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Review Article

AN AYURVEDIC PERSPECTIVE ON *STHAULYA*: LIFESTYLE AND DIETARY INTERVENTIONS WITH SPECIAL EMPHASIS ON *APTARPANA (LANGHANA)* AND AUTOPHAGY

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ABSTRACT

Obesity is the accumulation of fat that adversely affects health, contributing to diabetes, cardiovascular disease, hypertension, and dyslipidaemia. In Ayurveda, *Sthaulya* is viewed as a *Santarpanottha* disorder related to disrupted *Meda* metabolism. Modern research suggests that fasting-induced autophagy modulates lipid metabolism and adipokine balance. **Objective:** To synthesize Ayurvedic classical and contemporary biomedical perspectives on *Sthaulya* and explore how interventions such as *Langhana* (*Aptarpana*) may mechanistically engage autophagy to mitigate obesity and its complications. **Methods:** This narrative review examines classical Ayurvedic texts (e.g. *Charaka*, *Shushruta*, *Ashtanga Hridaya*) for concepts of *Sthaulya*, *Nidana*, *Samprapti*, and therapies (diet, fasting, lifestyle, local therapies). Contemporary literature (PubMed, Google Scholar) on obesity, fasting, autophagy, adipokines, and lipid metabolism was surveyed. **Results:** Ayurvedic treatments emphasize moderation in *Ahara* and *Vihara*, use of *Langhana* or light diet, localized therapies (e.g. *Udvartana*), and when suitable, *shodhana* (*Vamana*, *Virechana*). Fasting may activate autophagy, possibly reducing ApoB100, modulating TNF-α, IL-6, leptin/adiponectin, improving lipid profile, and insulin sensitivity. A theoretical integration supports a translational framework. **Conclusion:** Structured *Langhana* may potentially harness *autophagy* to restore homeostasis in *Meda Dhtau* in *Sthaulya*. Clinical trials with biomarker endpoints are needed to validate safety, dosing, and efficacy.

INTRODUCTION

The excessive or aberrant buildup of fat or adipose tissue in the body is known as obesity, and it negatively impacts health by increasing the chance of developing diabetes mellitus, cardiovascular disease, hypertension, and hyperlipidaemia. It is a serious public health crisis that has gotten worse during the last fifty years. The etiology of obesity is complicated and multifactorial. After smoking, it is the second most frequent preventable cause of mortality. Treatment for obesity must be multifaceted and may last a lifetime. A 5% to 10% reduction in weight can have a major positive impact on a person's health, quality of life, and financial burden, both individually and nationally.

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Like obesity in contemporary medicine, *Sthoulya* (overweight), as defined in Ayurveda, is marked by notable changes in lipid metabolism. A *Sthula* is a person who has an excessive amount of flesh and fat, which causes their breasts, tummy, and buttocks to swell disproportionately without their energy levels increasing in proportion. Overeating and inactivity are common causes of obesity. The rising incidence of obesity is mostly caused by readily available high-calorie diets and sedentary or inactive lifestyles, which lead to a few health problems, including *Sthoulya,* which impacts one's physical, mental, and social well-being. Genetics, medical conditions, and mental health disorders account for a small percentage of cases. Sedentary lifestyles, genetic causes, and excessive *Kapha*-increasing meals are contributing factors. Reducing extra fat and balancing *Vata* and *Kapha* are the goals of effective treatment.[1]

In Ayurveda, eight types of individuals are categorized as *Asta Nindita Purusha* (those considered undesirable), among which six are *Loka Nindita* (socially disapproved) and two- *Atisthaulya* (obesity)

and *Atikrisha* (emaciation)- are classified as *Chikitsya Nindita* (clinically significant or needing medical attention). *Atisthaulya*, or obesity, is characterized by an excessive accumulation of *Meda* (fat tissue) and *Mamsa* (muscle tissue), resulting in sagging or flabbiness particularly in the hips, abdomen, and breasts. It is identified as a *Santarpanottha Vikara*, meaning a disorder arising from over-nourishment or excessive calorie intake. Additionally, *Medodushti*- an imbalance or dysfunction in fat metabolism- is recognized as a potential contributing factor to conditions such as ischemic heart disease (IHD). Among the *Astanindita Purusha*, most hateful people on the planet, *Sthaulya* has been highlighted. Being obese makes a person feel self-conscious about his size in public, which makes *Sthaulya* or obesity a real health issue.

