4. Vijayvargiya P, Jameie-Oskooei S, Camilleri M, et al. Association between delayed gastric emptying and upper gastrointestinal symptoms: a systematic review and meta-analysis. Gut 2019;68:804–813.
5. Janssen P, Harris MS, Jones M, et al. The relation between symptom improvement and gastric emptying in the treatment of diabetic and idiopathic gastroparesis. Am J Gastroenterol 2013;108:1382–1391.
6. Tack J, Goelen N, Carbone F, et al. Letter to the editor: prokinetic effects and symptom relief in the pharmacotherapy of gastroparesis. Gastroenterology 2020;158:1841–1842.
7. Pasricha PJ, Grover M, Yates KP, et al. NIDDK/NIH GpCRC consortium. Functional dyspepsia and gastroparesis in tertiary care are interchangeable syndromes with common clinical and pathological features. Gastroenterology 2021;160:2006–2017.
8. Tougas G, Ying C, Luo D, et al. Tegaserod improves gastric emptying in patients with gastroparesis and dyspeptic symptoms. Gastroenterology 2003;124(Suppl 1):A54.
9. Arts J, Caenepeel P, Verbeke K, et al. Influence of erythromycin on gastric emptying and meal related symptoms in functional dyspepsia with delayed gastric emptying. Gut 2005;54:455–460.
10. Desai A, O'Connor M, Neja B, et al. Reproducibility of gastric emptying assessed with scintigraphy in patients with upper GI symptoms. Neurogastroenterol Motil 2018;30:e13365.
11. Moayyedi P, Lacy BE, Andrews CN, et al. ACG and CAG clinical guideline: management of dyspepsia. Am J Gastroenterol 2017;112:988–1013.
12. Tack J, Camilleri M. New developments in the treatment of gastroparesis and functional dyspepsia. Curr Opin Pharmacol 2018;43:111–117.
13. Pasricha PJ, Yates KP, Sarosiek I, et al; NIDDK Gastroparesis Clinical Research Consortium (GpCRC). Aprepitant has mixed effects on nausea and reduces other symptoms in patients with gastroparesis and related disorders. Gastroenterology 2018;154:65–76.e11.
14. Wauters L, Dickman R, Drug V, et al; the ESNM FD Consensus Group. United European Gastroenterology (UEG) and European Society for Neurogastroenterology and Motility (ESNM) consensus on functional dyspepsia. UEG J 2021 (in press).
15. Schol J, Wauters L, Dickman R, et al; the ESNM FD Consensus Group. United European Gastroenterology (UEG) and European Society for Neurogastroenterology and Motility (ESNM) consensus on gastroparesis. UEG J 2021 (in press).
16. Grover M, Farrugia G, Stanghellini V. Gastroparesis: a turning point in understanding and treatment. Gut 2019;68:2238–2250.
17. Talley NJ, Locke GR, Saito YA, et al. Effect of amitriptyline and escitalopram on functional dyspepsia: a multicenter, randomized controlled study. Gastroenterology 2015;149:340–349 e2.
18. Parkman HP, Van Natta ML, Abell TL, et al. Effect of nortriptyline on symptoms of idiopathic gastroparesis: the NORIG randomized clinical trial. JAMA 2013;310:2640–2649.
19. Carbone F, Van den Houte K, Clevers E, et al. Prucalopride in gastroparesis: a randomized placebo-controlled crossover study. Am J Gastroenterol 2019;114:1265–1274.
20. Kindt S, Van Oudenhove L, Mispelon L, et al. Longitudinal and cross-sectional factors associated with long-term clinical course in functional dyspepsia: a 5-year follow-up study. Am J Gastroenterol 2011;106:340–348.

Most current article

0016-5085/$36.00
https://doi.org/10.1053/j.gastro.2021.02.042

Dieting for Success: What Baseline Gut Microbiota Can Tell You About Your Chances of Losing Weight

See "The baseline gut microbiota directs dieting-induced weight loss trajectories," by Jie Z, Yu X, Liu Y, et al, on page 2029.

Obesity remains one the most important threats to human health worldwide. The World Health Organization estimates that nearly 2 billion adults are overweight or obese.[1] Dieting, physical activity, behavioral therapies, pharmacologic treatments, and bariatric surgery are all proposed in the management of obesity. Among these treatments, lifestyle modification and particularly dieting, remains the first-line intervention for weight loss in individuals with obesity and associated diseases such as nonalcoholic fatty liver disease.[2] The response to dietary intervention, however, is highly variable,[3] suggesting that characteristics of the host likely influence or predict weight loss. Within the growing field of personalized medicine, there is great interest in determining whether specific features of gut microbial composition might help to predict weight loss in response to dieting interventions. Previous studies have shown an association between certain bacteria (*Bacteroides eggerthi*, *Prevotella copri*),[4] as well as certain bacterial metabolites (choline and L-carnitine)[5] and greater weight loss in response to dietary intervention. In this issue of *Gastroenterology*, Jie et al[6] assessed a collection of factors including diet, physical

