

# Calorie control to gut microbiome management- nutrient rich foods for body weight control

## Abstract

The traditional body weight management is focused or popularized on calorie counting. This thinking was widely adopted because calories can be measured, net balance could be determined by the difference between food intake and what was spent on daily activities, and belief that weight gain or loss is a net calorie effect. However, sole calorie focused body weight management over the years has given very limited results. This mini review discusses body weight is more than a single function of calorie, role of gut microbiome on weight management, and provide overview of nutritious foods that may control body weight.

**Keywords:** body weight, gut bacteria, prebiotic carbohydrate, calorie

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## Introduction

Overweight and obesity has become a global epidemic. Approximately one to two thirds of world populations of all gender and age groups is overweight or obese.<sup>1</sup> Excess body weight affects mobility, contributor to a range of non-communicable diseases, personal suffering, and burden to health care systems. At present, there are no signs that global overweight and obesity rates are declining adding millions of more every year to suffer from uncontrolled body weight conditions. Conventional thinking of weight management is solely focused on calorie restrictions on the premise that net calorie is proportional to weight gain or loss. This thinking is widely accepted because calorie intake can be counted and what was spent could be measured; hence, net calorie must lead to weight gain or loss. However, rationalization and mass popularization of body weight to a net calorie equation ignores all other causative factors that may impact weight management.

Human body weight is a result of complex interactions of one's genetic, physiological, and metabolic processes with food and environment. Trillions of human body cells and hundreds of more of bacterial cells in human body interacts with each other and foods and water that receives to maintain their optimal metabolic and physiological functions. To this end, human intestinal epithelium and billions of commensal bacteria play important roles in how foods get digested, energy and other nutrients in them gets extracted, satiety, and gut-brain communications.

## Discussion

Every human requires at least 49 nutrients on daily basis for healthy living.<sup>2</sup> Those nutrients can be categorized in to two groups: carbohydrate, protein, and fat are major nutrients while vitamin and minerals are micronutrients. For majority of populations food is the only source supplying those nutrients. Therefore, it is important that nutrient rich diets are available to all to meet daily nutrient needs. However, unfortunately, most populations do not receive daily nutrient requirements; hence, large number of people suffer from both energy and micronutrient malnutrition. Just like calorie over nutrition, micronutrient deficiency may also be a contributing factor towards overweight and obesity conditions. Among all food components, carbohydrates are the most abundant one in human diet. It is also one

of the cheapest. Carbohydrates can be classified in to three types: digestible, low digestible, and non-digestible. The digestible ones broken down to its simplest form of monosaccharides or the form body can absorb by human digestive enzymes. The other types, low- and non-digestible ones or popularly referred to as dietary fiber, get passed down to large intestine. In the large intestine, the prebiotic carbohydrates, a part of low- and non-digestible carbohydrates, in essence, become bacterial foods. These prebiotics selectively stimulate the populations and functions of bacterial species which benefit the host. Therefore, not all carbohydrates are digestible and generate energy. Part of them are prebiotic or use by human health beneficial bacterial growth. The ones that are not digested by digestive enzymes or by action of bacteria are part of feces. Therefore, not all carbohydrates are equally digestible or body may not absorb, and classifying all of them in to one and providing a calorie number needs corrections.

More than number of human cells, the human gastrointestinal tract has  $10^{12}$ - $10^{14}$  commensal microbes, majority being bacteria.<sup>3</sup> Diversity of bacterial species, their substrates, metabolites and localization vary between individuals. The relative concentration and functions of these bacterial population fluctuate with response to stimuli from host such as health status, age, and especially diet. More specifically prebiotics foster the symbiotic relationship between host and beneficial bacteria. Bifidobacterium spp. and other species such as Lactobacillus spp. selectively use prebiotic carbohydrate to produce short chain fatty acids.<sup>4</sup> These fatty acids in turns change in intestinal environment by pH reductions to suppress harmful bacterial specie.<sup>5,6</sup> These complex interplays of foods, bacteria-bacteria interaction, and host factors determine the type and number of them in intestinal environment. The overall result is lean individuals have diverse range of bacteria to keep them lean while obese have less diverse range of bacteria.

Prebiotic carbohydrates such as resistant starch, fructooligosaccharides, and sugar alcohols promote human beneficial bacterial growth while suppressing the pathogenic ones. However, the current food supply is abundant with highly digestible carbohydrates such starch, sucrose, glucose, and fructose. These readily digestible carbohydrate cause blood sugar spikes, increase available energy, and convert to fat. Therefore, replacing part of these highly digestible carbohydrates with prebiotic ones will reduce caloric densities,

promote beneficial bacterial growth toward managing overweight and obesity situations. Creative use of prebiotic carbohydrates may not only provide weight control solutions but also superior sensory and functional properties of foods for greater enjoyment.

Greater availability of prebiotic carbohydrate rich foods will take extra effort and time. In the meantime, pulses such as lentil, chickpea, peas, and beans are good sources of prebiotic carbohydrates. One hundred grams of cooked pulses could provide 5 to 10 grams of prebiotic carbohydrates just sufficient for daily requirements.<sup>7</sup> In addition, pulses are high protein, and rich in range of essential micronutrients such as iron, zinc, selenium, and folates. Besides pulses, fruits and vegetables are a rich source of non-digestible carbohydrates and micronutrients. Incorporating more of these foods as part of daily diet could reduce malnutrition; thus, incorporating more of these foods in diet could provide necessary nutrient support system for host and beneficial bacterial towards weight managements.

## Conclusion

Body weight is a result of complex interplay of human cells, intestinal bacteria, and food nutrients. Therefore, supply of nutrients to promote host cell, gut bacteria, and human cell-bacteria symbiosis will be needed not only to manage weights but also to improve human health. More effort and time is needed to develop nutrient rich food supply, and to educate public to see beyond sole calorie based thinking towards effective weight management.

## Acknowledgements

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## Conflict of interest

The author declares no conflict of interest.

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