



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; SP-11(9): 139-144  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)  
Received: 03-05-2022  
Accepted: 15-06-2022

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## Intermittent fasting: A way towards healthy life

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### Abstract

As a weight-loss strategy other than daily calorie restriction, intermittent fasting is becoming more and more popular (DCR). There are numerous ways to practice intermittent fasting (IF), another form of dietary pattern based on periodic periods of fasting those human studies suggest may lower the risk of cardiovascular disease by improving body composition, weight management, and clinical health markers linked to disease. Each of them divided the day or week into eating and fasting times. IF is a very effective approach to lose weight and belly fat and is linked to better health results, including lower triglycerides, total cholesterol, low density lipoprotein, and more. It may modestly increase metabolism while assisting you in eating fewer calories. Fast days and alternate-day energy restriction, often known as alternate-day fasting (ADF), are two types of intermittent fasting. The second type is time-restricted feeding (TRF), which involves eating only during certain hours, most commonly the 16: 8 diets.

**Keywords:** Intermittent fasting, alternate day fasting (ADF), time restricted feeding (TRF), calorie restriction (CR)

### Introduction

Overeating has a significant impact on living person illness and demise, so losing weight is an effective tool for improving wellbeing and improving the quality of life. Fasting has been designed as a remedy that takes advantage of the favorable effects of caloric limitation while avoiding the negative effects. Weight loss is an effective strategy to improve public health and Caloric restriction (CR) is a dieting strategy that promotes losing weight and has a slew of benefits for obese people. (Adela Caramoci, 2017) <sup>[21]</sup> Obesity-related diseases can be reduced by losing weight and improving body composition (reducing body fat and/or increasing muscle mass) by physical activity and dietary changes. Alternate day fasting, whole-day fasting and time-restricted feeding are the three most common intermittent fasting regimes. (Grant M, 2015) <sup>[40]</sup> Fasting aids with the body's natural ability to cleanse itself and remove toxins from the blood, its increases inner serenity and awakens the intellect. (Agrim Jain and Co., 2020) <sup>[23]</sup> IF has developed into a versatile dietary approach that includes delayed or early feeding windows, (Clinical advantages, such as better glycemic and lipid profiles, as well as weight loss, have occasionally been seen in well-controlled randomized clinical trials using IF regimens of early or delayed meal windows. (Heitor O Santos, 2022) <sup>[24]</sup> The liver begins to break down fatty acids to make ketone bodies after an 8 to 12-hour period of fasting. When glucose, the traditional fuel source, is not available, the human body turns to ketone bodies as a backup to maintain important organs and tissues. Studies have demonstrated that intermittent fasting lowers blood inflammatory markers and enhances glucose control. (Zhaoping Li, 2021) <sup>[25]</sup>

### Definition of intermittent fasting

The term "intermittent fasting" refers to a calorie restriction that occurs on a regular basis, can range from a few hours during the day to a full 24-hour period (Harvard Health Blog 2018, Krista A Varady, 2009, Trepanowski 2017) <sup>[6, 26]</sup>. Time restricted feedings (TRF) is the most common type of intermittent fasting, which entails restricting daily meal intake to an 8-hour window and fasting for 16 hours each day. (Sutton, 2018) <sup>[27]</sup> TRF is especially popular among physically active people, because to reports of its ability to help people lose weight while keeping muscle mass (Sutton, 2018, Harvie, 2017) <sup>[27, 41]</sup> Intermittent fasting has been shown to improve energy metabolism and overall health (Fontana and Partridge, 2015) <sup>[28]</sup> Longo and Mattson, 2014) <sup>[18]</sup>. Dietary restrictions, such as calorie restriction or intermittent fasting (IF), in animal models, dietary restriction, such as a reduction in energy consumption or (IF), a

dietary exercise routine in which meal is available ad libitum but every other day, has been shown to extend life and reduce

the incidence of age-related diseases such as cancer, diabetes and kidney disease.

