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CONCEPT OF AUTOPHAGY WITH SPECIAL REFERENCE TO LANGHAN FOR HEALTHY LIFE – A REVIEW

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ABSTRACT

Nowadays, not only India but also western countries recognize the importance of fasting in different ways. Ayurveda has already mentioned its advantages comprehensively. Autophagy can be described as the controlled digestion of internal unwanted cell components which is necessary to survive and for the normal function of the body. It plays an important role in health as well as in disease. Autophagy not only provides fuel for energy but also it eliminates intracellular bacteria and viruses. In this article it's been focused on the concept of Autophagy and its correlation with *Langhan chikitsa* in Ayurveda.

Keywords: Ayurveda, *Langham chikitsa*, Autophagy, Diseases

INTRODUCTION

"Autophagy," this concept came first during the 1960s, where researchers observed that by enclosing its membranes, the cell destroys its own contents is called autophagosomes for the process of degradation. Later on, Professor Yoshinori Houma won the 2016 Nobel Prize in Physiology or Medicine for the discovery of the mechanism for autophagy under the title of "A fundamental process of degrading and recycling cellular components". Ayurveda knows the importance of fasting in which all the metabolic toxins get removed from the body with removal of all blockages in the channel and digestive system also get improved without any side effect on the body. In Ayurveda, fasting is considered as remedial methodology as well as it is precautionary methodology in human beings. Basically, fasting depends upon the body, type of human being which includes *Vayu, Agni, Kala* and *Doshi* of the person. Fasting is the mixture of all spiritual, psychological and physical therapies and gives better feeling in unhealthy condition.

Aim and Objectives:

1. To study the importance of Autophagy
2. Literary study of Autophagy at cellular level.
3. To study the available literature on *Langham chikitsa.*

Materials and Methods:

1. Ayurveda texts like *Briartite* and *Lighterage* have been used to study the concept of *Langham chikitsa.*
2. Latest different articles on Autophagy.
3. Sources from Websites and internet.

Conceptual Study:
Present study explains the basic concept of Autophagy and *Langhan chikitsa* for better and healthy life.
To study the concept of Autophagy we have to study concept of cell first.

A) Concept of Cell
The word cell comes from the Latin word cellar which means small room[1]. Cell basically can be called building block of the life. It is basically smallest unit of life and also structural, functional, and biological unit of all known living organisms. It was first discovered by Robert Hooke in 1665 and its theory, first developed in 1839 by Matthias Jakob Schleiden and Theodor Schwann [1][2]. According to them cells are the fundamental as well as structural and functional unit of all living organisms. From pre-existing cells, all organisms are made up of one or more cells. This cell also contains the hereditary information which is useful for regulation of cell functions and for transmission of information to the next generation. [3].

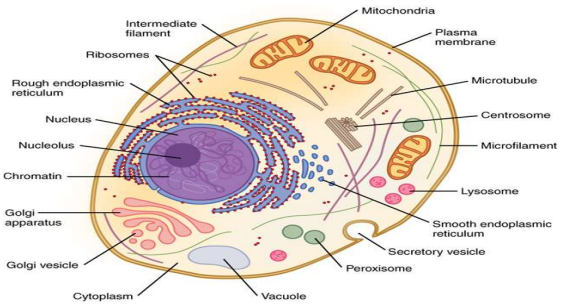

Image 1: The Cell

The Cell
Types of cells: -They are of two types --1) eukaryotic, which have a nucleus, and 2) prokaryotic, which do not have the nucleus. Mainly Prokaryotes are single-celled organisms, and eukaryotes can be either single-celled or multicellular**.**

Table 1: Difference between prokaryotic and eukaryotic cells

Sr no	Characteristic	Prokaryotes	Eukaryotes
1	Size	1-5 µm [16]	10–100 µm [16]
2	Organisms	Bacteria	Fungi, plants, animals
3	Nucleus	No true nucleus, nucleoid region	true nucleus with double membrane
4	DNA	Circular	Linear molecules(chromosomes) with histone protein
5	Mitochondria	None	One to several thousand
6	RNA/Protein synthesis	both in cytoplasm	RNA in the nucleus Protein synthesis in cytoplasm
7	Cell movement	Flagella made of flagellin	flagella and cilia containing microtubules; lamellipodia and filopodia containing actin
8	Cell division	Binary fusion	Mitosis, meiosis
9	Chromosomes	Single	More than one chromosome
10	Membranes	Cell membrane	Cell membrane and membrane-bound organelles

Organelles
They are parts of the cell which plays an important role for carrying out vital functions. [4].

