

Energy and Nutrient Timing for Weight Control

Does Timing of Ingestion Matter?



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KEYWORDS

- Eating frequency • Meals • Snacks • Breakfast skipping • Irregular eating
- Meal pattern • Eating pattern • Reported energy intake plausibility

KEY POINTS

- Observational studies on eating patterns for weight control are inconclusive.
- Breakfast is poorly, or inconsistently, defined across studies.
- Experimental studies on the effects of changes in the frequency and timing of eating to weight control are inconclusive and longer-term studies are needed.
- Improved tracking of participant compliance with eating pattern interventions using objective methods is needed.

INTRODUCTION

In 2011 to 2014, the prevalence of adult obesity in the United States was 36.5% and, especially among those aged 20 to 59 years, was higher in women (38%) compared with men (34%).¹ Up by 7.7% since 1999 to 2000, the continued rise in adult obesity is a constant reminder that a solution to the obesity epidemic remains elusive. Increasingly, factors, such as sleep duration and quality^{2,3} and the frequency and timing of energy and nutrient intakes,^{4,5} are being studied as possible contributors to the epidemic and, therefore, as potential targets for interventions to prevent and treat obesity. The extent to which eating patterns, such as meal skipping, snacking, irregular eating, and the frequency or timing of eating, confer any disadvantage to weight control remains poorly understood. Both the Academy of Nutrition and Dietetics⁶ and the 2015 Dietary Guidelines Advisory Committee⁷ have recently called attention to these factors, stating that more research is needed on these issues.

The state of the existing research on eating patterns related to frequency and timing is reviewed. This article focuses on studies in which self-selected diets are

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consumed, with the exception of the eating pattern manipulated in experimental studies, and includes observational as well as intervention studies.

EPIDEMIOLOGY OF EATING PATTERNS

The US Department of Agriculture Economic Research Service estimates the per capita energy availability from the food supply (adjusted for spoilage and waste) in the United States increased from 2039 kcal/d in 1970 to 2544 kcal/d in 2010, an increase of 505 kcal/d, or 25%.⁸ Other sources, based on US national survey data, show either similar^{9,10} or smaller^{11,12} increases in energy intake as well as a slight decrease since 2003 to 2004 of 65 kcal/d to 74 kcal/d.^{12,13} The increase in energy intake from 1977 to 2006 may have been due to increases in portion size (65 g) and eating frequency (1.1 eating occasions/d).⁹ Alternatively, other data¹⁴ show that from 1971 to 2010 (**Fig. 1**), the mean eating frequency has remained at approximately 5 eating occasions per day. These differences in estimates may be attributed to differences in the baseline data set used. **Fig. 1** also shows the mean number of meals per day has stayed consistently at approximately 2.75 meals per day, indicating some individuals do not adhere to the traditional breakfast, lunch, and dinner meal pattern and skip meals, whereas the mean number of snacks has decreased from 2.5 to 2.25 snacks per day for men but increased from 2 to 2.3 snacks per day for women.¹⁴ **Fig. 2** shows that the prevalence of skipping each of the 3 meal occasions increased from the early 1970s to the mid-1990s, then steadily decreased thereafter, although levels remain higher than baseline, with the most common meal skipped being lunch and the least common meal skipped being dinner for both men and women. Approximately two-thirds of Americans report eating breakfast, lunch, and dinner daily, representing a 10% decrease in the prevalence of eating all 3 meals in a day since 1971. The percentages of women consuming greater than or equal to 1 snack per day or greater than or equal to 2 snacks per day have increased, whereas the percentage of men snacking 1 or more times a day has not changed (see **Fig. 2**). Finally, concerning when people are eating, the data show that Americans are consuming breakfast, lunch, and snacks between breakfast and lunch and snacks between lunch and dinner later than previously and that dinner time has not changed, but a snack after dinner is consumed earlier than previously (**Fig. 3**). Overall, eating patterns have shifted toward more meal skipping and more snacking, especially among women, and all eating occasions before dinner are now consumed later, whereas an after-dinner snack is consumed earlier.

EATING FREQUENCY

Eating frequency, or the number of eating occasions per day, is commonly regarded as important for weight control. Specifically, it is said that a higher eating frequency assists with weight control by reducing appetite and/or increasing the metabolic rate or thermic effect of feeding. Studies in which energy intake is controlled, however, often have small sample sizes and are typically, although not always, of short duration.¹⁵ Leidy and Campbell,¹⁶ in reviewing controlled studies, concluded that eating more often than 3 times a day has minimal, if any, benefits to appetite control, and that eating less often than twice a day may have a negative impact on appetite control.

Many of the purported benefits of weight control come from cross-sectional studies in which a large number show an inverse association between eating frequency and adiposity.¹⁷ Bellisle and colleagues¹⁸ in the late 1990s, however, recognized that this association could be an artifact of implausible energy intake reporting, whereby individuals who reported eating less frequently had a higher body mass index (BMI) but also reported a lower total energy intake per day compared with those who

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