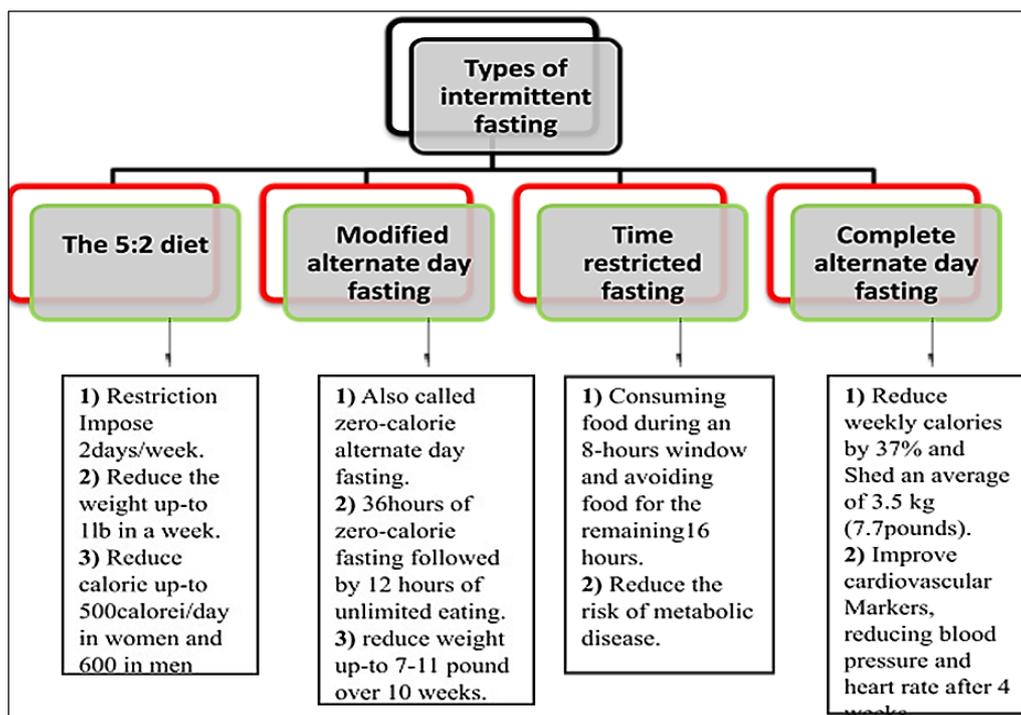


Fig 1: Types of intermittent fasting

**Alternate day fasting**

(ADF) is a novel type of dietary limitation that can help you lose 4-8% of your body mass in 8 to 12 weeks. ADF allows dietitians to switch between a "feed-day", in which they eat as much as they like, and a "fast-day", in which they limit their overall energy intake by 75% on specified fasting days, it allows for consumption up to 25% total energy demand. The popular 5:2 diet based on this concept, which involves extreme energy restriction for two days week and ad libitum eating for the other five days. Only a few research have been conducted to determine the effect of ADF on body mass and

CHD (coronary heart disease risk reduction, and nearly all of these investigations were conducted in obese people (BMI 30-39.9 kg/m<sup>2</sup>). Obesity has long been identified as a concern factor for metabolic illnesses such as atherosclerosis, dyslipidemia, & nonalcoholic fatty liver problems, and it is a factor that can be controlled. Adult obesity is a result of an energy imbalance induced by increasing calorie consumption and sedentary behavior. Long-term high carbohydrate consumption has the extremely serious detrimental effect on the human body.

Table 1: Alternate day fasting

Area of Research	Type	Duration	No. of Subject	Energy Consumption	BMI of Subject	Effect on Disease	Mechanism	Reference
University of Illinois at Chicago	ADF	10 Week	16	Consuming 25% of energy needs on the fast day and ad libitum food intake on the following day		These data imply ADF is a reasonable diet option for obese people who want to lose weight and lower the risk of coronary artery disease. Clinical trials, Gov. assigned the number UIC-004-2009 to this study.	Dietary adherence was good throughout the controlled food intake phase (86%) and the self-selected food intake phase (89%) and the rate of weight reduction was consistency during both phase (0.67-0.1 kg/wk. for controlled food intake and 0.68-0.1 kg/wk. for self-selected food intake). After 8 weeks of dieting, body weight reduces by 5.6-1.0 kg (5.8% 1.1%) (P 0.001). The % of body fat dropped from 45.2%-42.2% (P 0.01) after 8 weeks of ADF, total cholesterol, LDL cholesterol, and triglycercerol concentration all dropped (P 0.01) by 24%, 25% and 36% respectively, although HDL cholesterol remained stable. The systolic blood pressure dropped from 124.5-116.3 mm Hg (P 0.05).	Krista A Varady <i>et al.</i> , 2009 [6]
Chicago Birmingham	ADF vs CAD F	1 year	100	ADF -25% of energy needs on fast, 125% energy needs on alternating "fast days" CR-75% of every need every day		Alternate day fasting did not improve adherence, weight reduction, weight maintenance or cardio protection when compare to daily calorie restriction.	At month 6 (-6.8% [95% CI,-9.1% to 4.6%]) vs. -6.8% [95% CI, -9.1%-4.6%]) and month 12(0.6% [95% CI, -8.5% to -3.6%]) vs. -5.3% [95% CI 7.6% to -3.0%]), participants in the ADF group and those in the mean HDL cholesterol level increased considerably in the ADF group at month 6 (6.2 mg/dl [95% CI 0.1-12.4 mg/dl]), but not In the CR group at month 12 (0.1 mg/dl [95% CI-5.9 to 7.8 mg/dl]) by month 12, the participants in the ADF fasting group has substantially higher level of LDL	Surabhi Bhutani, <i>et al.</i> , 2013 [18]

