



A REVIEW ARTICLE ON PHYSIOLOGY OF INTERMITTENT FASTING

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ABSTRACT

Fasting is a voluntarily not eating or drinking anything for varying period of time. Intermittent fasting is not a diet, it is pattern of eating. It is a way to scheduling your meals so that you get the most out of them. Intermittent fasting does not change what you eat, it changes when you eat” says James clear. Intermittent fasting makes intuitive and scientific. Ayurveda described many *siddhanta* (principles) to eliminate toxins from the body and maintain the healthy condition of body. *Langhan karma* is one among the *Shat Upkramas* mentioned by *Acharya Charak*. The aim of this article is to understand about intermittent fasting and its mode of action in the body with special reference to *Langhan Karma*.

Keywords: inermittent fasting, Langhan, shat upkramas.

INTRODUCTION

Fasting is a practice that has been associated with a wide range of health benefits including improved blood sugar, weight loss, improve brain functioning, enhance cardiac health and prevention from cancer. Fasting has been scientifically proven to cure and prevent many ailments. Fasting is a wilful refrainment for eating.

“Right now, we are at a really important juncture for fasting” says Brad Pilon, an expert on intermittent fasting and author of book “Eat stop eat”.

Intermittent fasting is a pattern of eating where we can between periods of eating and fasting. It is also known as Intermittent Energy Restriction, in which meal timing schedule between voluntary fasting (reduced calorie intake) and non- fasting over a given period.

“The American Heart Association” states that intermittent fasting may produce weight loss, reduce insulin resistance, and lower the risk of cardiac metabolic disease. A 2019 review concluded that intermittent fasting may help with Obesity, Insulin resistance, Dyslipidaemia, Hypertension and Inflammation. Fasting has been a practice throughout human evolution. Our ancestors didn’t have supermarkets, refrigerators, sometimes they couldn’t find anything to eat, as a result human evolved to be able to function without food for extended period of time. Fasting is also often done for religious or spiritual reason. Ayurveda, a science of life, described many principles to cleansing the body and remove toxins from it. Among them, ‘*Langhan Karma*’ is known as fasting. *Acharya Hemadari* described *langhan* as “*Yatlaghavaya karshayaya tatlanghanam*” which means any process by which body feels lighten is known as *Langhan*^[1]. This lightness of body can be mental, spiritual, physical and social. *Langhan* provides sufficient time to the *Agni* which is situated in the body to complete the whole process of digestion of whatever food is left. So basically, *Langhan* is a process of load shedding in which no new food is

introduced and un-hampered *Agni* get sufficient time to digest the food.

PHYSIOLOGY BEHIND INTERMITTENT FASTING (EFFECT OF INTERMITTENT FASTING ON BODY)

Glucose and fats are the body’s major sources for energy. Glucose is most easily accessible and easily available fuel resource for the body. However, when glucose isn’t available body can manage by switching to the fat metabolism without any detrimental health effect.

The transition from fed state to the fasted state occurs in several stages-

1. Fed State^[2]- This state occurs within the first few hours after ingestion of meal as body starts to digest food and absorbs nutrients from food.

During this stage, blood sugar level raised and elevated amount of insulin secreted from beta cells of the pancreas. Insulin is accountable for transporting sugar from blood to cells. This glucose is used by brain, muscle tissues directly for energy.

Excess glucose stored in the form of glycogen in the muscles and liver, it can be converted back into glucose when needed (Glycolysis)^[3].

During fed state, levels of other hormones named *Ghrelin* and *Leptin*, also fluctuated. *Gherlin* is responsible for hunger (known as hunger hormone)^[4] but after meal intake level of *Gherlin* is decreased. Meanwhile *leptin*, which has hunger suppressing effect, increased after taking meal.

2. Post Absorptive Phase^[5] - 6-24 hours after beginning of fasting referred as post absorptive phase.

In this state level of insulin starts to fall and breakdown of glycogen releases glucose for energy. Glycogen stores last for 24 hours roughly.