It is a *Medovaha Srotasa* sickness that affects *Medodhatu*. The body experiences two different forms of *Meda Vriddhi*: *Abaddha (Posaka)* and *Baddha (Posya)*. Adiposity, or obesity, is the result of *Baddha Meda Vriddhi*, whereas dyslipidemia is the result of *Abaddha Meda Vriddhi.*

Abaddha Medodhatu /Poshaka* (Mobile) *Meda
This kind of *Medodhatu* travels around the *Medovaha Srotas* and is *Gatiyukta* (mobile). To nourish the *Posya Meda Dhatu*, this is also known as *Poshaka Medo Dhatu*, which circulates with the *Rasa-Rakta Dhatu.*

Sthayi Medo Dhatu*/Immobile/*Posya Medadhatu
This kind of *Medodhatu* is kept in different parts of the body and called *Gativarjita*, or immovable.

The *Ahararasa* has excessive nourishment analogous to *Medas* in *Medovridhhi* because of the abundance of *Snigdha*, *Madhura*, and *Guru* forms of *Ahara*. The *Medo Agni* is reduced because of ongoing overload, which causes an excessive buildup of *Sneha* in *Ama* form and *Rasa Raktagat Medovriddhi.* [2]

Genetic and inherited factors, as well as dietary and lifestyle markers (such as a high-calorie diet and sedentary habits), are some of the main etiological factors of *Atisthula*. If we look closely at the pathophysiology of *Atisthula*, *Rasa Dhatu* (plasma) and *Meda Dhatu* are affected, with excessive *Meda Dhatu* accumulation being a key feature. Apolipoprotein B100 serves as a significant biomarker in the pathology of obesity and dyslipidaemia. Its regulation by autophagy during fasting highlights a complex interplay between lipid metabolism and cellular homeostasis. Understanding this relationship could offer insights into therapeutic strategies targeting autophagy to manage lipid-related disorders.

Preventing *Sthoulya* is largely dependent on proper *Ahara and Vihara*, which are discussed in our texts. In *Ayurveda*, along with proper diet *(Ahar)* and lifestyle *(Vihar)*, it is also mentioned that local therapeutic depletion (*Sthaniya Guru-Aptarpana*) should be done. In *Aptarpana* (therapeutic fasting), specifically '*Langhan*' (fasting) has proven results. Through autophagy during fasting, elevated levels of TNF-alpha, IL-6, and leptin, and decreased adiponectin - this imbalance is corrected, which also accelerates metabolism. It also helps correct dyslipidaemia induced by ApoB100. *Medo Dhatu* (adipose tissue) are crucial *Dushyas* (affected tissues) in this process. Obesity and dyslipidaemia are thought to be the primary constituents of the fundamental matrix of this disease and its associated problems.[3,4,5]

MATERIALS AND METHODS

Literature and references related to the proposed title are collected from classical texts of Ayurveda and contemporary literature. Various publications, research papers, references from internet related to topic have been considered**.**

Literature review

Obesity

Obesity is one of the most significant public health concerns of the twenty-first century and has become a major health concern in both industrialized and developing countries.

According to WHO estimates from 2008, at least 500 million persons worldwide-roughly one in ten-were fat, with women being more likely than males to be obese. Approximately 70% of cardiovascular disorders, 42% of breast and colon cancers, and 80% of type 2 diabetes are caused by obesity. The number of children and adolescents who are overweight has increased in the last 20 years. Additionally, the prevalence of obesity rises with age, at least until the ages of 50 or 60. Once thought to be a problem unique to wealthy nations, obesity has spread like wildfire and is now a global issue. [6,7]

According to the WHO, obesity is a condition in which the body accumulates too much fat to the point where it seriously compromises health. According to the WHO, obesity is the most obvious yet underappreciated public health issue in the world as of 2000. Excess fat buildup in the body is referred to as obesity, and it can have detrimental effects on both mental and physical health. It is a leading cause of disability and a risk factor for several other illnesses, including infertility, diabetes, hypertension, atherosclerosis, cholelithiasis, and osteoarthritis.

Once thought to be a condition that was prevalent in industrialized nations, urbanization and the westernization of life have spread it throughout emerging nations as well, particularly among members of upper socioeconomic groups. It may typically be self-diagnosed by determining an individual's Body Mass Index (BMI). A BMI of (25 to 29.9) kg/m^2 is

considered overweight, and a BMI of 30 kg/m^2 or more is considered obese.

Normal BMI (18.5 – 24.9) kg/m^2,

Overweight (25.0 – 29.9) kg/m^2,

Obese ≥(30.0) kg/m^2

The word "*Sthaulya*" in Ayurveda refers to obesity. *Sthaulya* is classified under the *Medaja roga* group, which is caused by vitiation of *Meda dhatvagni* (the *agni* or enzymes that build and support *Meda dhatu*). Moreover, *Ashta nindita purusha adhyaya* of *Charak Samhita* describes it (8 categories of individuals with ugly physiques who are ridiculed by society due of incorrect body size).[8]

***Nidana* of obesity [9]**

According to Ayurveda the reason of excessive obesity is overnutrition brought on by consuming a diet high in fat, sugar, cold, and heavy foods, irregular eating patterns, little exercise, refusal to engage in sexual activity, Dozing off during the day, Lack of mental activity, Uninterrupted joy, and genetic or hereditary flaws. These outcomes could result in an overabundance of fat (with more fat formation).

