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CONCEPTUAL ANALYSIS ON METABOLIC ENERGY AND MITOCHONDRIA WSR TO AGNI

Dr. Mahantswami Hiremath[1]* and Dr. Ashwini I. Honagannavar[2]

[1]Assistant Professor, Department of Kriya Sharira Shri C. B. Guttal Ayurvedic College, Dharwad.

[2]Assistant Professor, Department of Kriya Sharira, Shri DGM Ayurvedic Medical College, PG, PhD, Research Center and Hospital, Gadag.

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***Corresponding Author**
Dr. Mahantswami Hiremath
Assistant Professor,
Department of Kriya Sharira
Shri C. B. Guttal Ayurvedic College, Dharwad.

ABSTRACT

Agni is a crucial factor in life. Agni has been meant to be sign of healthy life in the body. Diminution of agni is life-threatening. Normal functioning of agni leads to longevity.[1] Sustenance of life, complexion, strength, health, nourishment, luster, ojas, teja (energy) and prana (life energy) depend on the status of agni in the body. The quantity of diet is decided by agni. The digestion of food, metabolism, transformation, and nutrition of tissues depend on status of agni. It is an important factor for the assessment of health and disease. State of equilibrium of agni is an important component of health. All diseases are caused due to impaired agni. Proper metabolism is key to good health. Agni is the energy that drives all metabolic processes.[2] Selection of medicine, route and time of administration is decided based on agni of the individual. The preparatory procedures of panchakarma like oleation therapy (snehana), dose of unctuous medicine, purification protocol and its follow up measures are subjected to assessment of agni. The acceptance of macro and micronutrients in the body depends on the status of agni. It is a crucial factor for nutrition. Apart from gross digestion and metabolism, agni is responsible for bioenergetic and biochemical transformations in the body. Jatharagni especially converts heterogeneous component of food into homogenous and produces energy, which is essential for various vital function in the body.[3] The relation of agni with gut microbiome can be studied to explore new insights in medical treatments. This article

describes the concept of agni in Ayurveda texts and its applications in current medical science.

KEYWORDS: *Agni, Concept, Metabolism, Mitochondria.*

ETYMOLOGY

The word ‘agni’ is made of three words. Agni = A + G + Ni. The word “A” denotes root “I,” meaning “to go”; “G” denotes the root “Ajna,” meaning “to glitter” or root “daha,” meaning “to burn” and “Ni” means “to carry.” It denotes agni moves everywhere and metamorphoses substances, burns, assimilates, glitters, and grows.[4]

SYNONYMS

Vanhi, pawaka, anala, vaishvanara, tejasa, shikhi.

The following synonyms specifically indicate Jatharagni in the body.

1) Vaishwanara: It is helpful in digestion of different types of food like eatable (ashita), drinkable (peeta), lickable (leedha), masticable (khadita) etc.

2) Sarvapaka: It states that the agni converts the heterogeneous form of heavy or light food component into homogeneous form.

3) Tanoonpata: This synonym is like the function of vitality or life. Where there is agni, there is life. [Cha.Sa.Chikitsa Sthana 15/5].

4) Amivachantana: It is responsible for prevention and cure of the disease or ama that is causative factor of all the types of diseases.

5) Damunas: It is the factor which is responsible for maintenance of healthy life.

6) Shuchi: It is considered as the purest form or purest entity. In context of digestion it might be considered as equilibrium form of digestive capacity (jatharagni), i.e. samagni. Various synonyms like kaya agni [A.Hr.Sutra Sthana 11/34], antaragni [Cha. Sa. Sutra Sthana 28/3], udarastha agni, pachakagni [Su.Sa. Sutra Sthana 21], Jatharanala [A.Hr.Sutra Sthana 13], Paktru [Cha. Sa. Chikitsa Sthana 15] used to describe the jatharagni. It can also be compared with the 'audarya' type of 'teja' [Tarkasangraha].

Physiological entities resembling and comprising of jatharagni.

1) Pachaka Pitta (Pitta responsible for digestion).

2) Shareeroshma (Body heat).

3) Teja mahabhuta.

4) Digestive enzymes (salivary amylase, lipase, proteases, peptides), gastric juices (hydrochloric acid, peptic acid), Hormones (ghrelin, insulin, cortisol).[3]

13 Types of Agni

In Ayurveda, there are 13 types of Agni, classified into the following three large groups.