3. Gluconeogenesis^[6] - Gluconeogenesis quite literally means ‘the production of new glucose’. Gluconeogenesis is a metabolic pathway that results in the generation of glucose from non- carbohydrate carbon substrates. It occurs beyond 8 hours of fasting when glycogen which is stores in

liver start to deplete and an alternative source of glucose is required. It occurs mainly in the liver and the kidney (to a lesser extent in the cortex).

There are three main precursors: Lactate from anaerobic glycolysis in exercising muscle and red blood cells via the Cori Cycle [7]; Glycerol which is released from adipose tissue breakdown of triglycerides [8] and amino acids (mainly Alanine)^[9].

4. Ketosis ^[10]-

From 2-3 days after beginning of fasting The low levels of insulin reached during fasting stimulates lipolysis, the breakdown of fat for energy. Fat is stored in the form of triglycerides. Triglyceride is broken into the glycerol and three fatty acid chain. Fatty acids may be used straightly for energy by many tissues, but brain is not able to use fatty acids directly. Ketone bodies which are capable of crossing the blood brain barrier, used by brain. Ketone bodies are produced from fatty acids. PPAR-ALPHA (a regulator of fat metabolism in the liver), which is mandatory for process of ketogenesis, is activated and make sure that these fatty acids are used.

Fatty acids travel to the liver where they are transformed into ketone bodies through the process of Beta-oxidation ^[11].

At this point, ketones become body's primary fuel ^[12], but your brain still needs a bit of glucose to function. This glucose is provided through the process of gluconeogenesis.

After 4 days of fasting, approximately 75% energy utilized by the brain is furnished by ketones. 2 major types of ketones produced are Beta Hydroxybutyrate (BHB) and Acetoacetate ^[13].

5. Protein Conservative Stage-

More than 5 days

High levels of growth hormone nurture muscle mass and lean body tissues. The energy maintenance of basal metabolism is almost entirely met by use of free fatty acids and ketones.

During gluconeogenesis the proteins is being used to produced glucose, excess proteins are indeed broken down for

glucose, muscles, connective tissues, skin, old cells and other cells can be destroyed. This is a process of Autophagy^[14].

Fat is simply body's stored food energy, when availability of food is low, stored food is naturally released to fill the void.

Hormonal Adaptation:

Insulin ^[15]-

Fasting is most effective and consistent way to reduce insulin level. Almost all food raise insulin level, so most efficacious method of lessen insulin level is to avoid almost all type of food. When body is set about to switch over to burning fat for energy, blood glucose level remains normal. This effect is observed with fasting period as short as 24-36 hours. In extended span of fasting bring down the insulin more substantially.

Growth Hormone ^[16]-

GH is known to increase the attainability and usefulness of fats for fuel. It also aids to pressure muscle mass and bone density. GH secretion bring down steadily with age. Fasting is one of the most vigorous stimuli for secretion of growth hormone. The latter shows down glucose utilization and lead to hyperglycemia and formation of ketone bodies ^[17]. Over 5 days fasting period GH secretion more than doubled. The levels of GH Skyrocket increased and this has benefits for fat loss and muscle gain.

Electrolytes-

Potassium levels may fall moderately, but even after 2 months of continuous fasting potassium level does not reduce below 3.0mEq/L even without use of any supplements ^[18]. This duration of fasting is far longer than recommended duration.

Magnesium ^[19], calcium^[20] and phosphorus ^[21] levels are firmly fixed during fasting. May be because these minerals are stored in the bones (99% of the calcium and phosphorus in the body is stored in the bones).

Methods of intermittent fasting^[22]:

There are so many ways to attempt intermittent fasting, all of them involve dividing days and week into eating and fasting periods.

During the window of fasting, one may eat either very less or not at all.

Some of the most popular methods are-

1. Time 16/8 method: 16/8 method involves every day fasting for 14-16 hours and restricted daily eating window to 8-10 hours. In eating window- one can eat 2-3 or more small meals. In this method of fasting one cannot eat anything after dinner and breakfast must be skipped in this pattern.

