

Principle of Digestion, Metabolism and Bioenergetics in Ayurveda

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Abstract

Energy transformation is matter of essentiality to sustain life on earth. Photochemical energy stored in chlorophyll of plant food and biochemical energy stored in animal food undergoes digestion and metabolism to yield energy currency in the form of ATP in the living body. 'Tridosha Theory' implies physiological interplay of mutually reciprocal mechanisms, viz., *vata*, *pitta* and *kapha*, to maintain homeostasis at cell, tissue, body and system level of the human body. According to Ayurveda, *pitta* is a factor which is responsible for digestion, metabolism, heat production and thus channelizing the flow of energy within the living body and between living system and its environment. This paper is an effort to comprehend physiological function of *pitta* in the living human body in an integrated manner to find out how digestion and metabolism, production and channelization of energy is performed according to two different schools of thought, viz., Ayurveda and Biomedicine.

Keywords: *Pitta*, *Agni*, Digestion, Metabolism, Physiology, Bioenergetics

Introduction

'Tridosha Theory' implies physiological interplay of mutually reciprocal mechanisms, viz., *vata*, *pitta* and *kapha*, to maintain homeostasis at cell, tissue, body and system level of human body. According to Ayurveda, *pitta* is a factor which is responsible for digestion, metabolism, heat production and thus channelizing the flow of energy within living body and, between living system and its environment. Energy transformation is matter of essentiality to sustain life on earth. Photochemical energy stored in chlorophyll of plant food and biochemical energy stored in animal food undergoes digestion and metabolism to yield energy currency in the form of ATP in the living body and thus maintain the phenomenon of energy flow in the living system.

Objectives

This paper is an effort to comprehend physiological function of *pitta* in the living human body in an integrated manner to find out how digestion and metabolism, production and channelization of energy in living body is performed according to two different schools of thought, viz., Ayurveda and Biomedicine.

Materials and Methods

All contents and references regarding *agni* and *pitta* are collected from *Brihatrayi*, *Laghutrayi*, textbooks of *Ayurveda Kriya Sharir* as well as modern physiology and relevant matter described on journals and websites. Physiological functions of *Pitta* described in ancient texts were reviewed and critically analysed with the matters described by modern physiology and on-going researches.

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Agni in Relation to Pitta

Ayurveda has its own conception regarding the interaction between human body and its environment, known as 'Lok-Purush Samya', according to which whatever interactions occur in the universe the same happens inside the body (*yatha loke tatha pinde*). Owing to this, theory of *Tridosha* is thought to represent functional aspects of *Soma*, *Surya* and *Anil* (the universe) inside the living body. Every entity of this universe is made of *Panchmahabhuta*. *Agni mahabhut* is represented as *Pitta* inside the body and has similarity in terms of performing *dahan* and *pachan karma*.

The origin of *pitta* is from "tapa" having three meanings, viz., *tap dahe* – meaning to burn, *tap santape* – meaning to heat, *tap aishwarye* – meaning to enable the eightfold achievement. *Pitta* is the factor, which modulates all the thermo-dynamic and chemo-dynamic activities in the body, in which function of *agni* is a part. *Agni* is represented by *pitta* in the body and produces good or bad effects depending upon digestion or indigestion, vision or loss of vision, normal or abnormal temperature, normal or abnormal complexion, valor and fear, anger and joy, confusion and clarity and other dual functions. On studying the properties of *pitta* and *agni*, their parallel features can be evaluated in *dahana* and *pachana karmas* both having predominance of *tejo mahabhuta*. On the other hand, *sushka* and *ruksha* nature of *agni* and *drava* and *snigdha guna* of *pitta* exhibit their variant features. Also *paka karma* is maintained by *agni* while in addition to *paka karma Pitta* also maintains the *dhi*, and *buddhi*. Thus, *agni* can be appraised to have similar function as that of *pitta* in aspect of digestion and metabolism. According to Acharya Susruta, there is no existence of *agni* in the body without *pitta*, it is due to properties of *ushna guna* of *pitta* leading to digestion and combustion in the body.

Types of Agni

Agni is categorized into different types in various classical Ayurveda texts. According to function and site of action *agni* is divided into three groups (13 types) – *Jatharagni* (1), *Bhutagni* (5), *Dhatwagni* (7).

