The Impact of Intermittent Fasting on Gut Microbiota

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INTRODUCTION

- According to the United Nations, at least 2.8 million people die each year due to being overweight or obese.
- Global prevalence of obesity highlights the urgent need for solutions.
- Intermittent fasting as a cost-effective intervention.
- Exploring the complex relationship between fasting and gut microbiota.

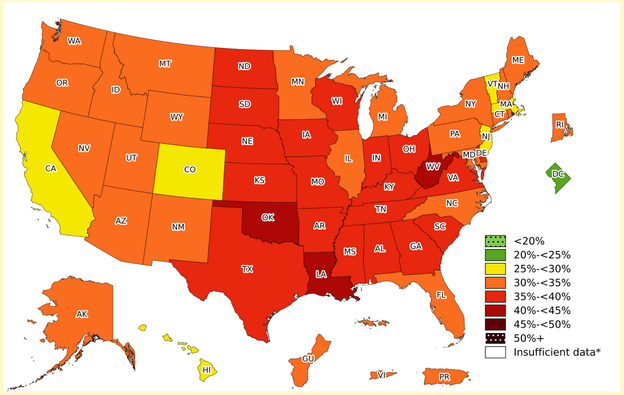

Figure 1. Prevalence of Obesity Based on Self-Reported Weight and Height by State and Territory (BRFSS, 2022).

OBJECTIVE

This study aims to explore, through the analysis of scientific literature, how intermittent fasting affects the treatment potential for obesity and related metabolic diseases by regulating the gut microbiota.

METHODS

To assess the relationship between intermittent fasting and gut microbiota, this study conducted an in-depth analysis of a comprehensive literature review for the TBIOMD 492 course at the University of Washington Tacoma. The research included various types of sources, including primary, secondary, and government sources. A total of 22 sources were explored in the writing of the review.

Impact of Intermittent Fasting on Gut Microbiota

- **Increases diversity and abundance of beneficial bacteria. (Lachnospirocaceae)**

The primary producers of short-chain fatty acids (SCFAs) in the gut. SCFAs serve as an energy source for intestinal cells, maintain the gut barrier function, regulate inflammation, and induce the browning of white adipose tissue.

- **Reduces abundance of potentially harmful bacteria. (Prevotellaceae)**

Excessive Prevotellaceae can lead to a reduction in short-chain fatty acids (SCFAs), exacerbate gut inflammation, and potentially trigger systemic autoimmunity.

	Day 0	Day 30	
	Baseline (A) (n = 14) Mean ± SD	Non-fasting (B) (n = 6) Mean ± SD	Fasting (C) (n = 8) Mean ± SD
Phylum			
Firmicutes	56.68 ± 9.77	52.79 ± 7.48	67.53 ± 4.84
Bacteroidetes	33.32 ± 10.96	38.79 ± 4.93	24.39 ± 6.12
Family			
Lachnospiraceae	37.46 ± 7.36	34.40 ± 7.36	43.99 ± 3.90
Ruminococcaceae	15.07 ± 2.90	13.98 ± 2.52	19.45 ± 1.99
Rikenellaceae	6.64 ± 1.58	5.46 ± 1.19	7.92 ± 1.85
Porphyromonadaceae	2.02 ± 0.48	1.51 ± 0.60	3.88 ± 1.57
Bacteroidetes_S24-7_group	20.26 ± 9.64	22.14 ± 3.33	9.77 ± 6.21
Prevotellaceae	2.90 ± 2.20	8.63 ± 4.13	2.12 ± 1.44

SD, standard deviation. The significance was calculated by two-sided unpaired student's t-test.

Figure 2. Changes in relative abundance of LefSe-identified taxa during fasting. (Su et al., 2022)

Fasting and Fat Browning

- Gut bacteria significantly influence the browning process. Changes in the gut microbiota composition due to fasting can enhance this conversion.
- Fasting can induce the conversion of white adipose tissue (WAT) into brown adipose tissue (BAT), a process known as browning. Brown fat is more metabolically active and burns more calories than white fat.
- The increase in Firmicutes bacteria during fasting contributes to the browning of white fat. These bacteria produce short-chain fatty acids (SCFAs) like butyrate, which are key signaling molecules in the browning process.

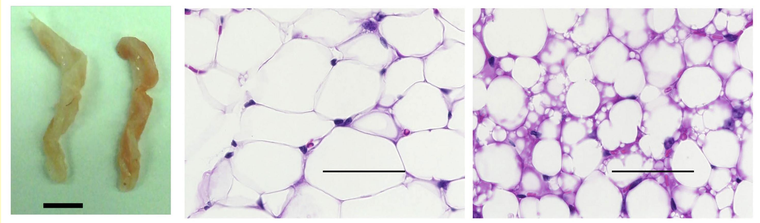

Figure 3. (Left) Representative image for inguinal WAT of AL (left) and EODF (right) mice. Scale bar: 5 mm. (Right) Microscope comparison, scale bar: 50 μm (Li et al., 2017)

DISCUSSION

- Intermittent fasting (IF) significantly benefits gut microbiota by increasing beneficial bacteria like Lachnospiraceae, which produce short-chain fatty acids (SCFAs). These SCFAs support gut health, regulate inflammation, and promote the browning of white fat, enhancing metabolic health and immune function.
- IF also reduces harmful bacteria such as Prevotellaceae, preventing decreased SCFA levels and gut inflammation, thus reducing the risk of systemic autoimmunity.
- These effects suggest that IF could be an effective strategy for managing obesity and metabolic disorders by improving gut microbiota composition and metabolic health.

FUTURE DIRECTION

- Further research needed to understand long-term effects of fasting on the gut microbiome.
- Promising avenue for obesity research with potential to revolutionize weight loss and disease prevention approaches.

CITATIONS