Flow Diagram-1, Explaining Etilogy of Obesity [10]

Prevention of *Sthoulya*

The prevention of *Sthoulya* is substantially helped by proper *Ahara* and *Vihara*, which are discussed in our texts. Mode of action on *Aharaja pratyahara* possesses qualities such as *Lekhana*, *Medahara*, and *Vatahara*. One of the primary causes of *Sthoulya* is *Ati Santarpana*. The enhanced *Meda* dhatu will be decreased by the *Dravya* that improves the *Medodhatu Agni*. One of the main reasons for *Samprapti* of *Sthoulya* is *Medodhatu*. The following is a compilation of *Pathya* (wholesome) and *Apathya* (unwholesome) dietary and lifestyle recommendations as outlined in various classical Ayurvedic texts.[10,11,12,13]

Table 1: *Pathya* (wholesome) *Ahara Varga* mentioned in Ayurveda

***Ahara Varga* (categories of food)**	***Pathya* (wholesome) food in that *Varga***
Shuka dhanya (group of grains with awn)	*Yava, Kodrava, Purana Shali, Priyangu, Laja*
Shami dhanya (group of pulses)	*Mudga, Rajamasha, Kulatha, Chanaka, Masura*
Shaka varga (group of vegetables)	*Patola, Tanduliya Shigru, Vruntaka, Mulaka, Karvellaka, Vartaka*
Phala varga (group of fruits)	*Kapitha, Jambu, Amlaki, Bibhitaki, Haritaki, Erandakarkati*
Drava varga (group of liquids)	*Takra, Madhu, Ushnodaka, Tila Taila, Sarsapa Taila*
Mamsa varga (group of meats)	*Rohita Matsya*
Kritt anna varga (group of processed food items).	*Mudga Yusha* (green gram soup), *Mudgamlaka Yusha* (green gram soup with *amla*), *Kulatha Yusha* (horse gram soup), *Laja Manda* (liquid portion of gruel of parched grain), *Yava Mantha, Yava Peya* (thin gruel of barley), *Yava Saktu* (roasted grain flour of barley), *Medohara Rotika, Yava Rotika, Madhudaka* (water mixed with honey)

Table 2: *Apathya* (Unwholesome) *Ahara* mentioned in Ayurveda

S.No.	Ahara Varga (categories of food)	*Apathya* (Unwholesome) *Ahara* in the Category
1	*Shuka Dhanya* (group of grains with awn)	*Godhuma, Naveena Shali*
2	*Shami Dhannya* (group of pulses)	*Masha*
3	*Shaka Varga* (group of vegetables)	*Kanda, Shaka Madhura Rasatmaka*
4	*Phala Varga* (group of fruits)	*Madhura Phala*
5	*Drava Varga* (group of liquids)	*Dugdha Varga, Ikshu Vikara*
6	*Mamsa Varga* (group of meats)	*Aanupa, Audaka, Gramya Mamsa Sevana*

Table 3: Pathya Vihar (Wholesome /Healthy lifestyle) mentioned in Ayurveda)

Pathya Vihar
Shrama
Jagarana
Nitya bhramana
Vyayama
Chintana
Shoka
Krodha

Table 4: *Apathya Vihar* (Unwholesome lifestyle) mentioned in Ayurveda)

Apathya Vihar
Sheetala jala sevana
Diwaswapna
Avyayama
Achintana
Harshita
Manaso nivrutti

Analysis of *Tikta*, *Katu* and *Kashaya Rasa* in Obesity

It is evident from the analysis of *Ahara* in *Rasa* (taste) that *Katu* (pungent) *rasa* is suggested in *Medoroga* and that its *Laghu*, *Ushna*, and *Ruksha guna* diminish *Kapha*, *Kleda*, and *Meda*. The *Ruksha* and *Laghu guna* with *Kledahara* and *Medososhana* properties are also present in *Tikta* (bitter) *rasa*.[14] Because of its *Laghu* and *Ruksha guna*, *Kashaya* (astringent) *Rasa* balances the *Pitta* and *Kapha doshas* and dries up the *Kleda* and *Meda*. [15,16] Thus, in *Sthoulya*, *Tikta*, *Katu*, and *Kashaya rasa* are indicated**.**

