

# Precision Nutrition, Diet and Gut-Microbiota in Obesity

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## Abstract

Obesity has many angles to its cause. Epidemiological works on diets and diet components show that obesity and other metabolic diseases are controlled to a large extent with proper diet and lifestyle. Most works with plant-based diets are noteworthy; they stimulate mechanisms in the host that proffer health, either through calorie restrictive pathways and the positive stimulation of the gut-brain cross-talks through fiber fermentation. Due to the heterogeneity of individuals, no one solution is fitting; therefore dieticians are partnering with other scientists to promote Precision nutrition that considers individual differences in the host's gene pool and healthy daily calorie intake. Such patterned diet help prevent obesity and maintain healthy weights by supplying more nutritional, low-energy dense diet components and minimal high-energy dense components that aid the accumulation of excess fatty acids and forming obese conditions. Examples of similar wholesome food patterns are the Healthy Mediterranean-Style Eating system (HMSE) and Dietary Approaches to Stop Hypertension (DASH). A road map is already in the design stage by the National Institutes of Health (NIH) Nutrition Research Task Force and is promissory.

**Keywords:** Precision nutrition; Obesity; Gut-microbiota; Wholesome diets; Healthy Mediterranean-Style Eating system (HMSE); Dietary Approach to Stop Hypertension (DASH); Metabolic diseases; Short-chain fatty acids-SCFAs

## Introduction

Diet is a major pivot for human health; its influence could be positively central, supplying needed and adequate amounts of nutrients and energy, or negatively extreme, in terms of undernutrition or overnutrition [1]. Malnutrition, poor lifestyle, susceptible host gene pool, and altered gut microbes are responsible for the increased rates of diet-induced diseases globally [2,3]. The detailed interaction between host gene pool, diet type, and gut microbes are important components in precision nutrition studies, which considers differences in host-nutrient-energy interactions. WHO [4] estimated that in 2016 alone, 650 million adults were obese, a subset of the larger 1.9 billion overweight adults. Overweight conditions are responsible for about 4 million deaths annually. Sixty percent and forty percent of this number are obese and non-obese victims, respectively, according to collaborators that worked on the 2015 global burden of diseases study [2].

A retrospective four-year study conducted by Mozaffarian et al. [5] with 120, 877 male and female volunteers, noted that the consistent consumption of high calorie diets is the major culprit for weight gain. In contrast, the consumption of low energy diets made for weight loss amongst the participants. All participants were free of metabolic diseases and non-obese at baseline. The study added that diet-independent lifestyles also influenced weight. Both the WHO [4] and Mozaffarian et al. [5] studies highlight the dangers of inappropriate weight increase in hosts, even without obesogenic phenotype, when energy balance is tilted to favour less expenditure and more storage, ectopic fatty acids storage results in weight gain.

An obese condition is characterized by increased adipokine secretions, increased secretion of pro-inflammatory cytokines, impaired insulin signaling, insulin resistance, organ metabolic dysfunction and reduced gut microbial diversity [6-8]. Reversal of obesity effects with diet change is possible, although at a very slow rate- the initial size of adiposity (weight) directly affects reduction rates. Hall et al. [9] stipulated that an average observable weight change could take not less than one year. We reiterate the importance of proper dieting for the prevention of diseases and maintenance of health.

## Discussion

There have been numerous attempts at solving, in the safest form, obesity and its related ailments through the use of single bioactive substances from health-giving diets. Many excellent results derived from murine studies have been recounted in human clinical trials with inconsistencies [10]; however, precision nutrition is a diet advisory fashioned after traditional eastern diets that rely mainly on plant-based diet components; known for their positive health effects [11,12]. Although there is still no consensus definition for precision nutrition, its emergence seeks dynamic nutritional recommendation that utilizes wholesome diets and considers the internal and external changes in the energy parameters of a host.

So, how does a wholesome diet work against obesity? Being a mix of different health-giving bioactive components, they modulate mechanisms that ensure lipolysis. One route by which it confers healthier weight in a host is its offering of reduced (but more nutritional) energy contents [13]. The Dietary Approaches to Stop Hypertension (DASH-75% low-dense energy components) and Healthy Mediterranean-Style Eating system (HMSE-60-70% low-dense energy components) are examples of precision nutrition diets [13]. The work of Smith et al. [14] with 124 participants saw 36% reductions in weight and BMI values for groups receiving DASH and DASH plus exercise in just four months.

Precision nutrition regulate overlapping calorie restriction mechanisms (pathways) like the AMPK, SIRT1, PPARs, IGF/insulin, and mTOR to achieve energy homeostasis. Another important aspect is their ability to stimulate gut microbes that regulate energy balance by influencing the brain signaling systems via intestinal secretion of neurotransmitters and neuropeptides, which in turn influence, amongst others, food consumption [15]. The consumption of wholesome diets increases gut microbial diversity; modulates intestinal by-products (short-chain fatty acids-SCFAs); elicits hormonal signals and regulates energy homeostasis [3,11,16]. Adherence to healthier energy supplies via precision nutrition ensures that the structure, composition, and function of the positively remodeled gut microbes are maintained [3]. Romaguera and colleagues [17] who worked with over 300,000 participants from 10 EU countries in a 5-year study, noted that

participants, who adhered to the HMSE diet had reduced chances of regaining weight.

