

Review Article

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The Role of Intermittent Fasting in Alleviating Inflammation and Strengthening Health

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ABSTRACT

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The term fasting is not a recent attraction. It includes an improvement in inflammatory markers, hormone balances, decision-making, immune regulation relationship with body-mass, and behavioural qualities. Recent researches have demonstrated that intermittent fasting (IF) exerts significant effect on stress hormone-cortisol-release on important metabolic pathways. Studies have shown that fasting induces the release of cortisol, in both humans and animals. It is a measure to create energy balance in times of food scarcity aiding in survival. Additionally, administration of intermittent fasting (IF) may help in managing microbiota-gut-brain axis and preventing neurodegenerative diseases like Parkinson's, Alzheimer's, dementia. Intermittent these bodily and behavioural responses indicate the intricate balance maintained by intermittent fasting, reiterating its potential as a therapeutic for stress or immune-related disorders.

Introduction

WHO (1994), affirms that health is a state of complete physical, mental and social wellbeing and not merely the absence of a disease or infirmity. Health has been defined as the ability of a body to adapt towards new threats and infirmities (Lancet, 2009). Several other definitions for health exist which describe alterations in well-being due to any biological situation leading to altered DNA's, abnormal physiologic states, abnormal anatomy, a disease, a disability or death.

Changing patterns of daily activities and the modern lifestyle have resulted in a lot of destructive health patterns. Human circadian and circannual rhythms have

undergone drastic changes. Decreased physical activities and sedentary, stressful work culture is a big deterrent in pursuing healthy practices (Walker *et al.*, 2020).

Major concerns for health arise from habits like sedentary life style, irregular eating patterns, excessive consumption of processed food, irregular sleeping patterns, use of excessive alcohol and tobacco etc. These lead to chronic illnesses such as diabetes, hypertension, cardiovascular diseases, muscular degeneration etc. (Patel *et al.*, 2015).

Toxins from environment pollutants cause diseases, premature deaths in addition to health issues like respiratory disorders, neurological disorders,

gastrointestinal disorders, kidney diseases, liver diseases, skin diseases, cancer, asthma etc. (Prüss-Üstün *et al.*, 2016).

Acute as well as chronic stress as researched by various studies has become so pervasive that they are impacting mental and physical well-being as studied by Schneiderman *et al.*, (2005). Psychological stress is always manifested as physiological disease as observed by Cohen *et al.*, (2007).

Human health is also under extreme pressure due to harmful stimuli such as pathogens, environmental contaminants, radiations etc. causing cellular damage. These injurious agents stimulate a complex biological response known as inflammation.

Inflammatory pathways within the body identify pathogens, pathogen recognition receptors get activated, they trigger intracellular signalling leading to the production of inflammatory cytokines (interleukin-1 β (IL-1 β), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF- α) (Stone *et al.*, 2024).

Acute inflammation it is generally helpful because it eliminates pathogens and also repairs the tissue. However, prolonged inflammation becomes chronic leading to autoimmune diseases like arthritis, diabetes, neurodegeneration and cardiovascular dysregulation. Chronic Inflammation often leads to the presence of persistent reactive oxygen species and cytokines which further cause tissue damage and makes the tissue dysfunctional (Chen *et al.*, 2017).

Types of Intermittent Fasting

Intermittent fasting is a dietary pattern characterized by alternating period of abstinence from food and meal consumption. People fast according to their needs, dietary preference, age, and physical conditions. Fasting has been age-old practice across culture. Patterns include alternate day fasting extended or partial fasting that limits specific foods or lipids (Longo and Mattson, 2014).

The most common intermittent fasting method includes alternate-day fasting, whole-day fasting with a specified frequency per week and time-restricted feeding, which means fasting during a designated time period (<https://www.healthline.com/nutrition/intermittent-fasting-guide#what-is-it>).

Time-Restricted Feeding (TRF): It is a dietary regimen characterized by consuming all calories in 6- to 10-hour periods of the circadian active phase without directly altering diet quality or quantity. Preclinical studies done by Regmi *et al.*, (2020) of TRE demonstrate reductions in blood pressure, atherogenic lipids and hepatic steatosis results improvements in metabolic flexibility, the gut microbiome and cardiometabolic health. It can also enhance glucose tolerance.