Udvartana

Using a gentle powder to massage the entire body, *Udvartana* possesses the qualities of *Kaphashamana* and *Meda vilayana*. Adipose tissue is lysed by the increased circulation brought on by the *Udvartana* process. Friction activates the beta-3 receptor found in the subcutaneous fat's adipose tissue, which causes the triglyceride to decompose into fatty acids. Because massage improves the circulation of the internal organ for the conversion of fatty acids into bile, these fatty acids are transported to the liver. When combined with a low-carb diet and physical activity, fats are used to produce energy. The lipid, which is carried by the blood, will subsequently reduce the re-absorption of bile**. [17].**

Vyayama

To maintain good health, *Dinacharya* incorporates *Vyayama*, or exercise. Lightness increased digestive capacity, *Meda kshaya* (fat reduction), and work capacity are all benefits. Because exercise affects fat metabolism, it is recommended to engage in regular exercise to combat obesity. Increased fatty acid mobilization from adipose tissues takes place during exercise, and these free fatty acids are then delivered to the muscle mitochondria for oxidation. Studies have demonstrated that they can improve lipid lipoprotein profiles (e.g., lower triglyceride levels, higher HDL levels, and lower LDL levels) and body composition (e.g., by reducing abdominal adiposity and improving weight control). **[18]**

Treatment of obesity

Treatment with Shamana (Palliative)

Langhan, or Fasting

Ama Pachan: (oral digestive supplementation to increase fat metabolism)

Ruksha Udwartan (massage with dry medicinal powder): *Udvartana* is commonly used because to its qualities, such as *Twak Prasadakara* (cleansing the skin), *Angasthirikarana* (gives the body firmness), *Kapha Meda Vilayana* (liquefies *Kapha* and *Meda*), and *Vatahara* (alleviates *Vata Dosha*). Foods and beverages that lower *Kapha* and *Meda Dhatu* (fat) and relieve *Vata*. A heavy and unnourishing diet is recommended, as are foods like salad, honey, and so forth. It is also advised to engage in mental and physical activity.

***Chikitsa Samshodhana* (Purificatory methods)**

An *Atisthula* individual should be treated with *Vamana* and *Virechana* if they are strong and have good endurance. Strong, warm, and non-unctuous enemas are recommended for these patients.

Langhan

DEFINITION

"यत किञ्चिल्लाघवकरं देहे तलङ्घनं स्मृतम्[19]

"लङ्घनं लाघवाय यत्"'[20]

In gross meaning, it indicates the whole procedure of producing lightness in the body.

SYNONYMS: *Anashana, Apatarpana*, *Laghubhojana* and *Upavaasa* are the synonyms of *Langhana*. *Langhana* as *Upavasa* found in *Samhita*. [21]

Concept of *Langhanupakrama*

Langhana treatment is a therapy that can make the body lighter and thinner. It's also known as a denourishing treatment. *Ashtanga Hridayakara* has defined *Langhana* as *Laghavaya yat dehasya* which means, the *Upakarma* that lightens the body is *Langhana*. *Hemadri* has added one additional *Lakshana* to the concept of *Langhana*, *Karshyata*, which defines it as the process by which the body becomes light and emaciated. In medical research, *Langhana* is regarded a light meal, which has just two meanings: moment and fasting. Ayurveda defines fasting as *Upvasa*. Fasting can be defined as actively refraining from all four sorts of food: chewing food, licking any food, gulping, and drinking. [22]

The vitiated *Dosha* in the human body slows digestion and leads to the generation of *Ama* (metabolic toxins) that cause illnesses.

Principles of fasting

This *Aam* also blocks all the body's pathways and is responsible for a variety of diseases. Fasting fires the digestive fire, removes all obstructions in the body's channels, and eliminates many metabolic poisons. This helps to combat disease. *Ayurveda* recommends regular and short-term fasting. The sticky, deadly waste accumulates in our digestive tract, travels through channels, and eventually reaches our body's tissues, impeding cellular nutrition and causing sickness. This helps to combat disease. Ayurveda recommends regular and short-term fasting. The sticky, deadly waste accumulates in our digestive tract, travels through channels, and eventually reaches our body's tissues, impeding cellular nutrition and causing sickness. As a result, most of the sickness is caused by an imbalanced *Agni* and collection of *Ama*. Fasting, as taught in *Ayurveda*, helps to control the buildup of toxins. According to *Ayurveda*, "*Aho ratri bhojana abhavaha*," which means "absence of food at night," can also be classified as one sort of fasting, and as a result, the body of an individual purifies itself by expelling the poisonous wastes the next day.[23]

Characteristic Features of *Langhan Chikitsa*

लघुष्णतीक्ष्णविशदं रूक्ष सूक्ष्मं खरं सरम् || कठिनं चैव यद्रव्यं प्रायस्तल्लङ्घनं स्मृतम||(Charaka Samhita Sutrasthana 22/12**)**

Light (*Laghu*) indicates the *Dravya* must be light in weight, Hot (*Ushna*) is primarily a hot quality substance, Sharp (*Tikshna*) means removing toxins from the body and entering the minutest body channels. Non-slimy (*Vishada*) helps to reduce adhesiveness and clear all the body channels, while dry (*Rooksha*) offers lightness to the body. Minute (*Sukshma*) implies enter in the minutest body channels, rough (*Khara*), hardness (*Katina*), and mobility (*Sara*). All these traits serve to eliminate the harmful material and clear all the body channels.