Table 2: Different parts of cell

Sr no	Organelle	Function
1	Nucleus	DNA Storage
2	Mitochondrion	Energy production
3	Smooth Endoplasmic Reticulum (SER)	Lipid production; Detoxification
4	Rough Endoplasmic Reticulum (RER)	Protein production; in particular for export out of the cell.
5	Golgi apparatus	Protein modification and export.
6	Peroxisome	Lipid Destruction; contains oxidative enzymes
7	Lysosome	Protein destruction

B) Concept of Autophagy

Definition: -

The controlled digestion of internal cell components is called Autophagy. Basically, it is derived from the Greek word "auto" means "self and "phage in" means to eat. It is the process in which the cell targets unwanted materials, damaged cell components and recycles. It is a normal process which can be finding out in all eukaryotic organisms, right from unicellular organisms to complex multicellular organisms which is necessary to survive the cell and to maintain body function properly. [5]

Mechanism

All the unwanted and defective cell components are covered by a membrane, which wraps it all and seal it inside a vesicular structure called an autophagosome. Then autophagosome are transport to lysosomes which is highly acidic and have enzymes which are able to break down unwanted cellular material. Due to degradation by lysosome, small molecules produced and thus available to the cell to reuse.

Level of autophagy increases when cells are starved or when cells are highly exposed to the accumulation of waste material. In this case, cells recycle the unwanted products by degradation and maintain all body functions normal.[6] **Steps:-** Autophagic processes has several steps. Damaged structures, like mitochondria, destroyed by Lysosomes. The Lysosomes then deconstruct it so that it can be used to generate fuel. It is a complex process which involves following steps: -

1. Damaged material must first be transported to a lysosome,
2. Then deconstructed,
3. Then spit back out to be repurpose

Procedure

1) First, cytoplasmic constituents, including organelles, are concealed by a unique membrane called the phagophore or isolation membrane. Complete sequestration is done by the elongating phagophore which result to form autophagosome, which is double-membraned organelle. In this step no degradation occurs. The site where autophagosomes generate is called the "pre-autophagosome structure (PAS)". Tag is autophagy-related) proteins, they all gather at a site which is very close to the vascular membrane. Among all 31Atg proteins, certain proteins involved in autophagosome formation and are called "AP-Atg proteins" they depend on each other for recruitment to the PAS.[7]

2) Degradation: In the next step, autophagosomes fuse with lysosomes and then degradation by lysosomal.

3) Reuse: When macromolecules have been degraded in the lysosome/ they are exported to the cytosol for reuse.

The Importance of Mitochondrial Biogenesis:

For healthy and disease- free life, healthy mitochondria is very necessary. Mitochondrial damage can affect genetic mutations which plays an important role to form cancer, to overcome this Autophagy is very important in which damaged mitochondria get removed and thus it help to prevent cancer. Mover ever biogenesis is another process in which new healthy mitochondria can be duplicated.

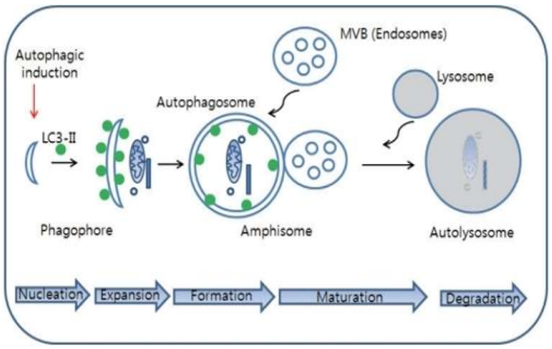

Image 2: Process of Autophagy

Types: On the basis of autophagy-related genes and their association with enzymes, autophagy has three types: Macro autophagy, Micro autophagy and Chaperone mediated autophagy. [7]

1) Macro autophagy

It is further divided into bulk and selective autophagy. Out of which, selective autophagy is the autophagy of organelles; mitophagy, lipophagy, pexophagy, chlorophagy, ribophagy. To remove damaged cell organelles and unused proteins, the main pathway is Macro autophagy. Here the unused material which needs to remove first engulfs with phagophore, which made double membrane structure known as autophagosome, around the

organelle which target for destruction. The autophagosome get fuse with lysosome by travels through the cytoplasm of the cell. Due to acidic lysosomal hydrolase which is present inside the lysosome the autophagosome are degraded.[7]

2) Micro autophagy

It involves the direct submerge of cytoplasmic material into the lysosome. It is because of inward folding of the lysosomal membrane.

