionally withstands disruptions, such as antibiotics and dietary modifications. Resilience provides a strong and flexible microbiota, by sustaining homeostasis and promoting general health. A resilient microbiota acts beneficially in recovering and also lowers the chance of longtermly health problems.

The trillions of microorganisms in humans' gut are essential for a healthy immune system, digestive system and mental well-being. Diseases including obesity and inflammatory bowel illness might be the result from dysbiosis, or an imbalance in the gut flora (Bhatt, et.al., 2024).

What is a healthy gut microbiota?

- ▶ Increased bacteria diversity, defined by a wide number of distinct species usually indicates good gut health. High microbial diversity, subscribes to strong digestion, metabolite generation, immune system control and better nutrition absorption (Mohr, et.al., 2020).
- ▶ The Firmicutes/Bacteroidetes (F/B) ratio acts like a possible health indicator, as high proportion of F/B may be connected to plenty of metabolic disorders and GI disorders, such as IBD and IBS, are linked to an elevated F/B ratio (Garcia-Mantrana, et.al., 2018).
- ▶ A pH of 5.5 to 7 in the colon is often connected to a robust microbiota. An ideal pH environment helps the development of good bacteria, inhibits harmful organisms, maintains enzyme activity and is beneficial for nutritional absorption and digestive capability (Van Hul, Cani, et.al., 2024).

What is a healthy gut microbiota?

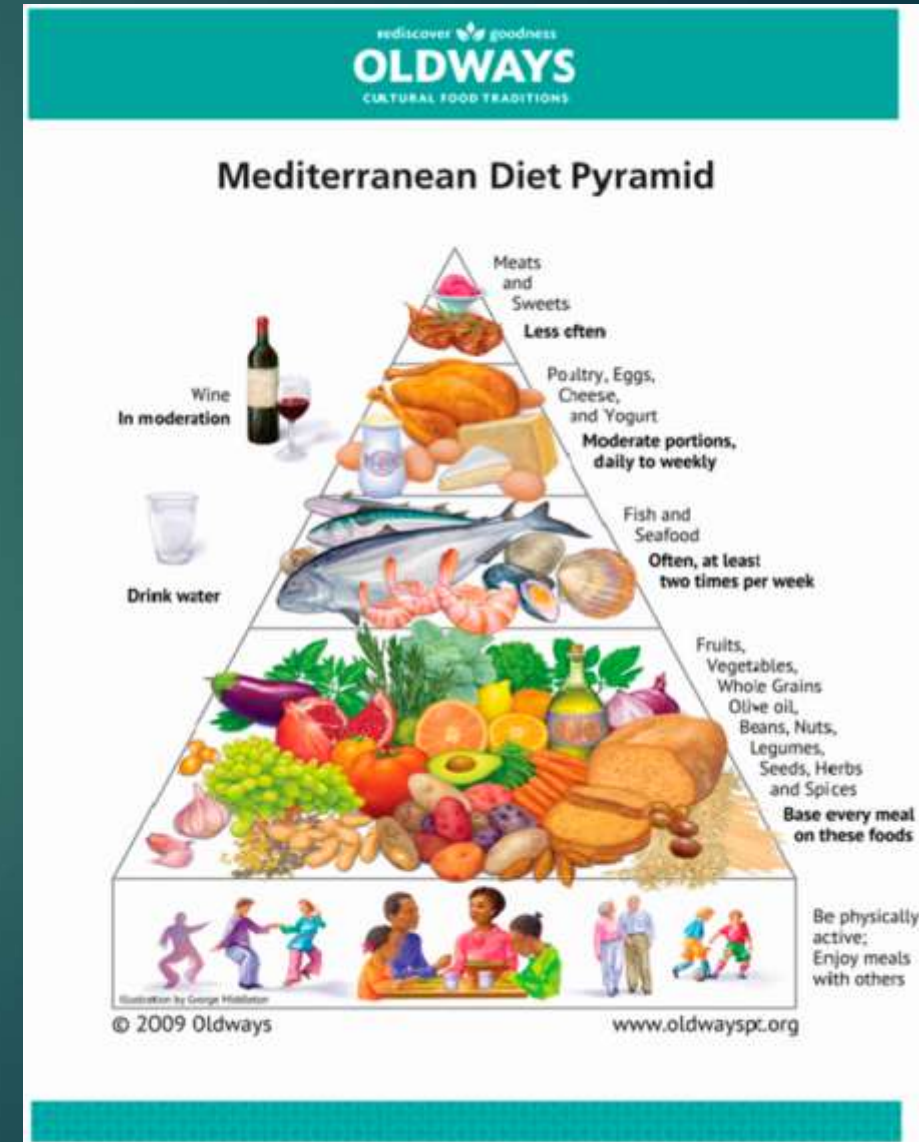
- ▶ Decreased levels of inflammatory markers, like calprotectin and lactoferrin, are connected to health in the gut. Inflammation detectors are affected by a variety of consideration, such as infections, illnesses and dietary habits and this could result false positives (Pierre, et al., 2021).
- ▶ Many factors like genetics, environment and eating habits, can also influence the dynamic and complex nature of the gut microbiota (Vandeputte, et.al., 2016).