Langhana indications include:

1) Diseases characterized by heaviness. Examples include diabetes, cough, obesity, fever, and indigestion.

2) Diseases characterized by channel blockage. Examples include asthma, hyperlipidaemia, coronary artery disease**,** and constipation.

Signs of Appropriate *Langhana Chikitsa*

वातमूत्रपुरीषाणां विसर्गे गात्रलाघवे हृदयोद्गारकण्ठास्यशुद्धौ तन्द्राक्लमे गते||

स्वेदे जाते रुचौ चैव क्षुत्पिपासासहोदये लङ्घनमादेश्यं निर्व्यथे चान्तरात्मनि||

(Charaka Samhita Sutrasthana 22/34, 35)

When appropriate *Langhan* is performed, the body experiences a sense of lightness and purity in the heart, proper emission of flatus, urine, and farces, purity in eructation, and clarity in the throat, feeling of freshness. Remove dullness and tiredness, appearance of perspiration and enjoyment of taste.

Benefits of Langhan

Improves metabolism and digestive strength, removes blockages from the *Strotas* and tissues, eliminates *Ama* (toxin) from the body, and promotes lightness and health.

Autophagy

The term "autophagy," which literally translates to "self-eating," is derived from the Greek words "auto (self)" and "phagein (to eat)" and describes an evolutionary conserved catabolic system that enables cells to eliminate their own superfluous or malfunctioning components. [24-25]

a) Underlying the sequestration of intracellular entities into double-membraned vesicles (known as autophagosomes) and their inclusion into lysosomes for their final elimination is a strictly controlled process.

b) Depending on how the cargo is delivered to the lysosome, autophagy can be divided into three subtypes:

i. Chaperone-mediated autophagy (CMA; chaperone-assisted translocation of substrate proteins into the lysosome).

ii. Micro autophagy (i.e., the direct absorption of cytoplasmic contents by lysosomes).

iii. And macroautophagic (the primary regulated form of autophagy that responds to environmental and physiological signals).

c) It is important to remember that macroautophagic, also known as autophagy, can be further divided into two categories according to the material to be broken down.

i. non-selective autophagy, in which most of the cytoplasm is catabolized in the autophagosome and recycled.

ii. and selective autophagy, in which the material to be broken down is a particular substrate that is recognized by a receptor before being delivered by lysosomes. Pathogens (xenophagy), lipids (lipophagy), mitochondria (mitophagy), peroxisomes (pexophagy), nucleus (nucleophagy), protein aggregates (aggrephagy/proteophagy), endoplasmic reticulum (reticulophagy/ER-phagy), or even lysosomes themselves (lysophagy) are examples of specific cargo in the latter context. [26]

d) The temporally coordinated recruitment of specialized autophagy-related proteins (ATG) (the "core machinery") and accessory proteins is how autophagy happens at the molecular level. There are six consecutive steps in this strictly regulated process.[27]

e) Autophagy is a vital cellular process that maintains homeostasis by degrading and recycling damaged organelles and proteins. While the process can be divided into several stages, a comprehensive review published in Cell Insight outlines the following six phases of autophagy:

1. Initiation

Autophagy is triggered by various stress signals, such as nutrient deprivation or hypoxia. This phase involves the activation of signalling pathways like mTOR (mechanistic target of rapamycin) and AMPK (AMP-activated protein kinase), which regulate the formation of the autophagy-related (ATG) protein complex. These complexes initiate the formation of the phagophore, a membrane structure that engulfs cellular components targeted for degradation.

2. Nucleation

The phagophore begins to form at specific sites within the cell, often associated with membrane structures such as the endoplasmic reticulum. Proteins like Beclin-1 and VPS34 play crucial roles in this nucleation step by generating phosphatidylinositol 3-phosphate (PI3P), a lipid that recruits other ATG proteins necessary for autophagosome formation.

3. Elongation

During this phase, the phagophore expands and elongates to envelop the cytoplasmic material targeted for degradation. This process involves the conjugation of LC3 (microtubule-associated protein 1A/1B-light chain 3) to phosphatidylethanolamine, forming LC3-II, which is essential for membrane expansion and curvature.