3) Chaperone-mediated autophagy (CMA)

It is a very complex where recognition by the hsc70-containing complex plays an important role. Here protein must contain the recognition site to form the CMA- substrate/chaperone complex. Then this complex moves towards the lysosomal membrane and bind with the CMA receptor. It is different from other types of autophagy as it translocates protein material in different manner, and is selective about material.

Different way of Autophagy

1) Exercise

Exercise is one of the ways to boost autophagy it helps to flush out toxins by sweating and creates mild damage to muscles and tissues which in turn body then repair it. Exercise also cause vasodilation and increased blood flow.

2) Intermittent Fasting

Fasting is another way of autophagy and it reduced diabetes and heart disease. There must be proper time table of getting meals. There must be proper gap between two meals. Basically, when we give fuel to mitochondria when they don't need it, they release a large number of electrons which gives a rise of reactive oxygen species which act as free radicals. Then these free radicals not only damage mitochondrial and but also nuclear DNA.

3) High-Fat, Low-Carb Diet

Nutritional ketogenesis plays an important role to boost autophagy, and for that increase the amount of healthy fat, cut down on the non-fibre, and get moderate amount of protein. We can get a lot of benefits from fasting without doing it actually by the mean of Ketogenesis. From overall calories 60 and 70 percent calories should come from [healthy] fat, 20 to 30 percent of calories should come from proteins and below 30 percent from carbs. Here healthy fats include natural, unprocessed fat which can get from seeds, nuts, real butter, olives, avocado, or coconut oil. Processed vegetable oils are very high in omega-6 fats which cause mitochondria damage. In our diet omega-6 fats consumption must be less than 4 to 5 percent.

Benefits

1. Make our bodies more healthy and full of energy and muscles get improve because of Autophagy.
2. It helps to fight against infections; prevent cancer, and other illnesses
3. It recycles damaged organelles and proteins and helps to decreases the inflammation.
4. Aging process get slow down due to Autophagy.
5. It regulates the function of mitochondria, which produce energy but due to oxidative stress it can damaged.
6. Damaged endoplasmic reticulum and peroxisomes get cleared by Autophagy.
7. It protects against heart disease and support for the growth of heart cells.
8. It eliminates intracellular pathogens and thus helps for immune system.
9. It helps for stability of DNA and help to prevent necrosis, neurodegenerative disease.

C) Concept of *Langham chastise*

Definition

"*Yet Kinchillaghavakaram Dehe Tallanghanam Smruta"// Charaka Samhita Sutrasthana* 22/9

The therapy which is able to bring lightness and thinness to the body is called *Langhana* treatment. It can also be called as denourishing treatment. Ayurveda illustrates fasting as *Upvasa.* "Fasting" can be characterized as "consciously get restricted from all the four types of food which include chewing of any material, licking of any food, gulping and drinking [8] for specific time spans." It can be utilized as a treatment for many diseases

Principle of fasting:

Intensity of fire is decreased by the ash particles remaining on it, which alters the process of burning. Same way in the human body, the vitiated *dosha* in human body, hampers the digestive fire and became main reason for the production of *aama* (metabolic poisons), which is the main source of all illnesses. This *aam* also block of all channels of the body and are responsible for dif-

ferent sicknesses. Because of Fasting, destruction of many metabolic toxins, occurred which ignite the digestive fire and also clear all blockages in the channels of the body. In this way it helps to fight against illness [9]. Time and duration of fasting for detoxification is vary from person to person according to their body category and individual constitution. According to Ayurveda, winter *(Shishir Rutu)* period from the end of February onwards is the best time for fasting. At that period force of the sun begins to boost which help for Self-cleansing in body. During fasting, the body remove all the metabolic waste materials and body fats. Intermittent fasting is pattern of consumption and method for planning meals to get the healthy life and to lose fat. Ayurveda recommend regular and short duration fasting. The sticky, poisonous waste gets collect in our digestive tract and then pass through channels and tissues of our body and hampered cellular nutrition and formed disease. Thus, imbalanced *Agni* and gathering, of *Ama* is the root of majority of the illness. Fasting explained in Ayurveda help to keep a lid on this build-up of toxins [10]. It is stated in Ayurveda that "*aho ratri bhojana abhavaha",* which means 'absence of food at night' can also be considered as one type of fasting. Because of this body of individual purifies itself by removing the toxin waste on next day.[11]

Characteristic Features of *Langhan chikitsa*

"Laghu Ushn Teekshn Vishadam Rukshm Sukshm Kharm Saram /
Katheenm Ch Aevm Yatt Dravyam Prayaha Tat LAnghanm Smrutanm"// Charaka Samhita Sutrasthana 22/12

Properties of *langhana dravya*

1. Light *(Laghu)*: -The *dravya* must be light in weight.
2. Hot *(Ushna):* - Basically hot quality substance is light in nature hence it is used.
3. Sharp *(Teekshna)*: -This property helps to remove toxin material out from the body and also enter in minutest body channels.
4. Non-slimy *(Vishada)*: - This quality help to remove stickiness and clear all the body channels.
5. Dry *(rooksha)*: - It brings lightness to the body.
6. Minute *(sookshma)*: - Sharpness help to enter every minute body channels.
7. Rough *(khara)*, hardness *(Katina),* mobility *(sara)*: - This all properties help to remove all the toxic material from the body and clear all the body channels.