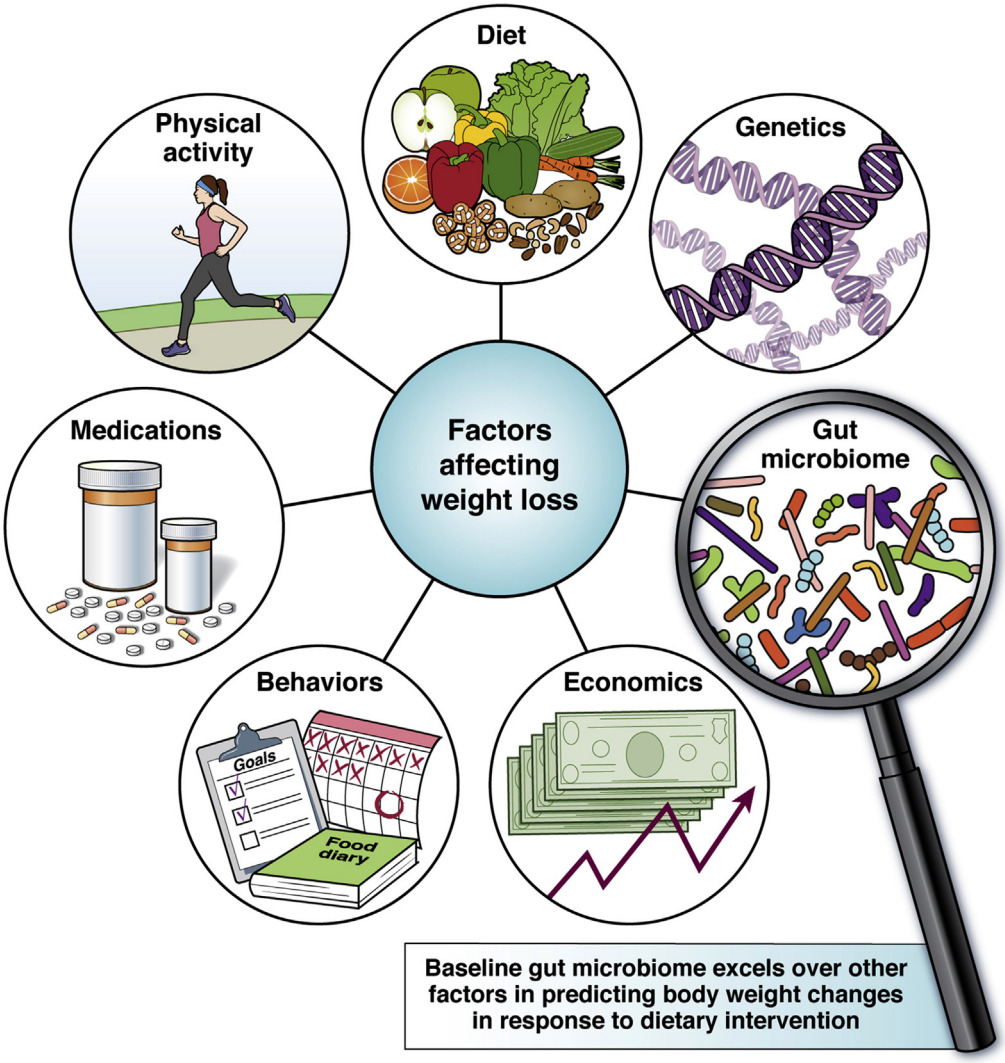

Figure 1. Factors that influence weight loss.

activity, body weight, fecal microbiome and single nucleotide polymorphism genotypes in adults participating in a 6-month weight reduction program. The authors show that of all the factors examined, the baseline gut microbiome was superior as a preintervention predictive factor for participant's weight loss trajectories.[6]

In the study, for 6 months the participants consumed 30%–50% fewer calories than the standard recommended levels for males and females of Chinese ancestry. Maintaining participant motivation and compliance over long durations in weight loss trials such as this is a major challenge and several strategies to reduce attrition have been investigated (eg, financial incentives and self-monitoring technology).[7] Smart phone applications are increasingly used in commercial weight loss programs and research trials[8] and the investigators in this study used an instant messaging application to communicate with participants on a daily basis to encourage them and ensure that food records were completed after each meal. Of the 84 participants enrolled in the study, dietary data, physical activity, and body weight were available for 83 participants and fecal samples were collected from 82 patients at baseline, 77 at 3 months, and 67 at the end of the study.[6] The average weight loss across all participants was 3.17 ± 3.56 kg over 6 months. The investigators identified weak and variable correlations between weight loss and various dietary factors, which led them to develop machine learning algorithms that would help to identify potential variables beyond dietary data that could predict weight loss trajectories in the participants.

Predictive models were trained on 5 sets of inputs that included dietary data alone (eg, caloric intake, macronutrient intake, etc), or diet plus obesity-associated single nucleotide polymorphisms, diet plus personal traits (age, sex, baseline body mass index), diet plus baseline gut microbiome, or diet plus all 3 variables combined. Similar to other recent studies that have shown the importance of baseline microbiota in predicting weight change in response to a dietary intervention,[9–11] baseline gut microbiome data outperformed other factors in predicting body weight

changes over the 6-month intervention.[6] Of interest, obesity-associated single nucleotide polymorphisms and personal traits did not improve the predictive accuracy of the model.