1. Jatharagni

Jatharagni is the main digestive fire located in the stomach and small intestine. It is responsible for the digestion of food. There are four variations in this digestive fire.

Vishamagni

This digestive fire is produced from excessive Vata and leads to indigestion, irregular appetite, gases, anxieties, and neurological problems.

Tikshagni

This intense digestive fire results from the excess of Pitta. It can cause acidity problems, heartburn, and skin alterations.

Mandagni

This slow digestive fire causes obesity, mucus, and allergies. It results from the excess of Kapha.

Samagni

This digestive fire indicates that all doshas are in balance. It allows the optimal absorption of essential nutrients and the necessary elimination of waste and toxins.

2. Bhutagni

In Ayurveda, this digestive fire is located in the liver and is associated with the five core elements found in every food. It stimulates the molecular metabolism and ensures adequate absorption of nutrients from the food you consume.

Each of the five elements has its own digestive fire.

- Parthiva (Earth)
- Apya (Water)
- Tejas (Agni)
- Vayavya (Vayu)

- Nabhasa (Akash)

3. Dhatu Agni

Dhatu Agni is the digestive fire of the seven tissues (plasma, lymph, blood, muscle, fat, bone, bone marrow, and reproductive tissue). According to Ayurvedic experts, each of the tissues has its own fire responsible for converting and obtaining the necessary nutrients.

The following are the seven digestive fires in this group.

- Rasa Agni
- Rakta Agni
- Mamsa Agni
- Meda Agni
- Asthi Agni
- Majja Agni
- Shukra Agni

SIMILARITIES BETWEEN AGNI AND PITTA DOSHA

1. Both of these perform similar functions of dahana, pachana, abhipravartana (digestion, assimilation and transformation) of food.
2. Both of these, when diminished state, can be ignited using the dravya of similar attributes like hot (ushna), sharp (teekshana), liquid (drava) etc.
3. Both of these in increased state (vriddha avastha) respond to cold measures (sheeta kriya).
4. Heat (ushma) is considered as the function of normal pitta in the body. [Cha.Sa. Sutra Sthana 18/50].

DISCUSSION

METABOLISM ACCORDING TO MODERN

Based on the intensity of action, agni is further classified in to four categories as below.

1. High intensity or quick digestion (tikshna): It can tolerate all types of irregularities in the diet. It is seen in pitta dosha dominant constitution.
2. Low intensity or slow digestion (manda): It cannot tolerate even slight irregularities. It is seen in kapha dosha dominant constitution. 9/25/22, 5:24 PM Agni https://www.carakasamhitaonline.com/index.php?title=Agni 7/20.
3. Normal intensity or normal digestion (sama): It is average intensity and maintains equilibrium. It is seen in an individual with a balanced dosha constitution.

4. Irregular intensity or unpredictable digestion (vishama): It is an unpredictable form that sometimes can or cannot tolerate irregularities. It is seen in vata dosha dominant constitution. The intensity of digestion is assessed on the basis of time taken for digestion of food. Normal digestion (samagni) needs 12 hours (4 yama) for complete digestion of food, and 6 hours (2 yama) for proper digestion of medicine. [A.S. Sutra Sthana 11/53] The time taken for complete digestion suggests the digestive pattern of that individual. Accordingly, four types of 'digestive patterns' are observed in clinical practice.[4] In ayurvedic practice, the treatment protocol aims towards maintaining the equilibrium status of agni through diet, lifestyle and medicine. The exact relation of these digestive patterns with phenotypic variations, epigenetic pathways and intestinal microbial flora needs more research to understand precisely. Location The jatharagni is located in the the gastrointestinal tract (koshtha).