Jatharagni

Jathara means gut or belly and *agni* (fire) denoting physiological components of digestion and metabolism taking place in stomach and intestine. Food ingested through mouth goes downwards to

kostha by means of *pranavata* where the food is disintegrated by fluids and softened by unctuous substances. *Jatharagni* situated below the *amasaya* in *grahani* is stimulated by *saman vayu* results into proper digestion of food which is taken in proper *matra* and proper manner, in order to increase the longevity of life. The strength of the *grahani* is from *agni* itself, when *agni* gets disturbed it also gets vitiated to produce diseases.

Bhutagni

Bhutagni are the five *agnis* related to *panchamahbhutas* or five basic elements of nature responsible for a physical being namely, *Parthiva* (earth), *Apya* (water), *Tejas (agni)*, *Vayavya* (vayu) and *Nabhasa* (akash). Acharya Charak has mentioned that the five *bhutagni* digest their own part of the element present in the food materials. After the digestion of food by the *bhutagni*, digested materials containing the elements and qualities similar to each *bhutas* nourish their own specific *bhoutika* elements of the body. So, according to modern physiological perspective, the action of *jatharagni* can be associated with the digestion in the stomach and duodenum, and the action of the *bhutagni* can be associated with the conversion of digested materials in the liver.

Dhatwagni

There are seven varieties of *dhatu* (tissue elements), which support and sustain the life of the body. These seven *dhatu* *rasa*, *rakta*, *mamsa*, *meda*, *asthi*, *majja* and *shukra* undergo metabolic transformation into two different ways i.e. *kitta* (excretory product) and *prasada* (nutrient portion). The *sapta dhatu* gets nourishment from the *ahara rasa*, i.e., the *ahara rasa* provide nourishment to *rakta* (blood), from *rakta* to *mamsa* (muscle tissue), from *mamsa* to *meda* (adipose tissue), from *meda* to *asthi* (connective tissue), from *asthi* to *majja* (bone marrow), from *majja* to *sukra* (semen) and from *sukra* to *ojas* (immunity). *Dhatvagnis* are seven (*rasagni*, *raktagni*, *mamsagni*, *medogni*, *asthyagni*, *majjagni*, *shukragni*) located in its own *dhatu* (tissues). Thus, after the *paka karma* the *ahara rasa* in the body is circulated to all the bodily tissues.

Physiological Function of Pitta

Ayurveda considers that *dehagni* is the prime cause of life, complexion, strength, health, nourishment, luster, *oja*, *teja* (energy) and *prana* (life energy).

Dehagni as cause of Ayu

According to Ayurveda, *ayu* (life span) is the continuity of vitality (*chetna*) or continuous interplay of essential component of *ayu*, i.e., *sharir*, *indriya*, *satva*, and *atma*. According to biomedicine, there are several theories to define life, viz., Darwinian Theory, cell-based theory of life, etc. Koshland, an experimental biochemist, gave the acronym 'PICERAS' to define life which stands for "program, improvisation, compartmentalization, energy, regeneration, adaptability, and seclusion." Carl Sagan proposed that life is a "self-sustaining chemical system capable of Darwinian evolution." Among the

many events that occur in the life of a cell are a multitude of specific chemical transformations, which provide the cell with usable energy and the molecules needed to form its structure and coordinate its activities. *Agni* in the form of *pitta* performs the function of digestion, metabolism and heat production and it is responsible for all the transformations of biomolecules at the cellular level, tissue level and at the level of body system. These transformations at various levels enable a living cell or body for programming set of required activities, improvise the cellular functions, channelize the cell or body energy to sustain 'Life', as indicated by ancient scholars (*pranah dehaagni hetuka*).