Recent research confirms TRF reduces inflammatory markers such as TNF- α , c- reactive protein (CRP), and leptin activates autophagy, and reprograms metabolism (Khalafi *et al.*, 2025).

Alternate-Day Fasting (ADF): Involves alternate days where calories intake is limited on the day of fast and food is eaten freely on the next day which is counted as non-fasting. This strategy improves energy, reduce body weight, improve lipid profile, and improves insulin sensitivity as observed by Tinsley and Bounty, (2015).

Whole-Day Fasting: Includes fasting for a full day (24 hours) once or twice weekly. This regimen can lead to significant weight loss, improved cardiovascular health, and decreased levels of oxidative stress (Patterson and Sears, 2017).

5: 2 Diet: It is a week-long fasting pattern where food is consumed normally for five days of the week and calorie intakes is restricted to about 500-600 calories on the remaining two days. This method helps with weight loss, insulin sensitivity, and is beneficial for metabolic health (Mattson and Harvie, 2017).

Intermittent Fasting (If) For Managing Inflammation

Chronic inflammation can produce numerous pathological conditions like Type 2 diabetes, Neurodegenerative disorders, Cardiovascular insufficiency etc. The traditional way to treat them pharmaceutical drugs which have side effects, on the other hand IF is a natural strategy which can control anti-inflammatory pathways just by nutrient deprivation. (Tavakoli *et al.*, 2025).

There is sufficient clinical evidence to demonstrate that intermittent fasting can reduce pro inflammatory cytokines in observable amounts. It has been established that intermittent fasting can significantly reduce TNF- α ,

CRP, and Leptin. In the case of Time restricted feeding (TRE) TNF Alpha was found to reduce quite significantly. Even a single fasting of 24 hours causes significant cytokine suppression. This suggests that the inflammatory pathways have been modulated for cytokine expression (Mulas *et al.*, 20023).

The suppression of the NRLRP3 inflammasome is one of the most well-defined mechanisms which prove the anti-inflammatory effect of intermittent fasting. The NLRP3 inflammasome is a critical component of innate immunity. Intermittent fasting increases arachidonic acid levels in the blood which can directly inhibit the activation of NRLRP3 inflammasome.

The suppression of NRLRP3 reduces the production of pro-inflammatory cytokines providing anti-inflammatory benefits (Traba *et al.*, 2017).

Intermittent fasting also triggers autophagy facilitating the degradation of damaged cellular components and pro inflammatory mediators. Enhanced autophagic flux during fasting promotes anti-inflammatory macrophages

and their polarization further reducing tissue inflammation. Extended periods of fasting also exhibits anti-inflammatory effect by inducing ketosis. It produces beta hydroxybutyrate (β -HB) which can trigger neuroprotection.

It also reduces pro inflammatory cytokines production thus tweaking inflammatory gene expression. (Zhu *et al.*, 2022).

Comparison studies between intermittent fasting and caloric restriction show that calorie restriction appears more effective in reducing CRP and IL-6 whereas TNF- α is reduced more efficiently by intermittent fasting (Aamir *et al.*, 2025).

With all the above evidence it can be established that anti-inflammatory effect resulting from intermittent fasting can lead to protection against many chronic diseases like Alzheimer's, Parkinson's and also improve metabolism by enhanced insulin sensitivity, reduced serum inflammation and overall improvement in the immune system function.

Table.1 Common Methods for Intermittent Fasting

S. No.	Intermittent Fasting Method	Fasting Period	Eating Period
1.	12: 12 Method	12 hours	12 hours
2.	14: 10 Method	14 hours	10 hours
3.	16: 8 Method	16 hours	8 hours
4.	5: 2 Method	Consume only 500-600 calories on 2 non-consecutive days	Eat normally on 5 days
5.	Eat-Stop-Eat Method	Complete fast on 2 non-consecutive days	Eat normally on 5 days
6.	4: 3 Alternate Day Method	Complete fast on the alternate 3 days	Eat normally on 4 days
7.	The Warrior Diet	Eat low calorie meals such as fruits and raw vegetables for 20 hours	Eat a good meal during 4 hours

Intermittent Fasting (IF) For Managing Health

Damage to health can be reversed or managed not only by pharmaceuticals but also by traditional methods as they are easy to adapt. Some available options include: a balanced diet, increased physical activity and mild exercises (Warburton and Bredin, 2017). In order to manage the neuroendocrine function or homeostatic or endocrine functions of the body, adequate sleep,

meditation, yoga, abstinence of from smoking and alcohol consumption is also helpful (Farhud, 2015).