Example- If a person taking dinner at 8pm then he does not eat anything until noon of the next day, technically fasting for 16 hours.

A person can consume water, coffee, green tea and other zero caloric beverages during the fasting window that can hamper the feeling of hunger. It is very mandatory to eat only healthy foods during the eating window, if tons of junk food or excessive calorie is consumed then this method will not work.

2. 5:2 diet: In this pattern person is allow to eat 5 days of week normally and restriction on caloric intake for 2 days of the week (500-600 calorie). on the fasting window, women are recommended to consume 500 calorie and men are allowed to take 600 calories.

This diet is also known as ‘fast diet’ and was popularized by British journalist Michael Mosley.

3. Eat to eat:

Eat to eat pattern involve a 24-hour fasting once or twice a week. For example- If a person completes his dinner at 8pm Monday then he does not allow to eat anything until 7pm Tuesday, in this way he is completed a full 24 hour fast.

This pattern can be followed from breakfast to breakfast fasting or lunch to lunch.

No solid foods are permitted during the fasting window, only water and zero caloric beverages are permitted.

4. Alternate day fasting: In this method of fasting a person fasts every next day. In this method person can go to bed in very hungry situation for several times, so this is not so pleasant and unsustainable in the longer term.

5. The warrior diet: In warrior diet, person is allowed to consumed raw fruits and vegetables during the day time and can take large or huge meal in night.

Basically, a person is on fast all day and take meal at night within a 4-hour eating window.

6. Spontaneous meal skipping: In this method. A person is simply skipping their meals for time to time. Skipping one or two meals when person is feeling inclined to do so is basically a spontaneous intermittent fast. Just make sure to eat healthy foods during the other meals

Benefits of intermittent fasting:

1. Level of blood insulin drops significantly, which facilitates fat burning^[23].
2. There are beneficial changes in several genes and molecules related to longevity and protection against disease^[24].
3. Intermittent fasting may help lower the blood pressure in the short term.
4. Alternate day fasting may help lower total cholesterol as well as LDL^[25].
5. Healthier cholesterol and lower BP plays a major role in helping reduce the risk of stroke^[26].
6. Eat according to circadian rhythm helps to promote deep sleep^[27].
7. Eat during a set period of time can help to reduce the numbers of calorie intake and ultimately lead to weight loss^[28].
8. It also increase the level of a brain hormone called brain derived neurotropic factor (BDNF), which is responsible for depression and many other brain problems^[29].
9. Alternate day fasting may reduce cancer risk by decreasing the development of lymphoma, limiting tumor survival and slowing the spread of cancer^[30].
10. After few days of fasting, higher level of endorphins “feel good” hormones are produced which can have a positive effect on mental wellbeing^[31].

In Ayurveda fasting is mentioned as *Langhan or Upvasa*.

“लंघनं बृहणं काले रुक्षणं स्नेहनं तथा ।
स्वेदनं स्तम्भनं चैव जानीते य स वै भिषक् ॥” (च.सू. 22/4)

In *Caraka samhinta* Langhan is mentioned in one of the *SHAT UPKRAMAS*^[32].

“एकः सन्तर्पणस्तत्र द्वितीयश्चापतर्पणः ॥१॥

बृहणो लङ्घनश्चेति तत्पर्यायावुदाहृतौ (अ.ह.सू. 14/1)

According to *Acharya Vagbhatt* the entire protocol of treatment in Ayurveda included under two main principles *SANTARPAN* and *APTARPANA*. *Brahghan* and *Langhan* are the synonyms for the therapeutic procedure respectively^[33].

Acharaya Hemadari mentioned *langhan* as “लङ्घनमत्रोपवासः”^[34].

Nirukti:

‘Langhan + Lyut^[35]’ (शब्दकल्पपद्मः)

‘*Laghi gatan, lagi shoshanea*’^[36] (अमरकोश)

Langhan word is derived from *Langha dhatu* and *Lyut pratayaya*. *Langha dhatu* means *Gati or shosana*.

