Autophagy is relatively new in the field of medicine and is known to be associated with several physiological, homeostatic, and incidental outcomes. It is an evolutionarily conserved mechanism of the cell that removes unnecessary or dysfunctional components. Several autophagy pathways operate within a cell, including macroautophagy, microautophagy, and chaperone-mediated autophagy. These basic units together make the body and are associated with each other through channels called Srotas. These are so intricately and extensively interlaced that body is thought to be made up of Srotas.

In the view of the pathogenesis, the body is divided into three Rogamarga – Abhyantara, Bahya, and Madhya. Abhyantara Rogamarga generally includes the whole alimentary tract. Bahya Rogamarga contains Tvak (skin), Raktagati (circulatory tissues like blood) organs and Madhya Rogamarga encloses organs like Shira (brain), Hrudaya (heart), Basti (urinary system), Asthisandhi (joints) etc. Dosha are mainly seated into the Abhyantara Rogamarga, i.e., Amashaya, Pittashaya, and Pakvashaya. From here, they deliver moieties to other body parts for bodily functions.

Unwholesome and unprincipled regimens disrupt the equilibrium of Doshas causing metabolic derangements. Depending on the degree of metabolic inconsistency and extent of virulence, three circumstances can arise – Alpa Doshavastha, in which vitiates Doshas are less significant and vitiations are comparatively minimal, Madhya Doshavastha where vitiates Doshas and vitiations are higher and Bahudoshavastha where vitiates Doshas and vitiations are critically high. These vitiates Doshas and vitiations cause effects on the body accordingly. The Doshas which are not dominant enough to cause metabolic irregularities, become dormant, saturate and after
getting sufficient access through Kalabala and Mithya Ahara-Vihara, lead to pathogenic changes.

These conditions can also be explained in terms of Chaya- Prakopa and Prashama or Prasaradi forms. Chaya is quantitative build up of Dosha in their respective places. These phases occur naturally due to seasonal variations (Kalaswabhava) or it can happen due to unethical routines. Acharya have directed to control vitiation of Dosha in Chaya phase only with different types of Upakrama of respective Dosha. In Prakopa phase, vitiated Dosha trends to progress to other places. Prakopa can occur due to detectable expansion of vitiated Dosha (Chayapurvaka Prakopa) or subjective augmentation of Dosha (Achayapurvka Prakopa). Achayapurvaka Prakopa is generally caused due to intensification of some peculiar Guna like Ushna, Sheeta or Guru and their effect on the system. Prakupita Dosha gets eased down due to soothing effects of the following season or complaisant routine which is called as Prashama phase. Otherwise, Prakupita Dosha initiates pathogenic changes ultimately leading to disease causation through Prasaradi Avastha. Langhana is one of the scientific methods followed in Ayurveda to check the development of pathogenesis.

Concept of Langhana

Treatment part in Ayurveda is outlined as Langhana and Brumhana. Langhana is also called as Apatarpanna. It is generally preferred in diseases which arise due to unscrupulous and overeating habits and sedentary lifestyles. It is sub-classified into Shamana and Shodhana[10]. Shamana is of seven subtypes – Pachanam (medications which accomplish metabolic activities), Deepanam (medications which augment and strengthen the metabolic activities), Kshut (fasting), Trut (dehydration therapy), Vyayama (work outs), Atapa (light therapy) and Vata sevana (wind therapy). Shamana brings about equilibrium of the body mostly by chemically transforming potentially harmful metabolites through above described methods[11].

Shodhana is removal of noxious elements from the body for preserving equilibrium. It is of five subtypes as Niruha Basti (enemata), Vamana (emesis), Virechana (purgation), Shirovirechana (nasal therapy) and Raktamokshana (bloodletting) [12]. The type of Shodhana is adopted according to the presentation of vitiated Dosha. Usually, Dosha in gastric region, lower intestinal region, large intestinal area, head region and circulating and presenting on skin are treated with Vamana, Virechana, Basti, Shirovirechana and Raktamokshana respectively.

Concept of Autophagy

Autophagy is a quality control mechanism that destroys invading pathogens, such as bacteria and viruses, detoxifies harmful materials and recycles large proteins into their individual building blocks, called amino acids. This lets the cell clear out harmful materials[13]. In disease, autophagy has been seen as an adaptive response to stress, promoting survival of the cell; but in other cases it appears to promote cell death and morbidity. In the extreme case of starvation, the breakdown of cellular components promotes cellular survival by maintaining cellular energy levels.

