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ABSTRACT Digestion, metabolism and assimilation i.e. whole process of biological conversion and utilization of energy is symbolized by the term *Agni*. Ayurveda considers *Agni* as the cause of life, color, strength, health, enthusiasm, nourishment, ojas, tejas, and prana. According to the function and site of action, *Agni* has been divided into 13 types, i.e. one *jatharagni*, five *bhutagni* and seven *dhatvagni*. Though each and every *Agni* among the 13 types of *Agni* has its own importance, *jatharagni* is the primary & most important among these. Because all other *agnis* are under the direct control of this *Agni*. *Jatharagni* is the main element responsible for the digestion in GIT. All the GI enzymes and GI hormones can be correlated with *Jatharagni*. *Bhutagnis* are concerned with the separation of minute fraction of panchabhautik consistency, it may be taking place in small intestine or liver or tissue level. *Dhatvagni* can be compared with enzymes involved in tissue metabolism. Digestion and metabolism that take place in *adho amsasaya* or metabolism takes place in liver or the whole metabolism that takes place in each and every cell of our body can be considered under *bhoothagni vyapara*. We can compare Rasa dhatvagni as enzymes involved in glucose metabolism. *Rakta dhatvagni* can be considered as enzymes and hormones involved in the formation of RBC and platelets, iron metabolism, protein metabolism (hemoglobin contain protein part). *Mamsa dhatvagni* can be considered as the enzymes and hormones involved in protein metabolism. *Medo dhatvagni* can be considered as the enzymes and hormones involved in lipid metabolism. *Asthi dhatvagni* can be considered as the enzymes involved in calcium and phosphate metabolism. *Majja dhatvagni* can be considered as the enzymes involved in hemopoietic activity and in proper maintenance of bone marrow. *Sukra dhatvagni* can be considered as the enzymes involved in glucose metabolism and the enzymes and hormones involved in the proper functioning of male and female reproductive functions

KEYWORDS : Jathragni, dhatvagni, bhootagni, metabolism, GI enzymes, GI hormones

INTRODUCTION:

Digestion, metabolism and assimilation i.e. whole process of biological conversion and utilization of energy is symbolized by the term *Agni*. According to modern medicine, metabolic process of division and multiplication are going on in every cell of our body from birth to death. For these constant processes in all cells, a biological energy is constantly essential without which the survival of our body will be quite impossible. The same biological energy is coined by *Ayurveda* as *Agni*.

Importance Of Agni:

Ayurveda considers *Agni* as the cause of life, color, strength, health, enthusiasm, nourishment, ojas, tejas, and prana¹. Extinction of this *jatharagni* leads to death. Its proper maintenance helps a person to live a long life, and its impairment gives rise to diseases. Moreover, *Agni* is placed among the twelve prana of the body, which discloses its significance for maintaining life². By seeing the significance of *Agni*, *Maharsi Susruta* enlisted equilibrium of *Agni* as a characteristic feature of health. In whom, the *dosas*, *Agni*, *dhatu*, *malas*, and their activities are normal; his soul, sense organs and mind are calm, is called as *swastha*³.

Agni And Pitta:

Whether *Agni* and *pitta* is same or different, is a controversy among acharyas. Some supports the view that both are same, while some oppose it. The term *pitta* is derived from the root 'tap' which means to heat or to burn⁴. 'Tap *dahe*' relates to the act of burning of the nutrition consumed. 'Tap *santape*' refers to the generation of heat.

Acharya caraka has mentioned that the *Agni* which is present in the universe, is present inside the human body in the form of *pitta*. *Chakrapanidatta* has clarified that the term *pittantargath* does not mean that the *pitta* is flaming fire. It only refers to the phenomenon of heat associated with *pitta*⁵. *Agni* in human body has got the nature of sookshmatva, i.e. invisible by naked eyes. But *pitta* is visible form. *Agni*, in the form of *ushma*, is present as a *sukshma bhava* in that *pitta*, which cannot be seen, but can be understood through its karma. It stays in *samavayisambandha* with *pitta*. *Agni* can be defined as the *veerya* of *pitta*, which stays in *samavayisambandha* with it. *Vagbhata* in *Astanga hrudaya* clearly says that only *pachaka pitta* can be correlated with *Agni* and all other types of *pitta* are different than *Agni*⁶. To be specific, *pitta* is the seat of *Agni*, as they have coexistence always. But the *pitta* as a whole itself cannot be considered as *Agni*. Only the *agneya* portion of *pitta* can be considered as *Agni*. Some doubts arise behind the concept of whether *pitta* is *Agni* e.g. *Ghee* alleviates *pitta* but enhances *Agni*. The quotation of Acharya *susruta*, "*Samadoshah samagnishcha*" has clearly indicated that *pitta* and *Agni* are not the same.