MITOCHODRIA VS AGNI

The process of converting food and oxygen into energy requires hundreds of chemical reactions, and each chemical reaction must run almost perfectly to have a continuous supply of energy. When one or more components of these chemical reactions do not run perfectly, there is an energy crisis, and the cells cannot function normally. As a result, the incompletely burned food might accumulate as toxin inside the body. This is called Auto-toxin. In Ayurveda, this is called as Ama Dosha. These auto-toxins can stop other chemical reactions that are important for the cells to survive, making the energy crisis even worse. In addition, these auto-toxins can act as free radicals (reactive substances that readily form harmful compounds with other molecules) that can damage the mitochondria over time, causing mitochondrial disorders. Mitochondrial diseases might affect functions of the brain, nerves (including the nerves to the stomach and intestines), muscles, kidneys, heart, liver, eyes, ears, or pancreas. Depending on how severe the mitochondrial disorder is, the illness can range in severity from mild to fatal. Mitochondrial disease is diagnosed by evaluating the family history, performing a physical and neurological examination. Other tests may be needed such as Magnetic resonance imaging etc. The physiological importance of mitochondria has been widely appreciated for a long time, as disorders of the mitochondrial respiratory chain are associated with a number of major diseases, and dysfunctional mitochondria have been linked to health problems ranging from cancer to neurodegeneration and type 2 diabetes mellitus (T2DM). Progress over the past few years has produced new insights that advance our understanding of the mitochondrial function in metabolism and the metabolic syndrome, and new ideas have emerged for strategies to develop therapeutic approaches.

This special issue of *Trends in Endocrinology and Metabolism* is a collection of articles dedicated to the mitochondrion and focuses on some of the most recent advances related to metabolic diseases. *Harper et al.* eloquently review the transformation of cellular redox potential into ATP synthetic capacity, and discusse the regulation of mitochondrial reactive oxygen species (ROS) production by the uncoupling proteins (UCPs). UCPs cause proton leaks resulting in poor fuel conversion efficiency, and some UCPs control ROS production from the mitochondrial respiratory chain. ROS may trigger cell signaling, but at excessive levels it might also contribute to mitochondrial dysfunction and disease development. This observation highlights the profound physiological effects UPCs have on mitochondria, as they acutely modulate mitochondrial ROS emission to maintain optimal function in a normal cell. *Murphy et al.* expand on the topic of redox potential and explain how a transient elevation in ROS production has positive effects. Under conditions of excess nutrient supply and low ATP demand, increased ROS act as a feedback signal to slow substrate oxidation and to divert carbohydrates to storage as fat, helping to decrease overall ROS production and facilitate more efficient energy usage. However, a combination of excess nutrition and physical inactivity, an underlying driver for the metabolic syndrome, chronically overactivates these redox signaling pathways and may contribute to pathology. This mechanistic link raises the possibility that pharmacological approaches to target ROS production in mitochondria could have therapeutic benefit.

An essential molecule in mitochondrial function is nicotinamide adenine dinucleotide (NAD). The next article by *Imai et al.* highlights the importance of preserving an optimal pool of mitochondrial NAD, a co-factor consumed by key cellular mediators such as the sirtuins and poly-ADP-ribose polymerases (PARPs). Not only is the maintenance of an optimal NAD/NADH ratio essential for mitochondrial function, but so is a balance between NAD production and consumption. This physiological juggling act involves biosynthetic, transport, and catabolic enzymes and is responsive to nutritional and environmental stimuli including diet and aging. Its physiological importance suggests that there may be options for nutriceutical-based interventions focused on NAD intermediates that could improve human health. The NAD-dependent protein deacetylases Sirtuins are molecular sensors of cellular energy balance and have been implicated in regulating metabolism, stress responses, and aging. *Verdin et al.* offer us excellent insights into the functions of the three mitochondrial sirtuins by taking us through their distinct deacylase activities in response to acetylation, malonylation, or succinylation of proteins. They propose a conceptual model in which

changes in energy homeostasis or nutrient availability lead to changes in the levels of metabolites including acyl-coAs. Acyl-coAs influence mitochondrial function by catalyzing the acylation of metabolic enzymes thus potentially changing their function, and mitochondrial sirtuins act to remove these groups from mitochondrial proteins. This balance of forces might ultimately coordinate the network of metabolic fluxes in response to dynamic changes in the metabolic state. Another key function is mitochondrial biogenesis. *Kelly et al.* dissect the transcriptional circuitry, both nuclear and mitochondrial, that controls mitochondrial biogenesis and provide unique and current insights into the regulation of these genes with emphasis on the role of key signal transduction pathways. At the core of the discussion is the peroxisome proliferator-activated receptor gamma coactivator-1 (PGC-1) family of proteins. These transcriptional co-activators, when activated by AMPK or the sirtuin SIRT1, co-activate transcription factors involved in respiratory gene expression, which in turn enhance mitochondrial biogenesis and oxidative function and increase functional mitochondrial capacity. Developing strategies to modulate this pathway represents yet another angle for potential therapeutic intervention.

