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The Conceptual Study Of Dhatu Poshana Nyaya In Relation To Transportation And Nourishment Of Cell

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ABSTRACT: -

Ayurveda is a medical science that has evolved over centuries of practical experience. Ayurvedic acharyas have recognized and documented various insights and theories through their perceptive understanding. The fundamental principles of Ayurveda must be articulated and validated in the context of contemporary knowledge. Among the three upasthambhas—ahara, nidra, and bramhacharya—ahara holds the utmost significance. Both physical and mental health are influenced by the type of ahara consumed and the metabolic transformation of ahara, as well as its absorption by different cells; this concept is referred to as dhatu-poshana nyaya in classical texts. The term Dhatus in Ayurveda pertains to the physiological aspects of essential nutritional and structural components of the body. Ahara Rasa serves as the foundation for nourishing the Dhatus, with Dhatu nutrients being sequentially nourished from Ahara Rasa to Shukra. Acharya employed Nyaya to elaborate on this concept. Dhatu Poshan Nyaya provides a comprehensive understanding of how Dhatus are formed and how the conversion of Ahara Rasa occurs within the Saptdhatus. Rakta Dhatu is crucial for longevity and survival in humans, and its formation is a continuous process that sustains life. To grasp tissue formation, it is vital to comprehend the Ayurvedic principles that elucidate the transformation of Ahara Rasa into Dhatus. Ahara must undergo digestion by Pachakagni, Dhatvagni, and Bhutagni. Each Dhatu nourishes itself and in turn nourishes another Dhatu. The theories of Dhatu Poshan Nyaya are interconnected, forming a sequential process where each step follows the previous one, akin to the gradual transformation of nutrients into body tissues (Dhatus) or the stepwise differentiation of stem cells into specialized cells. Modern science describes the formation of blood cells during the embryonic phase, involving mesenchymal cells followed by hematopoietic cells. Acharyas proposed theories regarding tissue nutrition and the conversion of tissue nutrients into bodily elements through Dhatu Poshan Nyaya, which includes Khseera Dadhi Nyaya (law of transformation), Kedari

Kulya Nyaya (law of transportation), Khale Kapot Nyaya (law of selectivity), and Ek Kala Dhatu Poshan Nyaya (simultaneous supply of nutrients to the entire body).

KEYWORDS: - Ayurveda, upasthambhas, dhatu-poshana Nyaya, Saptdhatus, Pachakagni.

INTRODUCTION: -

The fundamental principle of Ayurveda revolves around maintaining a balance among dosha, dhatu, and mala. These three elements are initially nourished by the potency of the individual Jatharagni, with productive nutrients (ahara rasa) being delivered to each level of dhatu (bodily tissues) for their nourishment. Ultimately, a single stream of nutrients is responsible for the formation and development of tissues. In Ayurveda, ahara holds the utmost significance among the three upasthambhas: ahara, nidra, and bramhacharya. The Acharyas have presented various concepts of dhatu poshana, such as kshira dadhi nyaya, kedari kulya nyaya, khale kapot nyaya, and ek-kal dhatu poshana nyaya, in different sections of classical texts according to necessity. Research has elucidated the concepts of passive and active transport. Passive transport refers to the movement of substances along concentration gradients or electrochemical gradients, or both. This process is also known as diffusion or downhill movement, akin to swimming with the current in a river. It encompasses simple diffusion and facilitated diffusion, with osmosis being a specific type of passive transport. Conversely, active transport involves the movement of substances against the electrochemical gradient, similar to swimming against the current in a river. This process is referred to as uphill transport and necessitates energy. Active transport is categorized into two types: primary active transport and secondary active transport. In Ayurveda, Acharya Sushruta articulated, "Dosha Dhatu Mala Moolam Hi Shariram," which translates to the human body being made up of Dosha (bioenergies that regulate bodily functions), Dhatu (structural elements), and Mala (waste products). These components are perpetually nourished by Ahara (food). The food undergoes processing by Jatharagni, which converts it into Ahara Rasa (nutritive essence) and Ahara Mala (waste products such as urine and stool). Subsequently, this Ahara Rasa is influenced by Dhatwagni, specifically Rasa Dhatwagni, which acts on Ahara Rasa and separates it into Sthoola Bhaga and Shukshma Bhaga. The Sthoola Bhaga provides nourishment to the Rasa Dhatu, while the Shukshma Bhaga is further divided into Rakta Nirmana Ansh (which nourishes Rakta Dhatu), Updhatu (Stanya and Artava), and Mala (Kapha), among others. Nutritional support for tissues and their differentiation changes throughout various life stages. In the early intrauterine phase (prior to the 8th week of gestation), the embryo relies on histotrophic nutrition. As the demand for oxygen increases in the fetus, the nutrition transitions to haemotrophic, aided by maternal-placental circulation. Following birth, oral nutrition commences, allowing nutrients to be sourced from food consumption. Likewise, tissue differentiation adheres to a defined pattern throughout an individual's life.