Definition:

“यत्किञ्चिल्लाघवकरं देहे तल्लङ्घनं स्मृतम् ॥” (च.सू. 22/9)

Which means a process which lightens the body^[37].

“लंघनम् लाघवाय यत् ॥” (अ.ह.सू. 14/2)

Whatever is capable to lightens the body is known *langhan karma*^[38].

Synonym:

Anashana, Aptarpana, Upvasa, Laghu bhojan

Panchmahabhoot Predominance:

^[39]

Agni+Vayu+Akash

Mode of action of Langhan Dravayas:

^[40]

In *Caraka Samhinta*, chapter 22, characteristics features of *Langhan Dravayas* is mentioned. With the help of all of these characters *Langhan dravayas* performs their action and lightens the body. These are-

“लघुउष्णतीक्ष्णविशदं रुक्षं सूक्ष्म खरं सरम् ।

कठिनं चैव यद्द्रव्यं प्रायस्तल्लङ्घनं स्मृतम् ॥” (च.सू. 22/12)

1. *Laghu*- Lightness is predominant quality of a herb, medicine or diet prescribed to a person.
2. *Ushana*- Substance is having hot quality and *ushana veerya dravayas* are generally light in nature.
3. *Teekshana*- In *Langhan* main

purpose is to open up the *srotas* so medicine obtaining the *teeskshana guna* is chosen, which allows the medicine to enter the minutest body channels.

4. *Vishadha*- This quality of substance takes stickiness away from the channels of body.
5. *Ruksha*- Dryness brings the lightness in the body.
6. *Sookshama*- This quality permits to enter minute channels.
7. 8. 9. *Khara, Kathina, Sara*- Usually in body channels (such as circulatory system, gastrointestinal system) whenever there is obstruction, *Langhana* treatment is adopted. These three qualities helps to relieve obstruction and ease out the morbid matter from the channels, ensuring movements of the body fluids in normal direction.

Types of Langhana karma:

“चतुष्प्रकारा सशुद्धिः पिपासा मारुतातपौ ।

पाचनान्युपवासश्च व्यायामश्चेति लङ्घनम् ॥” (च.सू. 22/18)

Langhan karma may be applied in various forms such as 4 types of *shodhana* (evacuation), *Pipasa*(thirst), *Marut, Atapa sevan* (exposure to wind and the sun), *Pachana* (digestive measures), *Upvasa* (fasting) and *Vyayama* (exercise)^[41].

“शोधनं शमनं चेति द्विधा तत्रापि लङ्घनम् ॥” (अ.ह.सू. 14/4)

Langhan is again 2 types- *Shodhan* and *Shaman*^[42].

“यदीरयेद्द्विर्दोषान् पञ्चधा शोधनं च तत् ।

निरुहो वमनं कायशिरोरेकोऽस्त्रविस्त्रुतिः ॥” (अ.ह.सू. 14/5)

Process which expels vitiated doshas from the body and maintain the state of equilibrium in the body is known as *Shodhan* therapy. These are 5 types- *Niruh basti* (Enema with medicated decoction), *Vamana* (Emesis), *Kaya virechan* (Purgation), *Shiro virechan* (Nasal administration), *Asravisruti* (Blood-letting)^[43].

“न शोधयति यद्दोषान् समान्नीदीरयत्यपि । समीकरोति विषमान् शमनं तच्च सप्तधा ॥

पाचनं दीपनं क्षुत्तृड्व्यायामातपमारुताः ।” (अ.ह.सू. 14/6-7)

Shamana is that which neither expels nor excites the doshas but mitigated the increased doshas and maintain the normalcy of the doshas within the body. It is of 7 types.

Pachana (Increased digestion), Deepana (Carmination), Ksut(suppressing appetite), Trsna (Suppressing thirst), Vyayam(Exercise), Atapa(exposure to sun), Marut (exposure to open air)^[44].