Types Of Agni:

According to the function and site of action, *Agni* has been divided into 13 types, i.e. one *jatharagni*, five *bhutagni* and seven *dhatvagni*⁷. These 13 types of *agnis* perform their function at different level, right from *ahara grahana* to *dhatu nirmana*. According to Acharya *susruta*, five types of *pitta* are illustrated, viz. *Pachakagni*, *ranjakagni*, *sadhakagni* and *bhrajakagni*⁸.

Jatharagni:

The prime function of *jatharagni* is to do *sanghata bheda* of food, i.e. breaking down of the ingested food into smaller parts for easy absorption. All other *Agni* depends upon the *jatharagni*. Its *vridhi* and *kshaya* depends on the corresponding changes in *dhatvagni* and *bhutagni*. So for getting *ayus* and *bala* proper care should be given to *jatharagni*. This is also known as *pachaka pitta*, *koshtagni*, *kayagni*, *antaragni* and *pachakagni*.

Jatharagni means the *Agni* which is located in the *jathara* or *annavahasrotas* i.e. Digestive tract. According to Acharya Caraka⁹ seat of *jatharagni* is *grahani* because of its power to restrain of food. *Maharsi Susruta* indicates the seat of *jatharagni* is in between *amasaya* and *pakwasaya*¹⁰. Though each and every *Agni* among the 13 types of *Agni* has its own importance, *jatharagni* is the primary & most important among these. Because all other *agnis* are under the direct control of this *Agni*¹¹. It bestows grace to all other *pittas* and *agnis* by giving them strength. Therefore, with appropriate types of fuel in the form of food and drinks, the condition of *jatharagni* should be suitably maintained, because the life and the strength of an individual are dependent upon it. The *prasama* or *prakopa* of *dosa*, *dhatu*, and *mala* are dependent on the status of *Agni*. So, one should be aware to maintain its *jatharagni* in its normal status. Though there are innumerable number of diseases that may afflict the man, but a good physician is clever to maintain & preserve the efficiency of *jatharagni*, he can save the life of the patient¹².

The digestion of food is possible only when it comes in contact with *pachakapitta* in *annavahasrotas*. Entry of food into *annavahasrotas* is facilitated by *pranavata* and *samanavata*. *Annapravesanakriya* is by *pranavata*. After the food enters the *annanadi*, the further movement of the food is taken over by the *samanavata*. In *koshta*, it will be subjected to *sanghatabhedana* by *dravatva* and *snigdhatva* of *kledaka kapha* which is present in *amasaya*. This makes food soft and mucillagenous. *Jatharagni* is activated by *samanavayu* and digests the food which is taken in proper *matra* and in proper manner observing all the *aharavidhivivesayatanas* and *aharavidhividhana*, in order to increase the longevity of life. All this process can be compared with

that of the preparation of rice in a vessel kept on a stove with fire under the vessel. Agni located in the *amasaya* helps in digestion of the food and produces the *saara* and *kitta bhaga*. *Saara bhaga* is the useful part or *prasada* part. Clear transparent liquid portion of *kitta bhaga* becomes *mutra* and solid portion becomes *sakrt*.

Bhootagni:

The five *bhootagni*'s are –*parthiva*, *apya*, *thaijasa*, *vayavya* and *akaseeya*. It is impossible to locate the *panchabhautikagni* at a particular site. *Jatharagni* is also version of *panchabhutagni*. *Acarya Cakrapani* says that the *dhatvagnis* are also one of the forms of *bhootagnis* and only due to their specific locations, they are identified as *dhatvagni*.

The animated organism is composed of five *mahabhutas* and the food of a living organic being necessarily have the same qualities. Therefore, the food which is meant to nourish the body i.e. the *dhatu*s is definitely *vijatiya*- heterologous in nature and requires to be transformed into *sajatiya*. The food after the digestion by *antheragni*, again dealt with the digestion by *bhootagnis*. Then, each one of its primary principle proceeds to augment its homologue in the human body. The full significance of this concept can be appreciated better by taking *Chakrapanidattas* opinion that, the basic structural factors of the body, such as the *rasadi dhatus*, unceasingly undergo destruction by their own *Agnis* and these are always being reformed by the four kinds of ingested food.