## Conclusion

In conclusion, with the commissioning of the National Institutes of Health (NIH) Nutrition Research Task Force with the task of remodeling precision nutrition template as part of precision medicine, the committee seeks to achieve its goals through the synergistic cooperation of several disciplines [18]. The template would birth the synergy of knowledge and technologies, better elucidation of various components and interactions between humans, genes, nutrition, and health [19]. The search for a better life revolves around better health. One advantage with flexible energy-giving diet components is their possible utilization in the prevention of obesity (and other metabolic diseases) and maintenance of healthy weight. The key to sustained positive results is consistency and adoption of a positive lifestyle [5,9,16].

## References

- de-Clercq NC, Groen AK, Romijn JA, Nieuwdorp M (2016) Gut microbiota in obesity and undernutrition. *Adv Nutr* 7(6): 1080-1089.
- GBD 2015 Obesity Collaborators, Afshin A, Forouzanfar MH, Reitsma MB, Sur P, et al. (2017) Health effects of overweight and obesity in 195 countries over 25 years by 2015 GBD obesity collaborators. *N Engl J Med* 377(1):13-27.
- Cox LM, Blaser MJ (2013) Pathways in microbe-induced obesity. *Cell Metab* 17(6): 883-894.
- WHO (2019) Obesity and overweight in 2019. World Health Organization, Geneva, Switzerland.
- Mozaffarian D, Hao T, Rimm EB, Willett, WC, Hu FB (2011) Changes in diet and lifestyle and long-term weight gain in women and men. *N Engl J Med* 364(25): 2392-2404.
- Heymsfeld SB, Wadden TA (2017) Mechanisms, pathophysiology, and management of obesity. *N Engl J Med* 376(3): 254-266.
- Turnbaugh P, Backhed F, Fulton L, Gordon J (2008) Diet-induced obesity is linked to marked but reversible alterations in the mouse distal gut microbiome. *Cell Host Microbe* 3(4): 213-223.
- Turnbaugh PJ, Ley RE, Mahowald MA, Magrini V, Mardis ER, et al. (2006) An obesity-associated gut microbiome with increased capacity for energy harvest. *Nature* 444(7122): 1027-1031.
- Hall KD, Sacks G, Chandramohan D, Chow CC, Wang YC, et al. (2011) Quantification of the effect of energy imbalance on bodyweight. *Lancet* 378(9793): 826-837.
- Mazloom K, Siddiqi I, Covasa M (2019) Probiotics: How effective are they in the fight against obesity? *Nutrients* 11(2): 258.
- Smethers AD, Rolls BJ (2018) Dietary management of obesity: Cornerstones of healthy eating patterns. *Medical Clin North Am* 102(1):107-124.
- Bäckhed F, Ding H, Wang T, Hooper LV, Koh GY, et al. (2004) The gut microbiota as an environmental factor that regulates fat storage. *Proc Natl Acad Sci USA* 101(44): 15718-15723.
- USDHHS and USDA (2015) 2015-2020 Dietary guidelines for Americans. (8<sup>th</sup> edn), US Department of Health and Human Services and US Department of Agriculture, USA.

14. Smith PJ, Blumenthal JA, Babyak MA, Craighead L, Welsh-Bohmer KA, et al. (2010) Effects of the dietary approaches to stop hypertension diet, exercise, and caloric restriction on neurocognition in overweight adults with high blood pressure. *Hypertension* 55(6): 1331-1338.
15. Sivamaruthi BS, Kesika P, Suganthi N, Chaiyasut C (2019) A Review on role of microbiome in obesity and antiobesity properties of probiotic supplements. *Biomed Res Int* 2019: 1-20.
16. Yatsunenکو T, Rey FE, Manary MJ, Trehan I, Dominguez-Bello MG, et al. (2012) Human gut microbiome viewed across age and geography. *Nature* 486(7402): 222-227.
17. Romaguera D, Norat T, Vergnaud AC, Mouw T, May AM, et al. (2010) Mediterranean dietary patterns and prospective weight change in participants of the EPIC-PANACEA project. *Am J Clin Nutr* 92(4): 912-921.
18. Rogers GR, Collins FS (2020) Precision nutrition-the answer to “what to eat to stay healthy”. *JAMA* 324(8): 735-736.
19. USHHS (2020) 2020-2030 Strategic plan for NIH nutrition research. National Institutes of Health Office of Nutrition Research, US Department of Health & Human Services, USA.

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