Mediterranean Diet

- ▶ The Mediterranean Diet (MD or Med Diet) is one of the most studied and well-known nutrition eating habit, nevertheless it is much more than a food pattern. The term of MD was first established and characterized by Doctor Ancel Keys in 1960.
- ▶ Italy, Greece and Spain as cradle countries of the MD tradition were selected as the center of this research. Together with Portugal, these countries were also nominated the MD “cultural landscapes” by UNESCO in 2010 (UNESCO, 2013).
- ▶ A balanced and well-organized gut microbiota is essential for good health. One of the main factors influencing the composition of the gut microbiota is thought to be diet (Graf, et.al., 2015)

Composition of the MD

- ▶ MD is characterized by a high intake of vegetables, fruits, nuts, legumes and unrefined cereals, a moderate intake of fish and dairy products, a low intake of red meat and its products and low to moderate alcohol consumption, mainly in the form of wine at mealtime (Radd-Vagenas, Kouris-Blazos, Singh, & Flood, 2017).
- ▶ The majority of the mediterranean dishes, contain prebiotic-rich foods such as garlic and onions and many of the numerous aromatic herbs, like oregano, thyme, cloves, mint, basil, pepper etc., as they have anti-inflammatory and antioxidant action (Di Renzo, Colica, et.al., 2015).



Mediterranean Diet & overall health

- ▶ The Lyon Diet Heart Study examined six hundred and five people with myocardial infarction. The results of this study were incredible, as they showed a big decrease in mortality (-70%) to the patients who followed the MD (Estruch, et.al., 2013).
- ▶ The PREDIMED study was the one of the biggest interventional studies in which proved that the MD prevents the CVDs (Martínez-Lapiscina, et.al., 2013), increases life expectancy and reduces the Alzheimer's disease onset (Tosti, et.al, 2018).
- ▶ The Italian team of European Prospective Investigation into Cancer and Nutrition (EPIC), in 2015 referred to the “Olive Oil and Salad” diet pattern, which base axis is the consumption of fresh and raw vegetables, extra virgin olive oil and legumes and it was related to low mortality risk and lower repercussion of colorectal cancer, as the probiotics contained in yogurts may act beneficial to its reduction (Sieri, et.al. 2015).

Mediterranean Diet & overall health

- ▶ De Filippis and colleagues (2016) proved that, a Mediterranean-style diet has shown to affect positively on the composition of the gut microbiota and people who consume more plant-based meals have larger levels of fiber-degrading bacteria and SCFAs.
- ▶ The MD boosts longevity and quality of life, increases life expectancy and enhances general health and well-being (Knoops, et.al., 2004).

Mediterranean Diet & Microbiota gut

- ▶ There is mutual relation between gut microbiota and nutrition (Flint, et.al., 2012).
- ▶ MD is a diet rich in specific food components, like cereals, olive oil and red wine, vegetables and legumes, which each one is associated with specific microbial strains, like Bifidobacterium, Faecalibacterium, Tenericutes and Dorea in cereals, Faecalibacterium in olive oil and red wine, Rikenellaceae, Dorea, Alistipes and Ruminococcus in vegetables and Coprococcus species in legumes (Gutierrez-Diaz, et.al., 2017).

Nutrient Groups

- ▶ Fiber functions can be found in foods like whole grains, legumes, fruits and vegetables. Prebiotics, primarily lactobacilli and bifidobacteria, support the activity and the high levels of good gut bacteria. This can contend the preservation of a balanced and varied microbiota, which is essential for gut health (He, & Shi, 2017).
- ▶ Healthy fats, monounsaturated fatty acids (MUFAs) and polyphenols found in olive oil a staple product of the Mediterranean diet, have anti-inflammatory effects and may help keep good bacteria like Bifidobacteria.
- ▶ Omega-3 ($\omega 3$) fatty acids from fatty fish can help control the composition of microorganisms, reduce inflammation in the stomach and may also promote the growth of good bacteria while suppressing bad ones (Finicelli, et.al., 2021).

Nutrient Groups

- ▶ Fruits, grapes, pomegranates, almonds, olive oil, vegetables and red wine in moderation are among the foods high in polyphenols - plant substances with antioxidant qualities - that are part of the MD. By supporting microbial diversity and feeding gut bacteria with beneficial action, polyphenols can have prebiotic effects, preferentially promoting the growth of good gut bacteria (Li, et.al., 2023).
- ▶ Vitamins are important for preserving a wholesome gut environment, fostering the development of beneficial bacteria and reducing the process of inflammation. Certain vitamins may have a positive impact on the gut microbiota because they increase the abundance of complementary vitamins (A, B2, D, E and beta-carotene), as well as the diversity and richness of microorganisms (A, B2, B3, C, K), by producing short-chain fatty acids (SCFAs) (vitamin C) or by increasing their abundance (vitamins B2, E).

Nutrient Groups

- ▶ Fatty fish, walnuts, flaxseeds and chia seeds are the main food sources rich in omega-3 fatty acids. In the gut, omega-3s moderate the microbiota by disposing a favorable environment for beneficial bacteria and have anti-inflammatory effects. They balance immune responses in the gut, which is important for managing conditions like inflammatory bowel diseases (IBD) (Stull, et.al., 2023).
- ▶ Yogurt, kefir, Mediterranean-style pickles or olives and fermented vegetables and meat are nutrients that the way of their process enhance the bioactivity. Fermented foods are rich in live beneficial bacteria (probiotics) that balance the gut microbiota (Naureen, et.al., 2022).

Conclusion

The Mediterranean diet promotes a varied gut microbiota. A healthy, diverse microbiota is associated with improved digestion, enhanced immunity and reduced risk of inflammatory diseases. Gut health may be linked to mental health through the gut-brain axis, the communication pathway between the gut microbiota and the brain, as it is a bidirectional communication network through the enteric and the central nervous systems. A balanced gut microbiome, bred by a Mediterranean diet, might have assertive effects on mood and cognition, potentially reducing risks for conditions like depression and anxiety (Appleton, 2018). MD is rich in anti-inflammatory nutrients, which help equilibrium in gut microbiota by limiting harmful inflammation, that damages gut lining and alters the composition of microbiota (García-Montero, et.al., 2021).

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