Selection of method of Langhana

Langhana Chikitsa reinstates homeostasis by either regulating metabolic mechanisms (Shamana) or eliminating mechanisms (Shodhana). The gravity of vitiated Dosha and the type of Rogamarga involved, decides the relevance of type of Langhana. Factors like involved Dhatu, Desha (affected body part as well as patient’s locality), Bala (physical and mental strength and immunity), Kala (season), Anala (digestive fire), Prakriti (body constitution of the patient) and Vaya (age of the patient) also need to be taken into account while selecting appropriate type of Langhana for the patient[14].

Kshudha & Trut (starving), Vyayama (exercise), Atapa (sun bath) and Vatasevana are relatively mild forms of Langhana Chikitsa and are opted in Alpa Doshavastha as well as Durbala Rugna[15]. Fasting (Kshut) has been vividly studied in modern medicine with encouraging results. Body enters the metabolic state called ketosis after twelve hours of fasting [16]. In this state, body starts to break down and burn fat. Eighteen hours of fasting switches body to fat-burning mode and generates significant ketones[17]. Within 24 hours, body cells increasingly recycle old components and break down misfolded proteins linked to Alzheimer’s and other diseases[18]. This is the one of the processes of autophagy. By 48 hours without calories or with very few calories, carbs or protein, growth hormone level is up to five times as high as when a person begins fast[19]. By 54 hours, insulin is dropped to its lowest level point since beginning of fasting and body becomes increasingly insulin-sensitive[20]. By 72 hours, body breaks down old immune cells and generates new ones[21].

One in vivo animal study showed that exercise had induced autophagy in multiple organs involved in metabolic regulation, such as muscle, liver, pancreas and adipose tissue. The study also showed treadmill exercise induced autophagy in cerebral cortex of adult mice. So it was concluded that exercise may in part mediate the beneficial effects of exercise in neurodegeneration, adult neurogenesis and it was also seen to improve cognitive function[22].
Deepana and Pachana Chikitsa are generally sought in Madhavala Doshavastha with administration of various medicines which have Deepana (Agnideepana – drugs which stimulate metabolism) and Pachana (drugs which bring about metabolic changes) actions[23]. Ushna Jala (warm water) is one such potent Deepana and Pachana drug which alters the metabolic pathways for the good[24].

Bahudoshavastha is the condition to be treated with Doshavasechana i.e. removal of pathologic Dosh from the body through various mechanisms. Avipaka (indigestion), Aruchi (disturbed perception of taste), Shhaulya (obesity), Panduta (pallor), Gaurava (heaviness of the body), Klama (unreasonable feeling of tiredness), Pidaka-Kotha-Kandu (skin eruptions with itch), Arati (world-weariness), Alasya (laziness), Shrama (exhaustion), Daurabalya (weakness), Daurgandhya (body smell), Avasa (mental fatigue), Kapha-Pitta Samutklesha (bouts of cough and sour eruption), Nidranasha-Athinidrata (sleep disturbances), Tandra (tiredness), Klaibya (impotency), Abuddhitvam (intellectual disorders), Ashasta-Swapna Darshana (irrational dreams), lethargy and loss of complexin in spite of consuming nutritious diet are some of the expressions of Bahudoshavastha[25]. Samshodhana helps to remove obstructions in the flow of substances through Srotasa, normalizes systemic functions and thereby imparts optimal physical and mental health[26].

In spite of huge set of benefits, Ayurveda warns to monitor effects of Langhana judiciously. Overuse of such therapies can lead to Balakshaya (loss of physical strength as well as immunity).

Ideal form of Langhana brings feeling of health and lightness and restores functions of systems. It is marked by smooth excretory functions like perspiration, bladder and bowel movements, feeling of lightness in Hrudaya (chest region), clean feeling of Kantha (throat region) and tongue, mental enthusiasm, appetite etc. [27].

Overindulgence in Langhana restricts nourishment to the Dhatus and leads to Parvabheda (pain in DIP & PIP joints), Angamarda (bodyache), Kasa (coughing), Mukhashosha (dry mouth), Kshut Pranash (loss of appetite), Aruchi (disturbed perception of taste), Trushna (thirst), Netra and Shrotra Daurabalya (weakness of sensory organs like eyes and ears), Manasambhrama (mental confusion), Urdhvavata (gaseous troubles) and Balanasha (loss of strength and impaired immunity) etc[28].