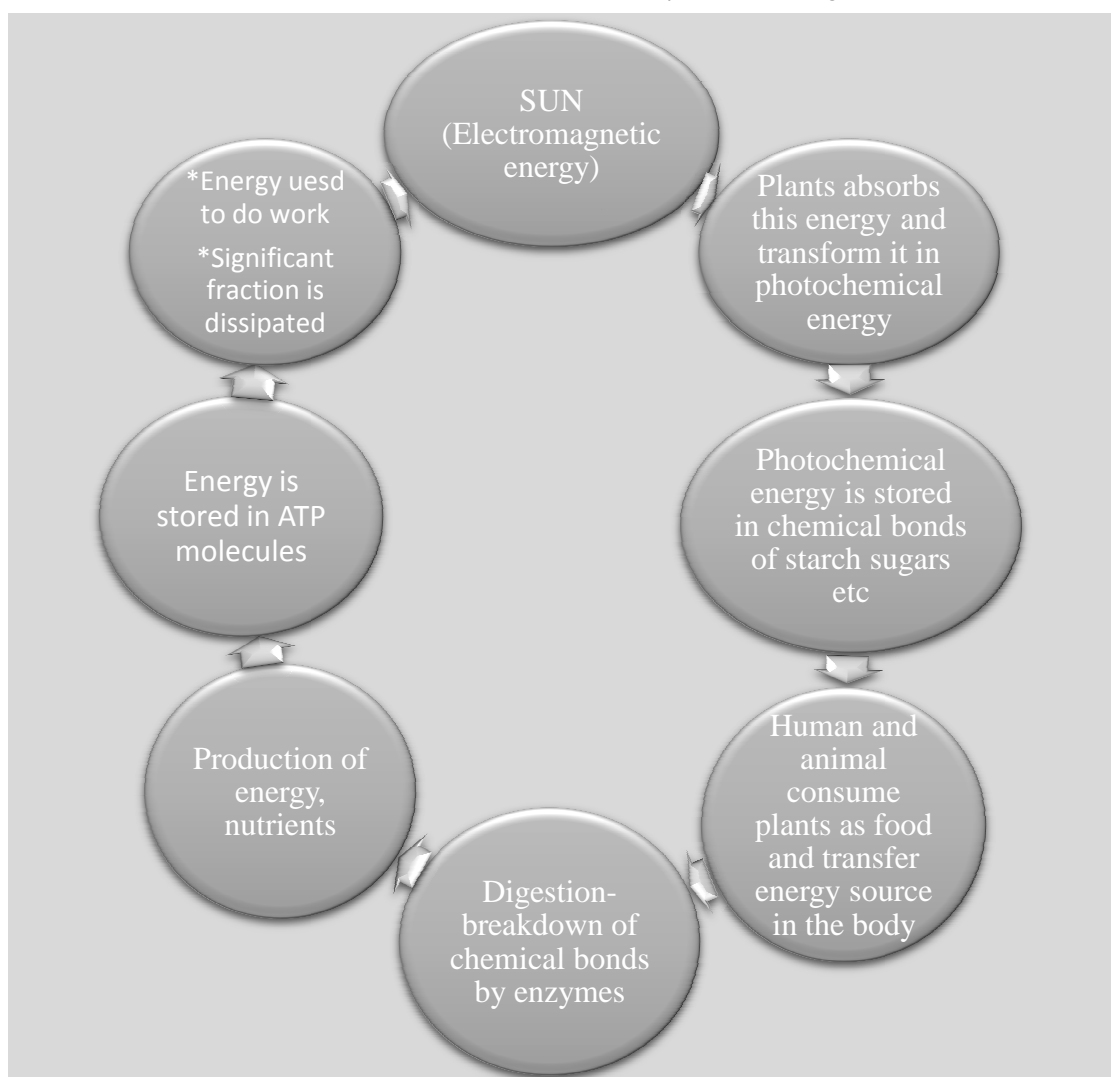


Figure 1. Flow of Energy between Living Body and Its Environment

Life and Energy System

An energy system can be understood as an interrelated network of energy sources, their transmission, distribution and storage. Every living cell follows law of thermodynamics which states that energy can be transformed from one form to another

but cannot be created or destroyed. In the living human body, this flow of energy is utmost thing to sustain life within and its interaction with its environment. In the long course of evolution, living cells have acquired ability to transform, biosynthesize, utilize and store the source of energy coming from their environment. The ability of this transformation is

owed to the phenomenon of digestion and metabolism in the living human body which plays a primary role in the maintenance and sustenance of life. According to Ayurveda, *pitta* is a factor which is responsible for digestion, metabolism, heat production and thus channelizing the flow of energy within living body and, between living system and its environment. That is why ancient scholars stated *dehaagni* (biofire) as one of prime cause of *prana* (life) – '*pranah cha dehaagni hetuka*'. Figure 1 depicts the above phenomenon in the living system.

