

# Ultra-processed diets promote excess calorie consumption

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A clinical trial designed to overcome limitations of previous trials now confirms that individuals consume more calories from ultra-processed diets than from minimally processed diets, even when both diets meet UK dietary guidelines and participants are losing weight.

The Nova classification system defines ultra-processed foods as industrially refined, containing industrial additives, and deliberately formulated to be irresistibly delicious (if not addictive) – and highly profitable<sup>1</sup>. Numerous observational studies have linked poor health and chronic disease to diets that provide large proportions of calories from ultra-processed foods<sup>2</sup>. However, although observational studies demonstrate correlation, they cannot prove causation. Controlled trials have shown that ultra-processed foods promote excessive calorie intake, but their design and real-world relevance have been widely questioned. In this issue of *Nature Medicine*, Dicken et al.<sup>3</sup> describe an ambitious clinical trial that compares the effects of two ‘healthy’ nutritionally equivalent diets – one minimally processed and the other ultra-processed – on the body weights of free-living overweight and obese volunteers during periods of 8 weeks on each diet. In doing so, they not only build on previous research but also address criticisms of that research and of the definition and significance of ultra-processed foods.

In 2019, a rigorously controlled trial compared the effects of ultra-processed and minimally processed diets. Participants were paid volunteers who were essentially incarcerated in a metabolic ward, enabling strict monitoring and measurement of dietary intake. The volunteers ate as much as they wanted of each diet for two weeks. The diets were designed to be comparable in nutrient composition and palatability but differed mainly in the degree of processing. The result was unexpected; on the ultra-processed diet, the participants consumed an average of 500 kcal day<sup>-1</sup> more than when on the minimally processed diet – and predictably, they gained one pound (–0.45 kg) in body weight per week. On the minimally processed diet, the volunteers lost weight<sup>4</sup>. When another group of investigators repeated this study in a one-week crossover trial, they found an even greater difference of more than 800 kcal day<sup>-1</sup> (ref. 5).

Despite the tight control that is possible in metabolic-ward studies, other researchers have questioned the value of such short-term findings, arguing that the caloric difference would eventually disappear if the studies lasted longer and included baseline measurements and washout periods<sup>6</sup>. Others have criticized the concept of ultra-processed as poorly defined, and claim that the term inappropriately demonizes whole categories of foods that are basically healthful, such as commercial yoghurts and wholewheat breads<sup>7</sup>. Dicken et al.<sup>3</sup> designed their

	Minimally processed food diet	Ultra-processed food diet
Complies with British Eatwell dietary guidelines?	✓	✓
Change in body weight after 8 weeks (change in percentage)	↓ –1.84 kg (2.06%)	↓ –0.88 kg (1.05%)
Change in daily calorie intake after 8 weeks	↓ –504 (self-reported) –290 (calculated)*	↓ –290 (self-reported) –120 (calculated)*

**Fig. 1 | Changes in body weight and calorie intake.** Participants lost more weight and consumed fewer calories on the minimally processed diet as compared to the ultra-processed diet. \*Calculated based on observed changes in body fat and fat-free mass.

study to address such criticisms. They allocated participants to each diet for 8 weeks, rather than 1 or 2, and included baseline and washout measurements. Moreover, they formulated both diets to meet UK dietary guidelines ([The Eatwell Guide](#)) for health. Thus, they arranged for the study participants to eat comparably healthy, nutritionally matched meals for 8 weeks each, with the degree of processing the main difference between them.

At the start of the study, the participants were consuming at least half their total calories (self-reported as about 2,100 per day) from ultra-processed foods. To promote adherence to the protocol, pre-prepared meals were delivered to the volunteers’ homes at no cost. These provided a generous 4,000 calories per day, divided into breakfasts, lunches, dinners and snacks. Participants could eat as much as they wanted from the food they were given. They kept diaries of everything they ate from the meals provided, as well as any other food or drink that they consumed. This information was self-reported and not monitored.

Dicken et al.<sup>3</sup> set the primary outcome as the percentage change in measured weight occurring on each diet. The result was a surprise: study participants lost weight on both diets. Although the weight changes were minimal, weight loss was greater on the minimally processed diet (–1.84 kg, –2.06%) than on the ultra-processed diet (–0.88 kg, –1.05%). These losses were smaller than what would be expected from the participants’ self-reports of reduced calorie intake – 504 kcal day<sup>-1</sup> less on the minimally processed diet compared with 290 kcal day<sup>-1</sup> less on the ultra-processed diet. Based on the actual changes in fat and fat-free mass, the investigators calculated the daily caloric reductions as closer to 290 kcal day<sup>-1</sup> on the minimally processed diet and 120 kcal day<sup>-1</sup> on the ultra-processed diet (Fig. 1). The authors predicted that if participants maintained such reductions for a full year, they could achieve about a 10% weight loss on the minimally processed diet but only half that much on the ultra-processed diet. Given the extraordinary complexity and expense of a trial like this, the feasibility of running one long enough to confirm this prediction seems unlikely.

Why did the volunteers eat fewer calories than usual on both diets, and significantly fewer on the minimally processed diet? A possible explanation is that they did not like the ‘healthy’ meals and snacks very much. Although they reported little difference in satisfaction and hunger on the two study diets, they deemed the minimally processed meals and snacks to be less tasty. That diet emphasized ‘real’ fresh foods, whereas the ultra-processed diet featured commercially packaged ‘healthy’ ultra-processed food products such as fruit, nut and protein bars, sandwiches, drinking yoghurts, and plant-based milks.

Self-reported dietary data raise questions of reliability, but the weight losses were measured and firmly support the hypothesis that ultra-processed foods promote greater calorie intake – even over an 8-week period, even with ‘healthy’ ultra-processed foods, and even during weight loss. The reason for this effect of ultra-processed foods remains under investigation, with hyperpalatability, a faster eating rate, softer texture, and higher calorie density being major contenders<sup>8</sup>.

Overeating, being overweight, and increased risks of chronic disease are rapidly increasing public health issues for global societies. Dietary guidelines in the UK and the USA have had little effect on improving overall dietary intake. None of these guidelines considers the degree of processing. The findings from Dicken et al.<sup>3</sup> suggest that they should. Brazil’s dietary guidelines, issued in 2015, specify to “avoid ultra-processed foods”<sup>9</sup>. Researchers in the USA have called for

guidelines and regulatory approaches to help to reduce the intake of ultra-processed foods<sup>10</sup>. Despite ongoing debates about their definition, classification and effects on health<sup>1</sup>, in the context of maintaining or losing weight, the evidence points to a clear message: minimize the intake of ultra-processed foods.

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## Competing interests

The author declares no competing interests.