



Intermittent fasting: a cure to reduce obesity

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Introduction:

1. Obesity

Obesity is a medical condition which affects physiology by gaining excess weight than ideal weight.³ According to WHO obesity is the advanced state of being overweight. Abnormal fat accumulation hinders natural processes of various systems in human body. Obesity is measured by body mass index (BMI) which is the ratio of square of height and weight.⁵ Overweight and obesity typically invites a risk to health increasing excess quantity of fats accumulation in the adipose tissues of the body. A person with body mass index 25 falls in the category of overweight, and BMI over 30 is considered as obese¹⁴. The prevalence of overweight and obesity has risen by 4% from 1975 to 2016 among children and increased about 3 times from 1975 to 2016 in 1.9 billion adults (18y+) including 39% of men and 40% of women were overweight and near about 650 million adults (11% of men and 15% of women) were obese. About 38 million “U-5 years” children were estimated to be overweight or obese in 2019 particularly in urban families.⁴ The National Family Health Survey of India 2019-21 (NFHS-5), nutritional status of adults (15-49 years) estimated that on an average 24% and 23% of urban-rural women and men were overweight or obese which is 4% and 5% greater than the NFHS-4 (2015-16) respectively. The waist to hip ratio of Indian women and men were 56.7 and 47.7 respectively which indicates high fat per cent accumulation in the body. About 3.4% of children under 5 years were found overweight which is 1.3% higher than NFHS-4 2015-16. The highest frequency of overweight or obese men (table-2) were found in the state/UT of Andaman & Nicobar islands (45%), Puducherry (43%) and Lakshadweep (41%) and in women (table-1) were Puducherry (46%), Chandigarh (44%), Delhi, Tamil Nadu, and Punjab (41% each), and Kerala and Andaman & Nicobar Islands (38% each).

Table – 01

Obesity status of women in states/union territory of India

Among women age 15-49 below 145 cm, mean body mass index (BMI), and percentage with specific BMI levels, by state/union territory, India, 2019-21

State/union territory	Mean BMI	Body mass index (overweight / obese)		
		≥ 25.0 Overweight/obese	25.0-29.9 Over weight	≥ 30.0 Obese
India	22.4	24	17.6	6.4
North region				
Chandigarh	24.5	44	27.7	16.3
Delhi	24.5	41.4	27.1	14.2
Haryana	23.4	3.1	23.2	9.9
Himachal Pradesh	23.2	30.4	23	7.5
J & K	23.6	29.4	24.6	4.8
Ladakh	23.6	28.3	25.1	3.2
Punjab	24.3	40.8	26.6	14.2
Rajasthan	21.4	12.9	10.2	2.7
Uttrakhand	23.1	29.8	22.3	7.4
Central region				
Chhattisgarh	21.3	14.1	10.8	3.3
Madhya Pradesh	21.5	16.6	12.3	3.7
Uttar Pradesh	22.2	21.4	16.1	5.2
East region				
Bihar	21.3	16	12.7	3.3
Jharkhand	21	11.9	9.4	2.5
Odisha	22.1	23	17.8	5.2
West Bengal	22.5	22.7	18.1	4.6
North east region				
Arunachal Pradesh	23.2	23.9	20.1	3.8
Assam	21.7	15.2	12.7	2.5

Manipur	23.8	34.1	26.7	7.4
Meghalaya	21.7	11.5	10.1	1.4
Mizoram	23.2	24.2	19.7	4.6
Nagaland	22	14.4	12.7	1.8
Sikkim	23.9	34.8	27.9	6.9
Tripura	22.3	21.6	17.6	3.9
West region				
Dadar and nagar haveli and daman and diu	22.2	26.9	19.9	7
Goa	23.7	36.1	26.6	9.5
Gujarat	22	22.7	15.8	6.9
Maharashtra	22.3	23.5	17.2	6.3
South region				
Andaman and Nicobar Islands	24.2	38.1	25.5	12.6
Andhra Pradesh	23.8	36.3	24.3	12
Karnataka	23	30.2	21.7	8.5
Kerala	24.1	38.2	28.3	9.8
Lakshadweep	23.6	33.5	26.6	6.9
Puducherry	25.2	46.3	28.1	18.2
Tamilnadu	24.3	40.5	26.4	14.1
Telangana	22.9	30.1	21.2	8.9

*NFHS-5 (2019-21) report

Table – 02

Obesity status of men in states/union territory of India

Among men age 15-49, mean body mass index (BMI) and percentage with specific BMI levels, by state/union territory, India, 2019-21

State/union territory	Mean BMI	Body mass index (overweight / obese)		
		≥ 25.0 Overweight/obese	25.0-29.9 Over weight	≥ 30.0 Obese
India	22.4	22.9	18.9	4.0
North region				