4. Maturation

The elongating phagophore matures into a double-membraned vesicle known as the autophagosome. This maturation involves the closure of the phagophore to fully encapsulate the cargo. The autophagosome then undergoes a series of modifications to prepare for fusion with the lysosome.

5. Fusion with Lysosome

The mature autophagosome fuses with a lysosome to form the autolysosome. This fusion is facilitated by SNARE proteins and other factors that mediate membrane docking and fusion. The acidic environment of the lysosome provides optimal conditions for the degradation of the autophagic cargo.

6. Degradation and Recycling

Within the autolysosome, the engulfed material is degraded by lysosomal enzymes. The resulting macromolecules, such as amino acids and lipids, are then transported back into the cytoplasm for reuse in various cellular processes, thereby completing the autophagic cycle.

Understanding these phases is crucial for comprehending how autophagy contributes to cellular maintenance and how its dysregulation can lead to diseases such as cancer, neurodegenerative disorders, and metabolic syndromes.

Autophagy and fasting

Several stresses, such as energy and nutritional stress, endoplasmic reticulum (ER) stress, pathogen- and danger-associated molecular patterns, hypoxia, redox stress, and mitochondrial damage, cause autophagy.[28]

Without the negative side effects of other therapies, fasting and Calorie Restriction are thought to be the best ways to improve health and lifespan, boost stress tolerance, slow down aging, and lengthen life expectancy. In a variety of animals, including humans and non-human primates, CR- generally understood to be a 10–40% decrease in calorie consumption without a decrease in dietary nutritional content- prevents diseases like cancer, hypertension, diabetes, and other age-related illnesses.

Intermittent fasting (IF) has garnered attention for its potential health benefits, including weight loss and metabolic improvements. However, its effects on inflammatory markers in individuals with obesity have been a subject of research. A systematic review and meta-analysis published in *Frontiers in Nutrition* in 2023 analysed data from randomized controlled trials to assess the impact of IF on circulating inflammatory markers-specifically C-reactive protein (CRP), tumour necrosis factor-alpha (TNF-α), and interleukin-6 (IL-6)-in individuals with obesity. The study found that caloric restriction (CR) was associated with significant reductions in CRP, TNF-α, and IL-6 levels. In contrast, (Intermittent fasting) IF did not show a significant effect on these inflammatory markers. These findings suggest that while IF (Intermittent fasting) may offer benefits in weight management, its role in modulating inflammation in obesity requires further investigation.[29]

Scientific Research on Ahar and Vihar against Obesity (Table-4)

S.No	Citation	Result	Interpretation
1	(Gujarathi, Dwivedi, & Vyas, 2014)[30]	Both groups experienced a statistically significant reduction in weight ($P < 0.001$) and body mass index (BMI) ($P < 0.01$), with the control group demonstrating more favourable outcomes compared to the trial group."	These results prove the impact of diet and exercise in the management of *Sthaulya*.
2	(Goyal, Goyal, & Chandola, 2013)[31]	The study found that the *Vashpa Svedana* group exhibited a more significant reduction in weight, body mass index (BMI), and other clinical signs and symptoms of obesity compared to the *Agnimanthadi*-treated group. This indicates that *Vashpa Svedana* may be more effective in managing obesity than the *Agnimanthadi* compound.	*Vashpa Svedana* showed superior results, indicating that metabolism-boosting therapies like steaming may be more effective for obesity management. Though the *Agnimanthadi* compound had positive effects, they were less pronounced, highlighting the value of fat-reducing, metabolic-stimulating treatments.
3	(Kedar, Joshi, & Prabhudesai, 2021)[32]	Body Weight Reduction: The patient experienced a 7.15% reduction in body weight over 21 days. BMI Decrease: Body Mass Index (BMI) decreased by 2.94 units.	The significant reductions in body weight and BMI suggest that the combination of *Terminalia chebula* supplementation and regular exercise can effectively manage obesity. This approach aligns with Ayurvedic principles emphasizing the balance of diet, physical activity, and herbal interventions.
4	(Pandey & Gupta, 2024)[33]	Lifestyle modification involves altering long term habits, typically for eating or physical activity and maintaining the new behaviour. *Yoga* and lifestyle modification can be used to treat a range of disease include obesity. Some Yoga and Asanas which are very helpful in reduce weight in obese	Yoga is presented as an effective, drug-free intervention for managing and preventing obesity, emphasizing the importance of lifestyle modifications.