Dhatvagni:

Dhatvagni is the derivative of *jatharagni* situated in each *dhatu*¹³. *Dhatu*s are basic body tissues which bear the body to exist steadily. *Dhatvagni* are seven in number corresponding to the seven *dhatu*s. 1. *Rasagni* 2. *Raktagni* 3. *Mamsagni* 4. *Medogni* 5. *Asthyagni* 6. *Majjagni* 7. *Sukragni*. There are several opinions about the site of *dhatvagni*. Moieties or aspects of *kayagni* which are located in its own place is termed as *dhatvagnis*. One of the legendary of Ayurveda *Pandit haridatta sastri* opined that the sthana of *dhatvagni* is in their respective *srotases*. He had given the support of *Acarya Caraka's* opinion that *srotases* carry the *dhatu*s undergoing transformation to their destination¹⁴. After *bhootagnipaka ahara rasa* needs some further processing till it takes the status of a particular *dhatu*, the agency responsible for this *rasasmapaka* is *dhatvagni*. *Ahara posakamsas* circulating in *ahara rasa* are subjected to the *dhatvagnipaka* and the end products of such *dhatvagnipaka* are divided into two parts; *prasada* and *kitta* parts. The *prasada* fraction is then transported by *rasa* and *rakta* and made available to the *dhatu*s through their respective channels. The *prasada* fraction of the *dhatvagni vyapara* is divided into three parts. One part for the replenishment and growth of the concern *dhatu*. One part for the formation of *upadhatus* and one part for the nourishment of subsequent *dhatu*. The *kitta* fraction contributes to the formation of various kinds of excrements and in part to the nourishment and synthesis of such structures of the body as hair, nails etc¹⁵.

DISCUSSION:

Jatharagni is the main element responsible for the digestion in GIT. *Bhootagnis* are concerned with the separation of minute fraction of *panchabhautik* consistency, it may be taking place in small intestine or liver or tissue level. *Dhatvagni* can be compared with the enzymes involved in tissue metabolism. As the consumed food is *panchabhautika*, it has to undergo transformation by the respective *bhootagni*'s. Then only it become easy for digestion and tissue metabolism by *dhatvagnis*. Then processed metabolic products circulate inside the *srotas* continuously by the help of *vata dosha*. Each *dhatvagni* has got a speciality to synthesize and transform the constituents suitable to its particular *dhatu*. This action is a sort of selective action. This favors the development, strength, complexion and happiness as well as growth of tissues. *Dhatu*s remain in their normalcy after receiving respective nutrients from metabolized food substances.

All the GI enzymes and GI hormones can be correlated with *Jatharagni*. Digestive enzymes in mouth include salivary amylase, maltase and lingual lipase. Digestive enzymes in Stomach include pepsin, gastric lipase, gastric amylase, gelatinase and urase. Digestive enzymes in pancreas include trypsin, chymotrypsin, carboxypeptidase, nuclease, elastase, collagenase, pancreatic lipase, cholesterol ester hydrolase, phospholipase A, phospholipase B, colipase, bile salt-activated lipase and pancreatic amylase. Succus entericus include peptidases, sucrase, maltase, lactase, dextrinase,

trehalase and intestinal lipase. GI hormones include gastrin, renin, secretin, cholecystokinin GIP, VIP, somatostatin, pancreatic polypeptide, peptide YY etc. All these GI enzymes and GI hormones and bile produced from hepatocytes can be considered as *jatharagni*.

Digestion and metabolism that take place in *adho amasaya* or metabolism takes place in liver or the whole metabolism that takes place in each and every cell of our body can be consider under *bhootagni vyapara*.

We can compare *Rasa dhatvagni* as enzymes involved in glucose metabolism. *Rakta dhatvagni* can be considered as enzymes and hormones involved in the formation of RBC and platelets, iron metabolism, protein metabolism (hemoglobin contain protein part). *Mamsa dhatvagni* can be consider as the enzymes involved in protein metabolism. *Medo dhatvagni* can be consider as the enzymes involved in lipid metabolism. *Asthi dhatvagni* can be consider as the enzymes involved in calcium and phosphate metabolism *Majja dhatvagni* can be consider as the enzymes involved in hemopoietic activity and in proper maintenance of bone marrow. *Sukra dhatvagni* can be consider as the enzymes involved in glucose metabolism and the enzymes and hormones involved in the proper functioning of male and female reproductive functions.