Indications:

1) Diseases where heaviness occurred.

Example: - diabetes, sinusitis, obesity, fever and in indigestion.

2) Diseases where obstruction of strotas occurred.

Example: - asthma, hyperlipidaemia, coronary artery disease, constipation.

It can also be given in the treatment of digestive disorders like *atisaar* (diarrhoea), *aruchi* (anorexia), *udarroga* (ascites), *hrullas* (nausea) etc. And also, in *vata* disorders which affect skin and urinary tract.

Langhana Dravya-The herbs which are used for langhana purpose are**: -**

Table 3: List of *Langhan Dravya*

Sr no.	Drugs	Latin name
1	*Guduchi*	Tinospora cordifolia
2	*Musta*	Cyperus rotundus
3	*Triphala*	Fruits of Terminalia chebula,Terminalia bellirica and Emblica officinalis
4	*Vadang*	Embelia ribs
5	*Shunti*	Zingiber officinale
6	*Yava Churna*	Barley powder
7	*Priyangu*	Callicarpa macrophylla
8	*Shyamaka*	Setaria italica
9	*Kodrava*	Paspalum scrobiculatum
10	*Kulathha*	Hoarse grams
11	*Chakramarda*	Cassia tora
12	*Patola*	Trichosanthes dioca
13	*Adhaki*	Cajanus Cajan

Samyaka Yoga* of *Langhana chikitsa-

"Vat Mutr Pureeshanam Visarge Gatr Laghve / Hruday Udgar Kanth Assya Shudhhau Tandra Klame Gate //
Swede Jate Ruchau Chaiv Khut Pipas Sah Udaye / Krutanm Langhanm Aadeshyam Nivyarthe ch Antaratmanee"// Charaka Samhita Sutrasthana 22/34,35

1. *Vata Mutra Pureesha Visarga*- It means proper excretion of flatus, urine and faeces
2. *Laghava and Hrudaya Shuddhi*– Feeling of lightness and purity in heart.
3. *Udgara Suddhi, Kanta Suddhi*- purity in eructation and clarity in throat.
4. Feeling of fresh, remove dullness and drowsiness, and
5. Appearance of sweat and appreciation of taste. [12]

Atiyoga* of *langhana

1. *Parvabheda*- cracking sound can occur in small joints.
2. *Angamarda*- Pain in total body.
3. *Kasa*-Cough
4. *Mukhashosha*- Mouth becomes dry.
5. *Aruchi*-Patient not willing to eat anything.
6. *Trishna*-thirst.
7. *Sambhrama*- Patient not able to recollect anything.
8. *Tamo hrudi*-bradycardia, bloating (upward movement of *Vata*).
9. Body becomes weak.
10. Digestive power and body strength become low and also weakness of eyes and ears occur.

Benefits of *Langhana-*

1) Improves the metabolism and digestive power
2) Remove *Ama* (toxin) from the body.
3) Removes the blockage from *strotas* and tissues
4) Brings lightness and feel heathy.

Langhana treatment is applied when there is heaviness in the body. It clears all the minute channels, improves the circulation and removed toxin from the body. It also helps for *deepana* and *pachana.*

CONCLUSION

Today people are continuously exposed to various poisonous substances through water, air, food which are basic need of human beings, these all are the reasons of accumulation of different toxins in the body. Because of this, body has to face many health- related issues. Hence it is the demand of time to remain healthy. Autophagy is the nutrient starvation in which there is the digestion of internal cell components due to lack of any type of essential nutrient. Intermittent fasting, Exercise and Ketogenic Diet means having very high-fat and low-carb these are all different ways of Autophagy. It can be co-related with *Langhan chikitsa* [Fasting] of Ayurveda given in Ayurvedic texts like *Sushruta Samhitha, Charaka Samhitha, Astanga Hridaya*. Our *Acharya* has focus on fasting and explained the importance of it. Actually, these all are priceless therapy to stay healthy and to defect disease. Thus, it is the Time demand to adopt it.

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