		persons are *Trikonasana*, *Pawanmuktasana*, *Sarvangasana*, *Dhanurasana* etc.	
5	(Kumar & Devi, 2024)[34]	n Group A, SN intervention causes a statistically significant reduction in BMI and BFP scores. In untreated control Group B, a statistically insignificant reduction in BMI and BFP scores was found. In Group A, BMI and BFP scores were reduced statistically significantly as compared to the Group B participants.	These results indicate that SN practice does influence BMI and BFP in *Sthaulya* (overweight). Specifically, Pana alone. So, *Tila Taila Pana* and practice SN, their BMI and BFP decrease.
6	(Patil, Patil, & Yadaiah, 2012)[35]	Both treatments procedures found to be equally effective in hyperlipidaemic *Sthaulya* patients.	Both the groups have shown significant results in subjective and objective parameters.
7	(Gunari, Prasad, & Illal, 2022)[36]	Both the clinical studies and both groups showed highly significant in all criteria but statistically on comparison Group B showed better results than Group A	Both the studies have highly significant effect in *Sthoulya*. The *Tila Taila Pana* and *Udvarthana* with *Triphala Choorna* showed better results compared to *Tila Taila Pana* alone. So*, Tila Taila Pana* and *Udvarthana* both can be applied in the management of *Sthoulya*.
8	(Alodaria, Gupta, Dholakiya, & Vyas, 2017) [37]	Weight reduced: from 114.8 kg to 105.1 kg (≈9.7 kg loss) BMI dropped: from 37.51 to 34.34 Improvement in associated symptoms like lethargy, excessive appetite, and sweating	Therapies like *Vamana* and *Virechana* played a detoxifying role, while *Udvartana* and *Basti* supported localized fat reduction and systemic balance.

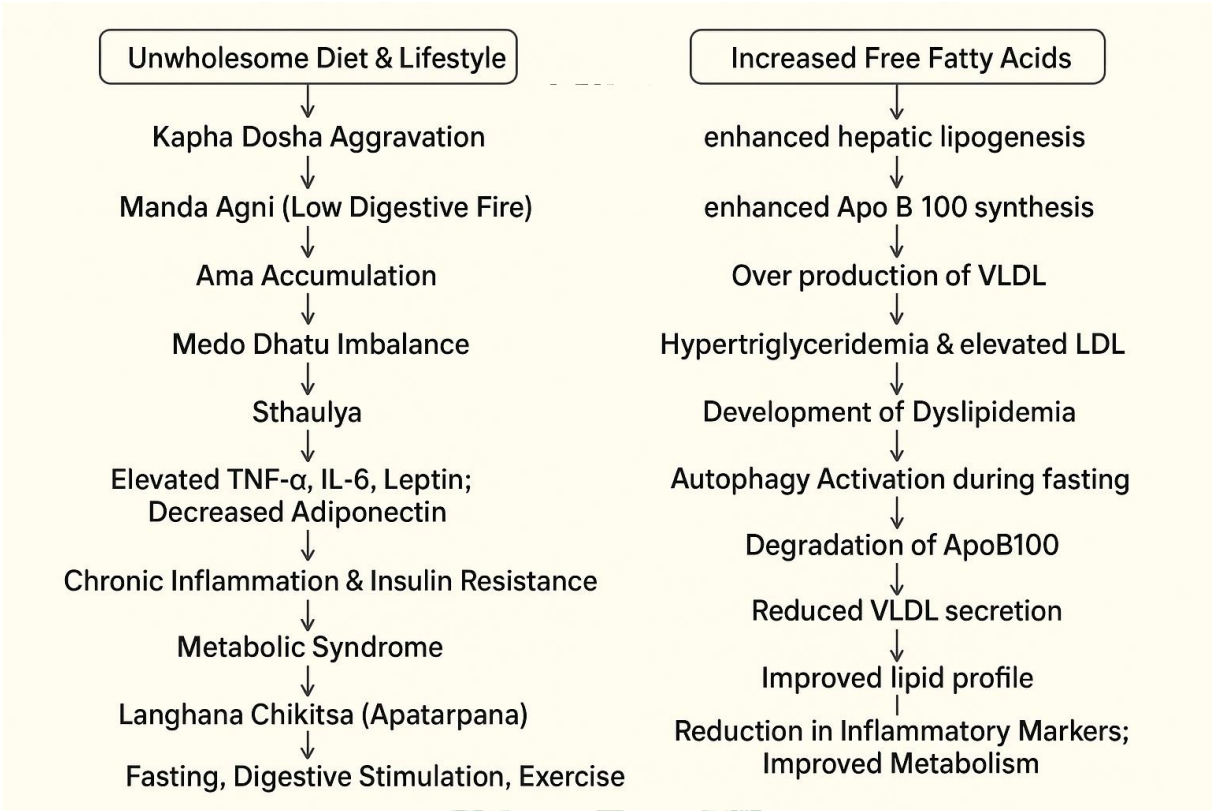
रोगाः सर्वे अपि मन्दे अग्नौ सुतराम् उदराणि च अजीर्णात् मलिनैः च अन्नैः जायन्ते मल संचयात् (A.H.Ni 12/1)