Chandigarh	23.6	34.4	25.9	8.6
Delhi	24.0	38.0	31.1	6.9
Haryana	23.0	28.3	22.4	5.9
Himachal Pradesh	23.1	30.6	26.1	4.5
J & K	23.8	31.7	28.7	3.0
Ladakh	24.2	37.8	34.9	2.9
Punjab	23.4	32.3	24.0	8.3
Rajasthan	21.9	15.0	13.8	1.2
Uttarakhand	22.7	27.1	22.0	5.0
Central region				
Chhattisgarh	21.7	15.0	12.6	2.3
Madhya Pradesh	21.5	15.6	13.0	2.6
Uttar Pradesh	21.9	18.5	15.6	2.9
East region				
Bihar	21.4	14.7	13.0	1.7
Jharkhand	21.8	15.1	13.7	1.4
Odisha	22.3	22.2	18.1	4.1
West Bengal	22.0	16.2	14.3	1.9
North east region				
Arunachal Pradesh	23.4	27.6	24.0	3.6
Assam	22.1	16.2	14.3	1.9
Manipur	23.2	30.3	26.4	3.9
Meghalaya	21.9	13.9	12.3	1.6
Mizoram	22.6	32.1	26.5	5.6
Nagaland	22.9	23.9	21.3	2.6
Sikkim	24.3	36.3	30.5	5.8
Tripura	22.6	23.5	20.5	3.0
West region				
Dadar and nagar haveli and daman and diu	22.1	21.4	18.3	3.1

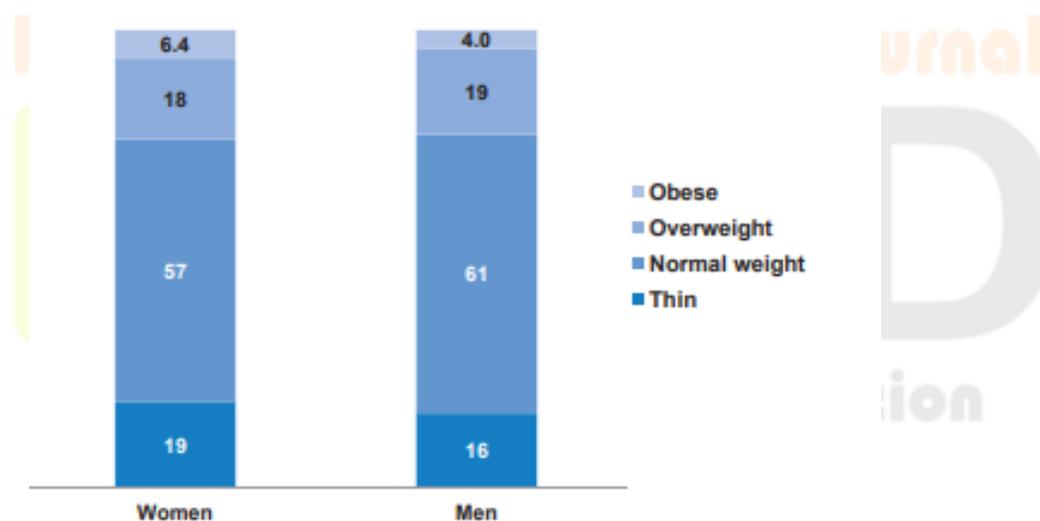
Goa	23.2	32.6	29.8	2.8
Gujarat	21.9	20.0	15.6	4.4
Maharashtra	22.6	24.7	20.1	4.7
South region				
Andaman and Nicobar Islands	25.0	45.3	34.5	10.8
Andhra Pradesh	22.9	31.1	24.8	6.3
Karnataka	23.2	30.9	25.0	5.8
Kerala	23.8	36.4	29.7	6.7
Lakshadweep	24.0	41.3	36.2	5.0
Puducherry	24.3	43.3	34.1	9.2
Tamilnadu	23.8	37.1	28.3	8.7
Telangana	23.3	32.4	24.8	7.5

*NFHS-5 (2019-21)

Graph - 01

Graphical representation of nutritional status percentage in Indian men and women