Dehaagni as Cause of Nourishment

Nutrition is the science that interprets the interaction of nutrients and other substances in food in relation to maintenance, growth, reproduction, health and

disease of an organism. It includes food intake, absorption, assimilation, biosynthesis, catabolism and excretion. According to approach of ancient scholars regarding constructive metabolic function of *pitta*, owing its physiological attributes (*sa-sneham, ushna, teeshna, sara, katu*), perform digestion of different forms of food articles (*ashit, peet, leedh, khadit*) and transform it into '*ahara rasa*'. This *rasa* goes into circulation, further undergoes metabolism and gives nourishment and strength to whole body. The whole process of digestion and metabolism depends on proper qualitative and quantitative functioning of 13 types of *agni* residing in the body in the form of *pitta*, along with six *aahar parinaamkara bhava* and integrity of *maruta srota*. This whole phenomenon can be understood in Fig. 2.



Figure 2.Flow of Energy within the Human Body

The above scheme represents the process of digestion and metabolism described in ancient texts. Physiologically, food undergoes three stages of conversion in the GI tract. The first is a mucilaginous neutral stage (*madhurabhava*) under the influence of kapha. The second stage, due to the interference of pitta, is an acidic stage (*amlabhava*), and the final stage is a dry, pungent stage (*katubhava*) under the effect of vata. Actions of 13 types of *agni* make food able to be taken by *dhatu* and potentiate metabolism so that energy stored in food can be accessible to get energy for activities of cell level to system level.

Dehagni as Cause of Complexion

Ayurveda categorises each of the *doshas* into five types. This categorization along with their specific site and functions helps in identification of normal and abnormal status of each type of *dosha*. Type of *pitta* which resides in skin is named as *bhrajak pitta* which performs digestion and metabolism of locally applied oily substance, pastes etc., responsible for complexion and lustre of whole body and regulate thermogenesis. Regarding complexion *Chakrapaani* says normal and abnormal functional status of *bhrajaka pitta* produces *prakrita varna* (natural complexions described in ancient texts – *Krishna*, *Shyam*, *Shyamavadata*, *Avadata* and *vaikrita varna* (discoloration) respectively.

Modern science is performing extensive research on skin physiology and has found multiple facets of this largest organ of body. Skin displays highly active metabolism of PUFAs (polyunsaturated fatty acids). It has capacity to biosynthesize, metabolize and interchange varieties of lipids. In the follicular epidermis, pigment-producing melanocytes produce specialized lysosome related organelle (melanosome). Melanosomes synthesize melanin which gives color to hair, skin and other tissues. Each melanocyte interacts with keratinocytes to transfer melanosomes. Skin color and complexion is influenced by amount and type of melanin produced and transferred to keratinocytes. Heat is byproduct of metabolism. This heat is transferred from deeper organs and tissues to the skin and from skin, heat is lost through conduction, radiation, convection and evaporation. The skin, the subcutaneous tissues, and especially the fat of the subcutaneous tissues act together as a heat insulator for the body. The insulation beneath the skin is an effective means of maintaining normal internal core temperature. Above researches empower keen observation and approach of ancient scholars regarding *bhrajak pitta* which resides in the skin and

maintains skin physiology by virtue of its *alpa-snigdha* (slight oily) and *ushna* (hot) *guna*.

Dehaagni as Cause of Oja-Bala

Ancient texts describe *oja* as most refined *sara* (essence) of all the seven *dhatu*s. Proper functioning of seven types of *dhatvaagni* results in *sara* and *kitta* part. The most refined part of these *saras* is termed as *oja*. According to verse of *Susruta*, sustenance of life is owed to proper processing of food, resulting in production of *oja* and thus strength. Strength decides ability and efficiency to do work. *Chakrapaani* states that *bala* resists the chances of causing pathogenesis in the body and thus resists occurrence of disease. In other words, *bala* plays role in maintenance of health.

So from above analysis we can understand that *prakrita pitta* along with *vata* and *kapha dosha*, affect the body in a positive direction, performing its functions of energy transformation, biosynthesis, storage and thus sustenance and continuity of life.

Conflict of Interest: None

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