Most ailments are caused by the *Vikruti* of *Agni*, namely "*Rogasarveapi mandagnou*". Because of *Mandagni*, ingested food is not adequately digested and forms *Apakwa rasa,* resulting in the creation of *Ama*, which is a key factor in the emergence of numerous diseases. Being overweight or obese is a global issue. Adiposity can also produce anatomical and functional problems in adipocytes and adipose tissue, known as adiposopathy (adipose-opathy) or "sick fat." Because *Jatharagni* (gastric fire) regulates all *Dhatvagni* (metabolism), this "sick fat" or *Dushitmedodhatu* is likewise caused by a distorted digestive fire. During *Langhana* (total fasting/light diet), food is not accessible for digestion, thus the *Agni* metabolize the *Ama* and *Saamadoshas* ('sick fat'), resulting in *Agnideepana* and *Amapachana*. Among the three *Doshas*, vitiated *Kaphadosha* is responsible for *Strotasavarodha* (blockings in body channels) due to its *guru* (heavy), *Abhishyandi* (channel obstruction), and *Picchila* (sticky) *Guna* (properties), which resemble the properties of *Ama*; thus, *Ama* is also responsible for *Strotasavarodha*. In *Langhana*, the absence of food or a light diet enhances *Laghuta* (lightness) in the body, lowers *Ama* and Vitiated *Kapha*, and aids in the destruction of blockages in body channels. During *Langhan* (fasting), the body can get energy by releasing free fatty acids from triglycerides in fat cells. Utilization of free fatty acid from blood lowers free fatty acid levels, resulting in a reduction in *Shrotavarodha* and *Guruta*. Finally, the body becomes *Laghu* and healthy.

Autophagy is a cellular process that degrades and recycles damaged components, playing a role in maintaining cellular homeostasis. Fasting induces autophagy, which can influence the secretion of adipokines and inflammatory cytokines. For instance, autophagy induction has been shown to modulate the inflammatory responses mediated by adipokines like leptin and adiponectin. Fasting appears to modulate key biomarkers involved in inflammation and metabolism. While it may reduce certain inflammatory cytokines and leptin levels, it can also decrease adiponectin, indicating a need for balanced approaches in dietary interventions. Continued research will enhance our understanding of these effects and their potential therapeutic applications.

Integrated Flow Diagram, Diagram-2

Below is a flow diagram integrating Ayurvedic concepts with the modern biomedical understanding of obesity (*Sthaulya*) and the effects of fasting with respect to autophagy, along with the impact of autophagy on obesity-related complications and overall lipid profile maintenance.



Concept of *Guru Aptarpana*

Guru Aptarpana is an *Ayurvedic* approach to managing obesity (*Sthoulya*) by recommending foods that are heavy (*Guru*) to digest yet non-nutritious (*Apatarpana*). These foods are designed to stay longer in the stomach, prolonging satiety and curbing frequent hunger pangs. However, they should not contribute to excessive calorie intake or fat accumulation. This strategy is particularly effective for individuals with a high digestive fire (*Tikshna Agni*), who may experience frequent hunger and overeating tendencies. Integrating Protein-Rich Foods Incorporating protein into the *Guru Aptarpana* framework can be advantageous as:

- Satiety Enhancement: Protein-rich foods promote a feeling of fullness, reducing overall calorie intake.
- Muscle Preservation: Adequate protein intake helps in preserving lean muscle mass during weight loss.
- Thermic Effect: Protein has a higher thermic effect compared to fats and carbohydrates, meaning the body expends more energy to digest and metabolize it.
- Low Glycemic Index (GI) foods are digested and absorbed more slowly, leading to a gradual rise in blood sugar levels. This slow digestion can enhance satiety and assist in weight management. In the context of *Guru Aptarpana*, combining low Glycemic Index (GI) foods with protein-rich options can be effective. The evidence suggests that low Glycemic Index (GI) diets can effectively reduce ApoB- 100 levels, particularly in overweight and obese individuals, thereby potentially lowering cardiovascular risk. However, the impact may vary depending on specific health conditions and individual responses. Incorporating low Glycemic Index (GI) foods as part of a balanced diet may be a beneficial strategy for managing obesity and associated metabolic risks.

CONCLUSION

- Autophagy is a cellular process that degrades and recycles damaged components, playing a role in maintaining cellular homeostasis. Fasting induces autophagy, which can influence the secretion of adipokines and inflammatory cytokines. For instance, autophagy induction has been shown to modulate the inflammatory responses mediated by adipokines like leptin and adiponectin
- Further research into these correlations between Ayurvedic treatments and modern nutritional science could provide stronger validation for Ayurvedic practices, enhancing their credibility and application in contemporary healthcare.

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