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FIRMICUTES/BACTERIODETES RATIO OF GUT MICROBIOTA AS A KEY REGULATOR OF HOST METABOLISM: IMPLICATION FOR OBESITY AND WEIGHT LOSS

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Obesity is defined as a chronic relapsing disease resulting from complex interactions between genetic, neurobiological, behavioral, and environmental factors. Obesity is rapidly increasing among people worldwide. The global prevalence of obesity has reached pandemic proportions, with approximately 2.5 billion adults (18-year-old and older) were overweight. (World Health Organization published in 2025)

The aim of this study is to analyze the role of the Firmicutes/Bacteroidetes (F/B) ratio of the gut microbiota in regulating host metabolism and to assess its significance as a potential target for therapeutic interventions in obesity and weight loss.

In recent years, the gut microbiota has emerged as a significant factor in metabolic dysregulation. The gut microbiota is composed of trillions of microorganisms that inhibit the gastrointestinal tract and forms an ecosystem characterized by high bacterial and functional diversity, strain specificity, and resilience. The F/B ratio is one of the most widely studied markers in gut microbiome research. These two phyla make up the majority of gut bacteria.

Obesity-associated dysbiosis is typically characterized by reduced microbial diversity, decreased beneficial bacteria (Bacteroidetes) and an increased F/B ratio. An increased value of this ratio can lead to obesity due to the increased level of energy harvesting, regulation of fat storage and metabolism, metabolic endotoxemia, gut hormones and satiety regulation, bile acid metabolism, circadian rhythm disruption. (Yuan CUI *et al.,*2022) (Dana withrow *et al.,*2021)

Gut microbiota produce a diverse array of bioactive metabolites that act locally within the gut or travel via systemic circulation to influence distant organs. Gut bacteria influence the host's energy balance through the fermentation of indigestible dietary fibers into short-chain fatty acids (SCFAs), including acetate, propionate, and butyrate. During obesity, the gut microbiota composition shifts to increased F/B ratio, becoming hyper-efficient at extracting calories from food.

This leads to excess acetate production, which drives fat synthesis in the liver (de novo lipogenesis), contributing directly to weight gain. Gut microbiota influence the host's ability to store or burn fat. Key molecular pathways involved in those processes include AMP-activated protein kinase (AMPK), which promotes fatty acid oxidation, and fasting-induced adipose factor (FIAF), which inhibits lipoprotein lipase activity and reduces lipid accumulation in adipocytes. In obesity, an elevated F/B ratio is associated with impaired intestinal barrier integrity, facilitating the translocation of lipopolysaccharides (LPS) into the systemic circulation, leading to metabolic endotoxemia, low-grade inflammation, and insulin resistance. The effect of these pathways is adipocyte hypertrophy and increased triglyceride deposition.

Dietary fibers, prebiotics, probiotics, regular physical activity, and circadian rhythm synchronization can favorably modulate the F/B ratio and promote body weight control. Animal studies have shown that high-fat diets increase Firmicutes abundance, whereas high-fiber diets promote the growth of Bacteroidetes. (Nayera *et al.*2024)

The gut microbiota plays a significant role in the pathophysiology of obesity. The F/B ratio serves as a key indicator of microbial imbalance associated with enhanced energy extraction and metabolic dysfunction. The variability in gut microbiota composition and microbiota-targeted interventions open up prospects for developing personalized therapeutic strategies for obesity. **(**Machado *et al*., (2025). Precision nutrition for obesity management: gut microbiota centered weight-loss approach. (Lucas *et al.,*2025).