						cholesterol (11.5 mg/dl [95% CI, 1.9-21.1 mg/dl]) than those in the daily CR group (11.5 mg/dl [95% CI, 1.9-21.1 mg/dl]).	
Chicago	ADF	8 weeks	74	24-hr feeding/24-hr, 25% energy intake at lunchtime	Allowing people to have the fast day meal at supper or in tiny portions results in equal weight loss and calorie protection as eating it at lunch. This meal-timing flexibility may improve tolerance and long-term compliance with ADF treatments.	All three group lose weight at the same rate (P 0.001) (ADF-I: 3.5 0.4 kg, ADF-D; 4.1 0.5kg, ADF-SM: 4.1 0.5 kg) fat mass and visceral fat reduction were also comparable (P 0.001). Plasma lipids remained stable, whereas the particle size of LDL increased (p 0.05) in all groups (1.3 0.5) only ADF-SM reduced systolic blood pressure 9P 0.05) the levels of fasting glucose, insulin, and HOM-IR did not alter.	Hoddy <i>et al.</i> , 2014 <sup>[29]</sup>
Chicago	ADF + endurance exercise	12 weeks	64		When compared to separate therapies, these findings imply that the combination promotes improved improvements in body weight, body composition and lipid indicators of heart disease risk.	In the combination ADF, and exercise groups, body weight was reduced by 6±4 kg, 3±1 kg and 1±0 kg respectively (P 0.05) in the combination, fat mass and waist circumference reduced (P 0.001) whereas lean mass was maintained. The combination group only saw a decrease in LDL cholesterol (12.5%, P0.05) and an increase in HDL cholesterol (18.9%, P 0.05). In the combination and ADF groups, LDL particle size rise by 41 and 51 (P 0.001), respectively. Only in the combination group did the fraction of tiny HDL particles decrease (P 0.01).	Surabhi Bhatani, <i>et al.</i> , 2013 <sup>[8]</sup>
USA	ADF	22 days	16(8 men and 8 women)		In nonobese participants ADF was possible and fat oxidation increased. On fasting days however, hunger did not reduce, possibly reflecting the impossibility of sticking to this diet for an extended period of time. This approach to dietary restriction may be more tolerable meal is including on a fasting day.	The participants shed 2.5±0.5% of their body weight and 4±1% of their initial fat mass (P 0.001). on the first day of fasting, hunger spiked and remained elevated (P 0.001) RMR and RQ did not change significantly from baseline to day 21, but RQ fell on day 22 (P 0.001), resulting in a daily fat oxidation increase of >or =15g fasting insulin reduced 57±4% (P0.001), although glucose and ghrelin did not change significantly from baseline with ADF.	Heilbronn
Korea	ADF		112 into 4 groups 1. ADF and exercise (E-ADF) 2. ADF exercise 3. Control		These findings imply that physical activity, whether with or without ADF, improves cholesterol metabolism as evaluated by serum sterol profiles, and that increasing physical activity has a higher impact cholesterol production than weight loss or calorie restriction.	Most serum sterol profiles associated with cholesterol metabolism were significantly changed across groups after intervention (P 0.05) by analysis of covariance (ANCOVA). Plant sterol, which are indicators of cholesterol adsorption showed no variations. Cholesterol esters and oxysterols all dropped dramatically in the exercise group. Furthermore, only changes in physical activity levels were inversely connected with changes in demosterol and 7-dehydrocholesterol to cholesterol metabolic ratios, which represent cholesterol production (r = -0.411; P = 0.030 and r = -0.540; P = 0.003) respectively.	Cho, <i>et al.</i> , 2019 <sup>[30]</sup>
Iran	ADF	8 weeks	15		These findings imply that a short-term ADF is a reasonable dietary option for obese people who want to lose weight and lower their risk of coronary artery disease. More and longer-term human research is needed to backup this crucial finding.	The individuals BW reduced (P 0/0001) from 4/3±11/44 kg to 78/3±10/18 kg over the duration of the study waist circumference fell from 87/87±9/74 to 82/86±9/68 (P/<0/001). Systolic blood pressure dropped from 114.8±9.16 to 105.13±10.19 mm Hg (p<0/001), whereas diastolic blood pressure dropped from 114.8±9.16 to 105.13±10.19 mm Hg (p<0/001), whereas diastolic BP dropped from 82.86±10.6 to 74.5±10.8 (p<0.05) total cholesterol dropped from 227/73±49/96 to 214/67±43/27, TG from 160/5±46/18 to 143/9±22/77, LDL from 149/46±49/81 to 131/3±50/97, and FBS from 102±14/7 to 96±11/79 mg/dl, although these changes were not statistically significant. The increase in HDL from 42/32±10/01 to 50/58±19/46 was not statistically significant.	Eshghinia, <i>et al.</i> , 2013 <sup>[31]</sup>