Percent distribution of women and men age 15-49



*NFHS-5 2019-21

1.1 Incidence of obesity:

Obesity is caused by an imbalanced ratio of calories intake and calories burnt. Consuming dense calorific value food gives rise to starvation eventually increases the calorie consumption till felt

loaded. Also decrease in physical activities supplements the sedentary behavior and prevalence of obesity. In modern world of technology human inventions favored inactivity and sedentary behavior in children as well as adults. The fundamental factor for obesity is the prolong imbalance of energy consumed (energy dense food) and spent every day in our life.^{4, 10} Obesity is also associated to various different factors including heredity and genetics, sedentary lifestyle, eating patterns, dietary patterns, psychological disorders and some extent to socio-economic status.^{11, 12, 13} It remarkably contributes to the prevalence of diseases like “type 2 diabetes mellitus, fatty liver disease, hypertension, myocardial infarction, stroke, dementia, osteoarthritis, obstructive sleep apnea and several cancers, thereby contributing to a decline in both quality of life and life expectancy.”^{4,15,6}

1.2 Weight management and fasting in India:

India has an ancient history with evident texts and literature describing the effects and methods of fasting. In Ayurveda fasting is termed as ‘upvasa’ which means abstinence from food for the detoxification of body and mind. The concept of fasting is based on ‘no food only water’ during a specific period of time. According to Ayurveda fasting is a therapeutic method for living a long and healthy life.^{16, 17} Fasting in India also have some spiritual and religious background claiming to have effects on both mind and body by quitting cereals but consuming fruits in entire Upwasa¹⁸. According to ancient Indian Ayurvedic philosophy, the food is divided into 3 categories on the basis of dominance of characteristics, satvik, rajsik and tamsik. Together all three are known as TRIDOSHA or disorders (vata, pitta, and kapha).^{2,22} A study on 16 obese adults claims that alternate fasting improves body composition and helps in weight loss.²⁰ A study observed significant downfall in low density lipoprotein (LDL) and triglycerides in men whereas high density lipoprotein (HDL) was observed high in women fasting during Ramdan.²¹

2. Intermittent fasting and weight loss:

The proper functioning of our body relies on the fuel we get from macro nutrients like carbohydrate, fats, and protein but majorly from carbohydrate.^{23,24} The fundamental principle for fat loss or weight loss decrease calorie consumption and increase energy expenditure.²⁶ In addition to calorie deficit and exercising, the concept of intermittent fasting has gained popularity since few decades. Whenever our body is on fasting, various energy systems through a systematic metabolic pathway supplies energy to different organs of the body. Long term fasting stimulates the promotes energy production from fats instead of carbohydrates for continuous function of systems.²⁴ Hutchison et al, 2019 conducted a study of brief fasting on obese subjects. They found that resting energy expenditure increased significantly from 14 to 36 hours of starvation (3.976 0.9 kJ/min to 4.376 0.9 kJ/min), Also they found that calorie restricted diet with intermittent fasting has significant results in weight loss instead of alone fasting.^{28,29,30} Varady et al, 2009 Bhutani et al, 2010 studied on 16 obese subjects for 8 weeks intervention program where they observed that intermittent fasting is reliable in weight loss.³¹ table-03 represents A 12 week 16:8 daily fasting program was done on 15 obese individuals which concluded that ntermittent fasting leads to weight loss as compared to the baseline weight of controlled group.³³

Table—03

Compilation of various studies on intermittent fasting

STUDY/YEAR	SUBJECTS	POPULATION	DURATION	INTERVENTION	RESULTS
Gabel et al, 2018 Gabel et al, 2019	15	Obese	12 week	16-h fast daily versus usual diet historical controls; self-reported	IF leads to weight loss compared with baseline and control group
Headland et al, 2019	244	obese	52 week	2-d fast (25% of usual calorie intake) and 5-d usual diet vs CR; self reported	Intermittent Fasting and Calorie Restricted diet have similar weight loss results at 1 year
Hutchison et al, 2019	88	Overweight and obese women	8 week	3-d fast (32%-37% of energy requirements) and 4 d at 100% or 145% of energy requirements vs CR and control group; self reported	Combining CR and IF is more effective for weight loss than either alone
Schübel et al, 2018	150	obese	8 week	2-d fast (25% of calorie requirements) and 5-d usual diet vs CR and control group; 12-wk maintenance; 26-wk follow-up; self-reported	Weight loss and maintenance is similar in IF and CR
Varady et al, 2009 Bhutani et al, 2010	16	obese	8 week	Alternated 25% of energy needs with ad libitum caloric intake; self-reported	IF is a viable option for weight loss in obese individuals
Varady et al, 2013	30	obese	12 week	1-d fast (430 kcal) and 6-d high-protein diet; 52-wk follow-up; monitored	IF with a high-protein diet is effective for weight loss, with low risk of weight regain
Coutinho et al, 2018	35	obese	12week	3-d fast (25% of caloric needs) and 4-d full caloric needs vs CR; self-reported	Similar weight losses result from IF and CR
Cho et al, 2019	31	Overweight and obese	8 week	Alternated 25% usual calorie intake with ad libitum intake vs usual diet with or without exercise; self-reported	Exercise does not improve weight loss for IF alone

Research Through Innovation

2.1 Metabolic effects of intermittent fasting:

During intermittent fasting the human body goes through eat-starve cycle, which regulates the various internal processes of body. Intermittent fasting goes through 4 stages of metabolic activity. The fed state, the early fasting state, the fasting state, and long term fasting state.

