Fasting And Autophagy

Fasting in Science comprises caloric restriction, nutrient restriction and seasonal eating restriction. Fasting cleanses our body of toxins and forces cells into processes that are not usually stimulated when a steady stream of fuel from food is present. It is safe to fast up to 24 hours; however, fasting beyond 72 hours could be alarming. The ideal fast is between 12-18 hours. It helps our body focus on cellular repair during the fasting period, gain mental health and clarity, reduce insulin resistance and aid in weight loss. Fasting consists of five stages: ketosis, autophagy, growth hormone secretion, insulin reduction and immune cell rejuvenation.

The first organ to respond to fasting is the pancreas. After that, we may lose hard fat surrounding our organs, like the liver and kidneys. Meta-analysis revealed that intermittent fasting reduces liver enzyme levels (ALT, AST) in people with Fatty Liver Disease. Fasting protects brain cells by providing Ketone for fuel instead of glucose. Ketones help the brain produce Brain Derived Neurotropic Factor (BDNF), a compound that grows new brain cells and connections between them. Fasting has beneficial effects on diseases like Diabetes Mellitus, Cardiovascular Ailments, Obesity, some Cancers and Cognitive Impairment. Intermittent fasting from down to sunset for 30 consecutive days is associated with anticancer, protease signature, and the up-gradation of key regulator proteins for glucose and protein metabolism. It also stabilises the circadian clock and DNA repair. It may lead to cytoskeleton remodelling and raising the immune system.[1]

The Noble Assembly at Karolinska Institute awarded the 2016 Nobel Prize in Physiology and Medicine to Dr. Yoshinon Ohsumi for his discoveries of the Mechanism of Autophagy. Autophagy is a fundamental process for degrading and recycling cellular components. Autophagy denotes ''self-eating,'' which means that the cell could destroy its contents by closing its membranes, forming sac-like vesicles that are transported to a recycling compartment, called the Lysosomes, for degradation. Lysosomes contain enzymes for the digestion of cellular contents. A new type of vesicle called Auto-phagosome is formed, which engulfs cellular contents such as damaged proteins and organelles. This process provides the cell with nutrients and building blocks for renewal. Autophagy controls important physiological functions where cellular components must be degraded and recycled. Autophagy can rapidly provide fuel for energy and building blocks for the renewal of cellular components and is, therefore, essential for the cellular response to starvation and other types of stress.[2] After infection, autophagy eliminates invading intracellular bacteria and viruses. Autophagy contributes to embryo development and cell differentiation. Cells also use autophagy to eliminate damaged proteins and organelles, a quality control mechanism that is critical for counteracting the negative consequences of ageing. Disrupted autophagy is linked to Parkinson's Disease, Type-2 Diabetes Mellitus and some disorders in the elderly. Mutation in Autophagy genes can cause genetic disease. Intense research is ongoing to develop drugs that modulate autophagy in different diseases.

The mammalian target of Rapamycin (mTOR) is a protein kinase that belongs to the Phosphatidylinositol 3 kinase-related kinase family. mTOR is a serine/threonine protein kinase that governs cell growth, protein synthesis, mobility, survival, and autophagy. There is a peculiar relationship between mTOR and autophagy,[3] (Figure).

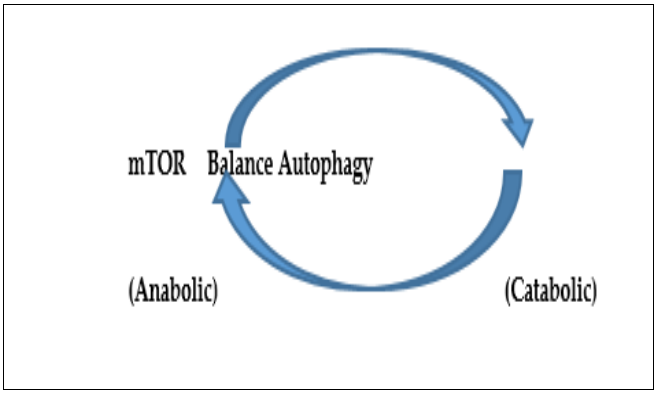

Figure: Relationship between mTOR and Autophagy

In summary, Fasting superadded with autophagy (within limits) has the following effects on various organs in the human body:-

Blood: It causes decreased insulin, IGF-1 and Leptin whilst increasing Ketone, adiponectin and ghrelin.

Liver: It leads to increased insulin sensitivity ketone body production whilst decreasing IGF-1 Level

Intestine: It causes reduced energy uptake, reduced inflammation and reduced cell proliferation.

Brain: It may lead to improved cognitive functions, increased neurotrophic factors, increased stress resistance and reduced inflammation

Heart: It may provide reduced resting heart rate, reduced blood pressure and increased stress resistance

Fat cells may cause lipolysis, reduced leptin, increased adiponectin and reduced inflammation.

Muscles: It may lead to increased insulin sensitivity, increased efficiency and reduced inflammation.

Therefore, autophagy promotes cell survival by eliminating damaged organelles and protein aggregates and facilitating bio-energetic homeostasis. Fasting for 10-16 hours (considering the circadian rhythm) can cause the body to turn its fat stores into energy, releasing ketones into the bloodstream.

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