### Time restricted feeding

Another intermittent fasting technique that has recently gained popularity is time-restricted feeding (Patterson RE & Sears DD, 2017) [32]. This method does not require knowledge of food composition or self-control during eating occasions; rather, it only requires awareness of the time during which eating occasions are allowed at all. This strategy seeks to limit feeding chances and extend the overnight fast to at least 14 hours per day by limiting food consumption to a temporal

window (usually 10h) during the waking phase (Sutton, 2018) [27]. Research conducted in the lab examined the effects of extending the overnight fast on energy balance and food metabolism, yielding many insights into how such tactics can work (Gonzalez, 2018, Chaudhary, 2016, Betts, 2014, Betts, 2016) [43-45]. In competitive cyclists, a TRE programme with an 8-hour eating gap results in losing the weight, improved body structure, and higher PPO/BW, TRE may also reduce inflammation and protect immune system cells.

**Table 2:** Time restricted feeding

Area of Research	Type	Duration	No. of Subject	Energy Consumption	BMI of Subject	Effect on Disease	Mechanism	Reference
USA	ETRF (early time restricted feeding)	5 weeks				Demonstrate that ETRF improves several elements of cardio metabolic health in humans for the first time and that the effects of IF are not entirely attributed to weight loss.	For 5 weeks, men with prediabetic were randomly assigned to either the ETRF (6hour feeding period, with dinner before 3 pm) or the control schedule (12 hour feeding period) and then switched to the other schedule. Insulin sensitivity, cell responsiveness, blood pressure, oxidative stress, and appetite were all enhance by ETRF.	Sutton, <i>et al.</i> , 2018 [27]
Iran	TRF	1 month	82 (44 female 38 male)	Dusk till dawn fasting		In participants with a past history of cardiovascular disease, this study reveals a significant improvement in 10-year coronary heart disease risk score and other cardiovascular risk markers such as lipid profile systolic BP, weight BMI and waist circumference.	Before and after Ramadan subjects who had fasted for at least 10 days came to the metabolic unit after fasting for at least 10 hours. there was significant reduction in 10-year coronary heart disease risk (based on the Framingham risk score) (13.0 8 before Ramadan vs. 10.8 7 after Ramadan P 0.001, T test) after Ramadan there was a substantial increase in HDL, RCB and platelet count (PIT), as well as decreased in plasma cholesterol triglycerides, LDL-c, VLDL-c, systolic BP, BMI and waist circumference (P 0.05 T-test) before Ramadan and after Ramadan, there were no significant difference in FBS insulin, homeostatic insulin resistance 9HOMA-IR) and diastolic BP ( $p > 0.05$ , T-test).	Namety, <i>et al.</i> , 2012 [42]
Turkey	RF	1 month	122	Dusk till town		Fasting throughout Ramadan has no effect on the glycemic control of type-2 diabetic patients.	The fasting group has greater rates od serve hyperglycemia and hypoglycemia although the difference was not significant (P = 0.18) weight BMI, waist circumference, BP, FPG (143.38±52.04 vs. 139.31±43.47 mg/dl), PPG (213.66±109.31 mg/dl) fructosamine (314.18±75.40 vs. 314.49±68.36µ mol/l), HbA1c (6.33±0.98 vs. 6.22±0.92%) and fasting insulin during Ramadan., microalbuminuria reduce considerably (132.85±197.11 vs. 45.03±73.11 mg/dl).	Sabin, <i>et al.</i> , 2013 [35]