2.1.1 The Fed state :

The fed state starts after 2-3 hours after a meal followed by the digestion and absorption of food. During this phase the pancreas secretes a high amount of insulin hormone to transport elevated sugar levels in blood stream to liver and muscle.²³ Sugar is broken down into glucose and excess of it is stored into liver and muscles in the form of glycogen. Lipolysis is inhibited; the body produces energy from glycolysis and pyruvate oxidation known as glycogenesis. Glycogenesis continues till the capacity of body is met .This phase ends with ghrelin and leptin hormone shift.^{23,25}

2.1.2 Early fasting state:

It is a post absorptive state which starts from 4 hours of food intake and lasts till 18 hours. at this stage the levels of insulin begins to fall down .falling glucose level initiates the metabolic pathway of energy production through gluconeogenesis (energy production from non carbohydrate compound).^{25,26} since rate of glucose used of body becomes higher than the rate of gluconeogenesis the stored glycogen converts into glucose through glucogenolysis to fulfill the energy demands of the body .as the fasting hours extends ,lipolysis of free fatty acids begins at this stage.^{23,24,25}

2.1.3 The fasting state:

After 36 hours of a meal the fasting state begins and continues till 48 hours. Here the body uses fat as the primary source of energy. The metabolic shifting occurs typically at this state of fasting depending upon the depletion of glycogen stores in liver.²⁴ Fats are stored in adipocyte tissues usually known as lipids (triglycerides) which metabolize to free fatty acids + glycerol and released into blood stream, Lipolysis is accelerated.^{24,26} Muscle protein catabolism also occurs simultaneously to produce the ketones compounds that converts fats into fuel (β -hydroxybutyric acid and acetoacetate).^{23,24}

2.1.4 The starvation state:

The extreme drop of insulin due to scarcity of glucose triggers lipolysis, where triglycerides are broken down into free fatty acids and glycerol.²⁴ Free fatty acid enters the kreb's cycle and then electron transport chain to produce energy inhibiting glucose oxidation in muscles and BCAA catabolism (protein sparing) for preserving muscle tissues in the body. Gluconeogenesis primarily occurs in kidneys to generate glucose, serving as chief source for normal functioning of brain.^{23,25}

2.3 Methods of Intermittent fasting:

Intermittent fasting (IF) - This eating pattern involves fasting for varying periods of time, typically for 12 h or longer

Calorie restriction (CR) - This eating pattern involves a continuous reduction in caloric intake without malnutrition.

Time-restricted feeding (TRF) - This eating pattern involves restricting food intake to specific time periods of the day, typically between 8 and 12 h each day.

Alternate-day fasting (ADF) - This eating pattern involves consuming no calories on fasting days and alternating fasting days with a day of unrestricted food intake, or a “feast” day

Alternate-day modified fasting (ADMF) - This eating pattern involves consuming less than 25% of baseline energy needs on “fasting” days, alternated with a day of unrestricted food intake, or a “feast” day.

Periodic fasting (PF) - This eating pattern consists of fasting only 1-2 d/wk and consuming food ad libitum on 5-6 d/wk.

Conclusion:

Obesity is a lifestyle disease in which the number of fatty tissues increases with increase in calories consumed and decrement in calorie expenditure. Obesity increases the risk of heart diseases, hypertension, diabetes mellitus and some cancers. Occurrence of one of the disease may give rise to the occurrence of other. In India the prevalence of obese population (children and adults) has been observed in past few decades. Intermittent fasting has been proved as an effecting method of weight loss and weight management. Several studies has been done on the concept of intermittent fasting which claims that a correctly done intermittent fasting gives significant allows a person to reduce fat mass and maintaining healthy weight.^{10,16,17,19,21} Unlike other strenuous methods of losing weight IF focuses on conscious efforts in when to eat rather than what to eat .¹⁹ The risk of communicable and lifestyle disease like coronary artery diseases, hypertension, diabetes mellitus and some cancers can also be reduced by consistent intermittent fasting.^{7,13,14,20,25} From available data of different studies, it is proven that, intermittent fasting and its variations are able to reduce fat mass and body weight.^{19,20,21,24,26} Therefore, it is recommended that intermittent fasting can be a better option for reducing weight loss for any healthy individual but gives poor relevance to long term effects. It is also suggested that people with medical conditions may execute the procedure under expert guidance and follow up.

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