One method to maintain health which is gaining attention is dietary modifications through intermittent fasting IF as it has proven significant anti-inflammatory properties and therapeutic potential. Benefits include reduced inflammation, hormonal balance, weight loss, improved metabolic health, improved cognition, decision making,

behavioural improvements, and regulated immune responses.

There is an established interrelationship between stress and intermittent fasting. Stress triggers the release of hormones like cortisol, insulin, and leptin. This release affects metabolism, contributes to weight gain as well as causes modulation of the immune system (Chrousos, 2009). They can be balanced through lifestyle changes, including adopting IF, dietary adjustments and stress management practices (Mattson *et al.*, 2017).

Intermittent fasting reduces stress by promoting cellular repair, improving brain function, and regulating mood through hormonal balance (De Cabo and Mattson, 2019; <https://www.healthline.com/nutrition/10-health-benefits-of-intermittent-fasting>).

IF improves the body's natural sleep-wake cycle and helps to activate immune cells, decreases inflammation, reduces oxidative stress and decreases the occurrence of endocrine illnesses (Patterson and Sears, 2017).

It provides advantages like autophagy, boosts memory and thinking, improves blood pressure and resting heart rates (John Hopkins Medicines, 2023). It also improves physical performance, leading to fat loss and maintenance of muscle mass and correspondingly a decrease in autoimmune diseases (Harvie and Howell, 2017).

It helps in weight reduction, regulates glucose and lipid metabolism, decreases blood pressure, decline in obesity, reduced risk factors for chronic diseases and positively modifies the immune system (Clayton, 2020).

From a physiological standpoint calorie restriction has been demonstrated to enhance lifespan as well as the body's ability to withstand different metabolic pressures along with many immunologic and stress-related endpoints in animals especially rodents (Robertson and Mitchell, 2013). Intermittent fasting is proportionately linked with physiology and behaviour (Seimon *et al.*, 2015, <https://www.masterclass.com/>). According to a study done by Ring *et al.*, (2022), people who fasted felt more aware and were less tired, stressed or anxious.

Inadequacies of Intermittent Fasting (IF)

It is crucial to acknowledge as per the findings of Horne *et al.*, (2015) that intermittent fasting may not be

appropriate for all individuals, particularly those with specific medical issues or dietary requirements.

IF may lead individuals to encounter variations in blood glucose levels, which can provide challenges for individuals with diabetes or other blood related disorders. It may lead to digestive issues, irritability, mood changes, fatigue, bad breath, sleep disturbances, dehydration, and malnutrition (Nye *et al.*, 2024). It may also cause headaches, lethargy, disordered eating, constipation, hypoglycemia, sleep disturbances, dizziness (Corley *et al.*, 2018).

In conclusion, the present-day living conditions are stressful and reduce down to mere survival. So it is important to devise methods for sustenance. Intermittent fasting leads to increase in HGH, the growth hormone which can help with both fat loss and muscle growth. It improves insulin sensitivity, increases autophagy and simultaneous removal of old and dysfunctional protein build up. Additionally, IF can affect hormone levels and aid in disease prevention. IF increases the release of the fat-burning hormone norepinephrine (noradrenaline).

Its trail of health benefits includes reduction inflammation markers, weight loss, brain health and supports the growth of new nerve cells.

Intermittent fasting has now been validated to strengthen our immune system by inflammation reduction through complex molecular mechanisms like NLRP3 inflammasome suppression, cytokine modulations and decrease in inflammatory biomarkers. It also helps reduce risk of chronic diseases.

Although underweight individuals, those with a history of eating disorders, having low blood pressure, is on medications, are trying to either conceive, are pregnant or are nursing should not do IF without consultation.

We need to be aware that the research on IF is still in its nascent stages. Intermittent fasting is an accessible non pharmacological intervention for health optimization, reducing stress and immune system modulation without dependency on pharmaceuticals.

Author Contributions

Eshita Pandey (Corresponding Author): Conceived the original idea, wrote the manuscript, formal analysis,

reviewing and validation; Shikha Verma: Wrote the manuscript, formal analysis, reviewing, and editing.

Declarations

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Consent to Participate Not applicable.

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