### Brain Disease and IF

Brain illnesses linked to ageing, such as neurodegenerative disorders, have become increasingly widespread in recent decades and are now among the major causes of death. After decades of searching for a "pharmaceutical cure," researchers began looking for self-care behaviors. Furthermore, gaining a better understanding of lifestyle factors and how they affect ageing and neurodegenerative has yielded hopeful results. Many researchers believe that modern lifestyle variables like bad food and lack of exercise contribute to the accelerated brain ageing and diseases seen in modern culture. (1, 2, 3) IF and mental illnesses Dietary treatments are being investigated to see if they can aid in the prevention and treatment of mental diseases. (IF), which entails absence or severe calorie limitation for hrs. Followed by times of regular food consumption, it has been shown to improve brain function in animal experiments. Clinical trials have demonstrated that intermittent fasting can help with epilepsy, Alzheimer's disease, and the symptoms and progression of multiple sclerosis, according to (Jip Gudden *et al.*, 2021) [37] in their review. IF may assist individuals with ischemic stroke, Parkinson's disease, autism spectrum disorder, and mood and anxiety issues, according to animal research. If the

Mechanism is Beneficial to Mental Wellbeing and Cognitive Function Figure-Brain Health and Cognitive Functioning General Mechanism (Jip Gudden *et al.*, 2021) [37]. Overall, the metabolic, cellular, and circadian systems of fasting periods have direct and indirect impacts on the brain, which may enhance cognitive functioning and delay or hasten the progression of brain-related disorders. Neurological Disorders Alzheimer's disease is characterized by beta-amyloid (A) plaques and neurofibrillary tangles, which cause neuronal death and cognitive impairment. Parkinson's disease is defined by the production of syncline-containing Cell bodies in the substantia nigra (SN), as well as motor control and cognitive deficits (PD). (Tysnes, O.B. *et al.*, 2017; Baquet, Z.C. *et al.*, 2004; Howells, D.W. *et al.*, 2000) [46, 47, 39]. Multiple Sclerosis is an autoimmune illness in which the body's abnormal T-cell-mediated inflammatory response causes demyelination and axonal damage, leading to neuronal death. (Raine, C.S. *et al.*, 1993; Choi, I.Y. *et al.*, 2016) [48, 6]. Relationship with IF is in a state of disarray. Latest studies suggest that fasting-induced metabolic alterations in the brain can improve cognitive ability, neuroplasticity and disease resistance Overfeeding and metabolic illnesses, on the other hand, are known to harm brain metabolism and exacerbate

neurodegenerative disease symptoms. As a result of the scarcity of validated and effective medicines, the attention has shifted to modifiable lifestyle factors like dietary habits. Dietary restriction, in particular, looks to be among the highly effective method and is currently a hot issue in scientific publications. Several researches have looked into the effects of intermittent fasting on mental health disorders such as tension, anxiety & depression. A recent scientific analysis looked at 11 of this research, totaling over 1,400 people. The large number of studies was focused on fasting from sunrise to sunset during Ramadan, the Islamic holy month. Others included 5:2 and 1-day-per-week fasts, and also 14/10 eating restrictions. Fasting throughout Ramadan was linked to reduced stress, anxiety, and depression symptoms, according to the researchers. Other methods of IF did not show significant results when studied jointly. However, after the low-quality trials were excluded, the remaining studies revealed that intermittent fasting reduced anxiety and depression in subjects.

### Conclusion

In the health and fitness world, intermittent fasting (IF) is a pattern of eating that alternate between periods of fasting and eating. When you fast, your body cells modify the expression of genes, start crucial cellular repair processes, and your levels of insulin drop. IF can be really good for your body and mind. It can lead to weight loss and may lower your risk of cancer and heart disease. Numerous IF studies support the therapeutic value of IF on human health and human studies demonstrate IF's beneficial effects on weight loss.

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