Upvasa:

Langhan karma is also referred as Upvasa. *Upvasa* may be partial or complete restriction of food intake. By the complete or partial restriction, *Agni* digests the undigested food more effectively. The basic cause of ailments in the body is impaired *jatharagni*.

In *upvasa*, person is taking less or no amount of food even when he is hungry.

In ayurveda classics *langhan* is prescribed in disease like *jwara*, *vishuchika*, *alashaka*, *medoroga* etc. It is important to follow *langhan karma* until it produces lightness and positive impact on body, but care is to be taken that it never leads the negative effects of *kshudha vegadharan*.

In religious term Upvasa means “उप वसति इति उपवासम्” which means stay close to God^[45].

Types of Upvasa^[46]-

According to Duration-

- Less duration- Fasting for 1-2 days
- Long duration- Fasting for 3-4 days
- longer duration- Fasting for 5-7 days

According to Purpose-

- Religious
- Spiritual
- Political

According to Physical Health-

- Fasting for healthy person
- Fasting for person suffering from acute disease
- Fasting for person suffering from chronic disease

According to Dravya-

➤ *Nirahar* (Dry fasting)- it is again divided in 2 types *Sajala* and *Nirjala*.

➤ *Falahar* (Eating raw fruits and vegetables during fasting)

Benefits of Langhan karma:

“विमलेन्द्रियता सर्गो मलानां लाघवं रुचि। क्षुत्तृसहोदयः शुद्धहृदयोद्गारकण्ठता ॥ व्याधिमार्दवमुत्साहस्तन्द्रानाश्च लङ्घते ।” (अ.ह.सू. 14/17-18)

Sense organ become clear, Proper excretion of flatus, urine and feces, lightness in the body, increase the perception of taste, excessively hunger and thirst contentment, feeling of purity in heart eructation and throat, decreasing the signs and symptoms of disease, activeness and disappearance of lassitude^[47].

“वातमूत्रपुरीषाणां विसर्गे गात्रलाघवे। हृदयोद्गार कण्ठस्य शुद्धौ तन्द्राक्लमे गते ॥

स्वेदे जाते रुचौ चैव क्षुत्पिपासासहोदये। कृतलघनमादेश्यं नित्यथे चान्तरात्मानि ।”

(च.सू. 22/34-35)

Langhan therapy should be regarded as properly administered when there is proper elimination of *apana vayu*, urine and feces, lightness in the body, cleansing of heart, eructation and throat and mouth, disappearance of drowsiness and exhaustion, appearance of sweat, relish both hunger and thirst together and also the feeling of wellbeing^[48].

DISCUSSION:

When dietary intake is restricted, the body must draw upon stored energy reserves to continue metabolic activities.

In 2013, Mosley and Spencer published a best-selling book titled “The fast diet” which promotes the benefits of restricted energy intake severely for 2 days in a week while eating normally for rest of the days. Glycogen a polymer of glucose is stored in liver and during fasting condition certain enzymes break it down into glucose which provides energy to body. If one never fasts this system of enzymes may not remain effective and therefore periodical fasting in beneficial to body. When glycogen reserve is exhausted the adipose tissues comes to rescue of fasting person but prolonged fasting is not advisable for longer periods.

Ayurveda works on the principle of””
Ayurveda includes both preventive and curative treatment^[49]. *Upkramas* are the course of action to achieve the condition of *dhatu samayata* and bring back the vitiated doshas to their *samyavastha*. *Langhan* is adopted whenever there is heaviness in the body. Purpose of *langhana karma* is to bring lightness in the body by clearing the blocked channels of body and to improve the circulation and eliminate morbidity.

CONCLUSION

Periods of voluntary abstinence from food has been practice since earliest antiquity by people around the globe. It is well known that in human, even a single fasting interval can reduce basal concentration of metabolic biomarkers associated with chronic disease such as insulin and glucose. For example, patients are required to fast 8-12 hours before blood draws to achieve fasting levels for many metabolic substrates. Eating pattern that exclude night time eating and focus on prolonged night fasting may be a simple, feasible and potentially effective disease prevention.

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