Mechanism of autophagy

Autophagy is described to be of three types namely macroautophagy, microautophagy and chaperon mediated autophagy. Macroautophagy is extensively studied amongst these. Macroautophagy occurs at a low level constitutively and can be further induced under stress conditions, such as nutrient or energy starvation, to degrade cytoplasmic material into metabolites that can be used in biosynthetic processes or energy production, allowing for cell survival. Thus, macroautophagy is primarily a cytoprotective mechanism; however, excessive self-degradation can be deleterious. Microautophagy refers to a process by which cytoplasmic contents enter the lysosome through an invagination or deformation of the lysosomal membrane. Chaperon mediated autophagy is highly specific. CMA degrades a wide range of substrate proteins, including certain glycolytic enzymes, transcription factors and their inhibitors, calcium and lipid binding proteins, proteasome subunits, and proteins involved in vesicular trafficking[29].

In addition to elimination of intracellular aggregates and damaged organelles, autophagy promotes cellular senescence and cell surface antigen presentation, protects against genome instability and prevents necrosis, giving it a key role in preventing diseases such as cancer, neurodegeneration, cardiomyopathy, diabetes, liver disease, autoimmune diseases and infections[30].

DISCUSSION

Langhana has been widely followed as a part of treatment in Ayurvedic practice. It is considered so important that it is blended as part of Indian lifestyle since ages. Fasting is known to every household to revive bodily systems and is religiously practiced on many instances.

Depending on the presentation of pathological conditions, more and more vital options of Langhana are used by Vaidya in patients as a part of treatment.

The term autophagy was well admitted in the 19th century. By the beginning of the 20th century it was assimilated into the core of the scientific knowledge of the time. The term was used to describe survival in periods of starvation on one’s own resources[31].

Christian de Duve coined the term autophagy in its present usage in 1963 based on his discovery of the functions of lysosome. Identification of autophagy-related genes in yeast in the 1990s led to study mechanisms of autophagy, which eventually fetched 2016 Nobel Prize in Physiology or Medicine to Japanese researcher Yoshinori Ohsumi. The incidental findings of autophagic activities have opened new doors to study the optimal responses generated in body for survival.
Various bioinformatics and network biology approaches have been developed by researchers in the last few years to understand the global organization of the autophagy system and its integration with other cellular processes. Recently, large-scale multi-omics approaches (like genomics, transcriptomics, proteomics, lipidomics, and metabolomics) have been developed and carried out specifically focusing on autophagy, and generating multi-scale data on the related components. [32]

Autophagy is usually a degradative pathway also participating in biosynthetic and secretory processes [33], Hence it is correlated with Langhana in the present article. Autophagy is explained as an innate response of body whereas Langhana is a treatment offered by Ayurveda. Autophagy dysfunction has been observed during aging, and several genetic alterations in cancer, neurodegenerative and immune-related diseases have been associated to autophagy and autophagy genes [32].

So it is a million dollar question whether autophagy can be induced by any technique with the objective of stimulating survival mechanism or to achieve the effects of Rasayana.

Access to experimental autophagy in the present scenario appears to be equipped with nutritional status (fasting), eating particular types of foods that are supposed to enhance autophagy (through nutrient sensing hormones, kinases and phosphatases) and also to some extent exercising. It is induced with chemical agents in some experimental studies [34]. If it can be strategically designed, prevention and treatment of many diseases of poorly understood origin may be possible.

Langhana is an expression of Ayurvedic therapy in its technical and scientific way which incorporates fasting and exercising along with many more procedures to explore. It is interesting to note that Bahudosa Lakshana like Avipaka, Kapha-Pitta Samuktlesha, Sthaulya, Panduta, Kandu-Kotha-Pidaka, Alasya, Klama, Arati, Tandra, Nidravikara etc are the manifestations in number of diseases from simple digestive to endocrinal, lifestyle as well as auto-immune pathologies.

Thus apparently both Langhana and autophagy mechanisms seem to be intended on the same objective of removing or degrading harmful substances which can potentially endanger the survival system.

Autophagy is integral to human health and is involved in physiology, development, lifespan and a wide range of diseases, including cancer, neurodegeneration and microbial infection [35].

CONCLUSION

Although Langhana and autophagy are explained on different grounds, their approach towards health appears to be quite resonating. Benefits of autophagy may be availed on a larger scale by practicing the scientific approach of Langhana.

Ayurveda provides more alternatives through Langhana to achieve health benefits alleged by autophagy means. Langhana techniques need to be thoroughly explored on cellular levels through joint approach of Ayurveda and modern medicine with its huge technological apparatus in order to study whether Langhana can be used to generate autophagic responses and to maximize its benefits.

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Cite this article as:
Gandhe Gayatri Shyamsundar. Hypothetical Analysis of the Concept of Langhana with respect to Autophagy. International Journal of Ayurveda and Pharma Research. 2020;8(Suppl 2):77-82.

Source of support: Nil, Conflict of interest: None Declared

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