Various enzymes involved in Glycolysis, Emden-Meyer-Hof pathway include glucokinase or hexokinase, phosphofructokinase, phosphotriose isomerase, phosphoglycerate kinase, phosphoglycerate mutase, enolase etc. In anaerobic glycolysis lactate dehydrogenase or lactic acid dehydrogenase is involved. Enzymes involved in Tricarboxylic acid cycle or krebs cycle involved pyruvate dehydrogenase, carboxylase, citrate synthase, isocitrate dehydrogenase, succinyl thiokinase, succinic dehydrogenase, fumarase, malate dehydrogenase etc. Adrenalin and glucagone hormones activate glycogenolysis and inhibit glycogenesis. Glucagon inhibit gluconeogenesis and cortisol increase gluconeogenesis. Insulin increases uptake of glucose in skeletal muscles, cardiac muscles, adipose tissue etc. All these involved in glucose metabolism can be consider as *rasa dhatvagni*.

The rate of production of erythrocyte is controlled by the hormone erythropoietin. Intrinsic factor of castle is produced in gastric mucosa by the parietal cells of the gastric glands, essential for the absorption of vitamin B12 from intestine. Vitamin B12 is the maturation factor necessary for erythropoiesis. Aminolevulinic acid synthase, ALA dehydratase, Decarboxylase involved in hemoglobin synthesize. All these enzymes and hormones can be consider under *rakthadhatvagni*.

ALT, AST and Glutamate dehydrogenase explained under protein metabolism can be compared to '*dhatvagni*' explained in Ayurveda. After nonessential amino-acids are made from α -ketoacid precursors, with the help of transaminase enzymes. The catabolism of amino acids i.e. transamination and deamination reaction is also catalyzed by transaminase enzymes and glutamate dehydrogenase. Urea formed as a by-product can be considered as *kitta* and the carbon skeleton obtained which further enter in Krebs cycle can be considered as the *poshakmsa* which helps to nourish *uttaradhatus*. The hormones glucagon, gluco corticoids and adrenaline are all increased in catabolic states and may work in concert to increase protein breakdown in muscle tissue and to increase aminoacid uptake in liver for testosteronegenesis. Growth hormone, insulin like growth factors and testosterone helps in protein anabolism. All these enzymes and hormones can be consider under *mamsadhawagni*.

Key enzymes that involved in regulation of lipid metabolism are carnitine palmitoltransferase 1, acetyl –coA carboxylase, fatty acid synthase, and 3 hydroxy-3 methyl –glutaryl coenzyme A reductase. Carnitine palmitoyltransferase 1 transfers fatty acid into the mitochondria for oxidation. The hormones leptin, insulin, oestrogens, androgens and growth hormone influence our appetite, metabolism and body fat distribution. All these enzymes and hormones can be consider under *medodhatvagni*.

Recent reviews determined that serum levels of the osteoblast enzyme bone alkaline phosphatase (Balp), the osteoblast-secreted hormone osteocalcin (OC), and the by-product of collagen synthesis procollagen type 1 N-terminal propeptide (PINP) are commonly measured as sensitive and specific markers of bone formation. Parathyroid hormone, calcitriol also play role in bone metabolism. All these enzymes and hormones can be consider under *asthidhatvagni*.

Bone marrow acid and alkaline phosphatase can be consider under *majjadhatwagni*. Erythropoietin is essential to the production of red blood cells because it is required for survival, proliferation and differentiation of erythroid progenitor cells in the bone marrow.

Three signaling enzymes PP1Y2, GSK3 and PP2B along with the documented PKA (protein kinase) have key role in sperm maturation. FSH and testosterone are the main hormonal regulator of spermatogenesis. The enzyme prostaglandin play role in menstrual cycle. The menstrual cycle is regulated by the complex interaction of hormones: luteinizing hormones, follicle stimulating hormone, and the female sex hormones estrogen and progesterone. All these enzymes and hormones can be consider under *shukra dhatwagni*.

CONCLUSION:

In whom, the *dosas*, *Agni*, *dhatu*s, *malas*, and their activities are normal; his soul, sense organs and mind are calm, is called *swastha*. In living - organisms *Agni* maintain the structural and functional integrity by performing *pakaadikarmas*. Everything in the universe is made up of five fundamental elements. In this *panchabautika sarira* various digestive and metabolic transformation are going on constantly. *Agni* is the root cause of all these transformation. Whole metabolism in our body can be consider under the concept of *Agni*.

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