Mitochondria are present in all cell types except erythrocytes, and have cell-specific functions as well as general roles. An emerging and very interesting topic is the role of mitochondria in white adipose tissue (WAT). Although the importance of mitochondria in brown adipose tissue homeostasis has been discussed extensively, our understanding of the relevance of mitochondria in WAT homeostasis is still relatively limited. *Scherer et al.* skillfully tackle this topic and discuss how mitochondria might play a crucial role in WAT homeostasis and systemic insulin sensitivity, through their ability to influence key biochemical processes central to the adipocyte, such as fatty acid esterification and lipogenesis. The potential regulatory role of WAT mitochondria on whole body physiology suggests that therapeutic interventions, such as ones that increase WAT mitochondrial biogenesis, could positively impact systemic metabolism.

Similar point of view, the lower part of the stomach and duodenum (grahani) is the main site where the initial digestive process occurs. [Cha.Sa. Chikitsa Sthana 15/56-57], [Su.Sa.Sutra Sthana 21/10], [A.Hr.Sharira Sthana 3/50] Pittadhara kala (a layer responsible for pitta dosha) is responsible for the digestion of the gross components of the food in the body resembles the seat of jatharagni. [Su.Sa. Sharira Sthana 4/18-19]. Nabhi (umbilicus) is the site of flame (jyoti sthana) or specialized seat of the agni in the abdominal region. [Su.Sa. Sharira Sthana

4/57] Jatharagni has similar character with pittoshma, which is the eminent component for digestion and situated in solar circle (surya mandala) in umbilicus.[Bhela Samhita] The bhutagni mainly works in the liver and hepato-biliary system. Dhatvagni are located and work at their respective abodes of body tissues. Properties Agni possess similar properties like agni mahabhuta. These properties are as follows: Hot (ushna) Sharp (teekshna) Subtle (sukshma).

Ayurveda considers the whole organism instead of its respective units. All the systems are believed to be connected. The main source for maintaining these systems is the gut. If anything is happening in the gut, it'll send signals or waste products to the body tissues, resulting in abnormal changes.

According to Ayurveda, the human brain is large-sized bone marrow. As long as we eat healthily, the tissues in our body keep performing at optimal levels. In case there's an abnormality in the gut, the output raw material will not support the tissues but will be a hindrance and cause disease or deficiency.

The gut biome is a part of the Agni where the microorganisms boost our metabolism and food breakdown. They are supportive and enhance the process of Agni. Certain foods in Ayurveda meant for increasing the quality or taste will improve specific nutrition for these gut bacteria. This, in turn, will help keep the gut environment healthy so that the tissues are in good condition.

You must keep the ratio 1:9 in mind for promoting your gut health. For every cell, there are 9 microorganisms in our body. These organisms depend on your food and nutrition to survive unlike the popular belief that they consume waste. If the food is high-quality and is packed with nutrition, it will allow the microorganisms to exist in a symbiotic relationship rather than parasitic depending on your body type and season.

According to Ayurvedic principles, everything we need to eat for each season is provided by nature.

Ayurvedic experts believe that if you can grow your vegetables in your backyard, it will significantly promote your health by matching your Agni or metabolism to locally grown food. If you feel your rate of metabolism is low, you should consider eating food that tastes pungent, bitter, and astringent.[5-7]

In the spring season, nature produces an abundance of leafy greens, sprouts, cilantro, arugula, and dandelion.

A strong appetite in the winter season is coherent with sweet, salty, and sour tastes that feel heavy on the stomach. During summers, you need a Pitta-balancing diet of sweet foods. Coconut meat, raisins, cooked oatmeal, rice, and quinoa are all good options. You can eat salads for bitter taste, and for astringent taste, lentils and mung beans will do.

You should focus on different tastes to balance out your metabolic needs of the season. You may not realize this but the food you eat has a close connection with your mind. While you enjoy the taste with your tongue, you should eat mindfully. In Ayurveda, eating with a focused mind with no distractions is important.[8]

CONCLUSION

According to Ayurveda there is gut brain theory in context of agni and we can corelate each othere. if our gut is healthy than we can get good health and can solve the issue related to agni by improving gut health. Hence we can use Ayurveda in terms of healing our body.

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