

# Intermittent fasting: a dietary intervention for prevention of diabetes and cardiovascular disease?

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## Abstract

**Intermittent fasting, in which individuals fast on consecutive or alternate days, has been reported to facilitate weight loss and improve cardiovascular risk. This review evaluates the various approaches to intermittent fasting and examines the advantages and limitations for use of this approach in the treatment of obesity and type 2 diabetes.**

**Keywords:** diet, fasting, intermittent fasting, obesity, type 2 diabetes, weight loss

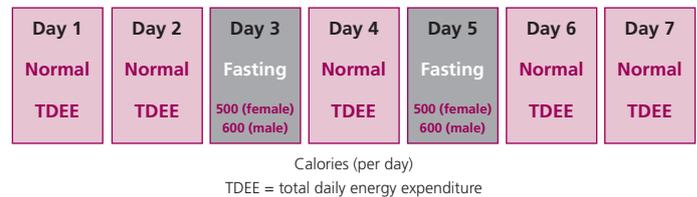
## Introduction

The increasing prevalence of obesity and type 2 diabetes in recent decades has been associated with increased comorbidities including atherosclerotic macrovascular disease and premature mortality.<sup>1-3</sup> Individuals with sub-diabetic degrees of hyperglycaemia, such as impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are also at increased risk of premature cardiovascular disease, emphasising the importance of interventions to improve glucose homeostasis in pre-diabetic, as well as diabetic individuals.<sup>4-5</sup>

Several large studies have identified pre-diabetic individuals as subjects in whom to investigate lifestyle changes to prevent the progression to a fulminant diabetic state.<sup>6-10</sup> However, there is considerable debate regarding the most effective manner in which lifestyle changes such as diet and/or exercise should be implemented.<sup>11</sup> The approach of intermittent fasting is currently generating particular interest.

## Intermittent fasting

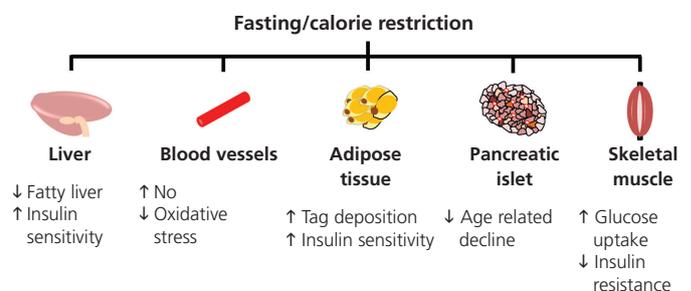
Extensive evidence suggests that imposing fasting periods upon experimental laboratory animals increases longevity, improves health and reduces disease, including such diverse morbidities as cancer,<sup>12,13</sup> neurological disorders<sup>14-17</sup> and disorders of circadian rhythm.<sup>18,19</sup> The specific benefit of intermittent fasting as a health-giving therapeutic approach has been recognised since the 1940s.<sup>20</sup>



**Figure 1.** Diagrammatic representation of a typical intermittent fasting plan. Subjects who undertake this form of diet are required to limit their calorie intake for two days, consecutively or otherwise each week. The calorie limit for fasting days is approximately 25% of TDEE or 600 calories for men and 500 for women. On non-fasting days subjects can eat normally to their TDEE calorie level (approximately 2 500 for men and 2 000 for women).

Intermittent fasting can be undertaken in several ways but the basic format alternates days of 'normal' calorie consumption with days when calorie consumption is severely restricted. This can either be done on an alternating day basis, or more recently a 5:2 strategy has been developed (Figure 1), where two days each week are classed as 'fasting days' (with < 600 calories consumed for men, < 500 for women). Importantly, this type of intermittent fasting has been shown to be similarly effective or more effective than continuous modest calorie restriction with regard to weight loss, improved insulin sensitivity and other health biomarkers.<sup>1,21</sup>

Fasting has been used in religion for centuries. For example, the Daniel fast is a biblical partial fast that is typically undertaken for three weeks, and during Ramadan, the ninth month of the Muslim calendar, there is a month of fasting during daylight hours, during which some observers also refrain from fluid consumption.<sup>22</sup> Such periods of fasting can limit inflammation,<sup>23</sup> improve circulating glucose and lipid levels<sup>24-27</sup> and reduce blood pressure,<sup>28</sup> even when total calorie intake per day does not change, or is only slightly reduced. Ethical and logistical constraints have restricted most caloric deprivation studies to six months, although some have assessed the effects for longer.<sup>29-31</sup> The majority of studies show positive effects on markers of metabolic health and body composition, in part due to the demonstrated effects intermittent fasting has on metabolic tissues (Figure 2). In addition caloric restriction studies undertaken



**Figure 2.** Tissue-specific effects of intermittent fasting and calorie restriction. Research has identified several biological effects of intermittent fasting and/or calorie restriction on tissues that are central to metabolic and cardiovascular health. NO: nitric oxide, TAG: triacylglycerides.

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