Using shotgun sequencing, the investigators were able to characterize the compositional and functional shifts in the microbiome from baseline to 6 months. In the weight loss model, the baseline abundance of *Blautia wexlerae* and *Bacteroides dorei* were shown to be the most influential variables.[6] Given that participants with overweight or obesity as well as some lean participants were included in the study, the investigators were able to establish the relationship between the gut microbiome and changes in body weight across the weight continuum. They identified *Coprococcus* sp., *Holdemanella biformis*, *Solobacterium moorei, Solobacterium moorei*, *Ruminococcus gnavus*, and *Clostridium* as significantly enriched in individuals with obesity and their decreasing abundance was associated with weight loss. In lean individuals, *Coprobacter*, *Bacteroides intestinalis*, *Akkermansia muciniphila*, *Alistipes obesi*, and *Tannerella* sp. were enriched with an increased abundance during dieting associated with weight loss. At baseline, microbial genes encoding for fatty acid biosynthesis were enriched in lean participants with an increase associated with weight loss.[6]

Promoting appropriate dietary advice that allows for the maintenance of a healthy body weight, and/or the improvement in body weight in individuals with overweight or obesity, remains a challenge worldwide. The proof of concept, established in dietary intervention studies like the one published by Jie et al,[6] supports the need to consider gut microbiome characteristics as a key component of individual response to dietary interventions. Although challenges remain with studying the human gut microbiome (eg, confounding factors such as age, medications, and geographical location; variation in gut microbiome among individuals even those considered healthy; and varying bioinformatics approaches),[12] the potential to implement the gut microbiome into clinical practice is nonetheless enormous. The application of diet–gut microbiome data in global algorithms, taking into account biological and environmental factors, will bolster the success of food-based interventions. Together with the promotion of physical activity and exercise, dietary interventions tailored to individuals gut microbiome represent a promising and sustainable approach to maintain or recover weight-related health (Figure 1).

RAYLENE A. REIMER
Faculty of Kinesiology
University of Calgary
Calgary, Alberta, Canada

NATHALIE M. DELZENNE
Metabolism and Nutrition Research Group
Louvain Drug Research Institute
Université catholique de Louvain
Brussels, Belgium

References

1. World Health Organization. Overweight and obesity - fact sheet. 2021. Available: www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
2. Younossi ZM, Corey KE, Lim JK. AGA Clinical practice update on lifestyle modification using diet and exercise to achieve weight loss in the management of nonalcoholic fatty liver disease: expert review. Gastroenterology 2020;160:912–918.
3. Astrup A, Buemann B, Gluud C, et al. Prognostic markers for diet-induced weight loss in obese women. Int J Obes Relat Metab Disord 1995;19:275–278.
4. Dhakal S, McCormack L, Dey M. Association of the gut microbiota with weight-loss response within a retail weight-management program. Microorganisms 2020; 8:1246.
5. Heianza Y, Sun D, Smith SR, et al. Changes in gut microbiota-related metabolites and long-term successful weight loss in response to weight-loss diets: the POUNDS Lost Trial. Diabetes Care 2018;41:413–419.
6. Jie Z, Yu X, Liu Y, et al. The baseline gut microbiota directs dieting-induced weight loss trajectories. Gastroenterology 2021;160:2029–2042.
7. Pirotta S, Joham A, Hochberg L, et al. Strategies to reduce attrition in weight loss interventions: A systematic review and meta-analysis. Obes Rev 2019; 20:1400–1412.
8. Dounavi K, Tsoumani O. Mobile health applications in weight management: a systematic literature review. Am J Prev Med 2019;56:894–903.
9. Christensen L, Sorensen C, Wohlk FU, et al. Microbial enterotypes beyond genus level: Bacteroides species as a predictive biomarker for weight change upon controlled intervention with arabinoxylan oligosaccharides in overweight subjects. Gut Microbes 2020; 12:1847627.
10. Hjorth MF, Christensen L, Larsen TM, et al. Pretreatment Prevotella-to-Bacteroides ratio and salivary amylase gene copy number as prognostic markers for dietary weight loss. Am J Clin Nutr 2020;111:1079–1086.
11. Rodriguez J, Hiel S, Neyrinck AM, et al. Discovery of the gut microbial signature driving the efficacy of prebiotic intervention in obese patients. Gut 2020; 69:1975–1987.
12. Miyoshi J, Rao MC, Chang EB. Navigating the human gut microbiome: pathway to success from lessons learned. Gastroenterology 2020;159:2019–2024.

Correspondence
Address correspondence to: Raylene A. Reimer, Faculty of Kinesiology, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4. e-mail: reimer@ucalgary.ca.

Conflicts of interest
The authors disclose no conflicts.

Most current article

0016-5085/$36.00
https://doi.org/10.1053/j.gastro.2021.02.021