MATERIAL AND METHODS: -

Ksheera Dadhi Nyaya: -

Kshira (milk) and dadhi (curd) are distinct entities. Curd is produced from milk through a complete transformation. This concept illustrates the change of specific tissues into subsequent tissues. According to this principle, just as milk changes into curd, the rasa dhatu similarly transforms into rakta dhatu. Likewise, mamsa, meda, asthi, majja, and sukra are generated through progressive stages of transformation, with sukra playing a crucial role in facilitating pregnancy (garbha). This phenomenon is also referred to as karma parinama paksha.

The sequential transformation of various substances reinforces this nyaya. In this context, acharyas have elaborated on the conversion of one substance into another. Various biochemical transformation processes, such as the glycolysis pathway (Glucose → 2 molecules of pyruvate), the Krebs cycle (Pyruvate + aceto–Co-A → Oxaloacetic acid), the gluconeogenesis pathway (Phosphoenolpyruvate → Pyruvate and then Glucose-6-phosphate ultimately leading to Glucose), and the urea cycle (where alpha amino acids and

keto amino acids undergo transamination and oxidative deamination to produce urea), all support this nyaya, demonstrating that one substance transforms into another.

In accordance with this principle, just as milk is sequentially transformed into curd, curd into buttermilk, buttermilk into butter, butter into Ghrita (clarified butter), and finally, Ghrita into Ghritamanda, the Dhatus (bodily tissues) undergo a similar transformation. Rasa Dhatu (plasma) is entirely converted into Rakta Dhatu (blood), Rakta into Mamsa Dhatu (muscle), and this process continues until Shukra Dhatu (reproductive tissue) is produced, which is essential for progeny. This principle highlights the gradual transformation of one Dhatu into the next. Furthermore, it is known as Karma Parinama Paksha Nyaya, as each preceding Dhatu is completely transformed into the subsequent one through a continuous metabolic process. According to Acharya Charak, the Dhatu Nirmana Kala from the initial Rasa Dhatu to the final Shukra Dhatu is 7 days, while Acharya Sushruta states it is 30 days.

Kedari Kulya Nyaya: -

Water is delivered to the fields via canals. As the water travels through the canal, it first arrives at the closest field. After meeting the irrigation requirements of that field, the surplus water proceeds to the subsequent field, and this cycle continues in order. Likewise, this concept (Nyaya) exemplifies the sequential nourishment and the time needed for the replenishment of the seven Dhatus. The nourishing liquid, referred to as Ahara Rasa, primarily nourishes Rasa Dhatu. Vital nutrients for its growth are taken in by the Rasavaha Srotas, where Rasa-Dhatawagni processes them to create Rasa Dhatu. Once Rasa Dhatu is restored, it then provides nourishment to the next Dhatu in the series. This cycle persists until Shukra Dhatu is nourished, thereby completing the entire transformation process within seven days.

Kedari (also known as kyari) refers to a field, specifically a paddy field, while kulya in this context signifies a small canal. This technique is employed in irrigation, where water from a reservoir is directed to small fields (kedari) via canals. In kulya (canals), water flows in accordance with gravitational force. Initially, the water reaches the first section of the field (kedari), and subsequently, it moves to the second section through a pressure gradient process (once the first kedari is filled, water then transfers to the next kedari). This illustrates the passive diffusion of particles across a cell membrane. The theory suggests that dhatus are nourished through a transmission or transportation process. It likely highlights the significance of the pressure gradient, which influences fluid flow into tissue spaces. Furthermore, it elucidates the passive diffusion of particles across the cell membrane along the concentration gradient, as water in this scenario moves into various fields passively, following the concentration gradient. This theory may account for various forms of passive transport, including diffusion, facilitated diffusion, filtration, and osmosis.

Khale-Kapota Nyaya: -

This concept is illustrated through the analogy of Khale (field grains) and Kapota (pigeons). After the harvest, grains are stacked in the field, attracting pigeons from various locations that come to gather them before flying back to their nests. The duration of their return journey depends on the distance and direction they travel. This law elucidates how Ahara Rasa nourishes different dhatus via specific Srotasa. As Srotasa extend further, their diameter diminishes, which slows the nutrient flow and impacts the time required for nourishment distribution. Khale refers to the location where grains are stored after being harvested (grainary or bran), while Kapota signifies pigeons or represents birds. Just as pigeons approach a pile of grains to select what they need and then return to their homes, dhatus similarly extract their nutrition from the pool of rasa dhatu according to their requirements. The ahara rasa contains the nutrient components necessary for all the dhatus in the body, akin to how pigeons (kapotas) choose their grains. In this process, kapotas expend energy to meet their needs. Likewise, any biological process necessitates energy (active transport) to sustain the homeostasis of our body. For example, primary active transport includes

mechanisms like the sodium-potassium pump, calcium pump, and proton pump, while secondary active transport encompasses antiport and symport, along with selective reabsorption, etc.

Ek Kala Dhatu Poshan Nyaya-

The theory posits that with the assistance of Vyan Vayu, Ahara Rasa uniformly nourishes all Dhatus at the same time. Arundutta has noted that the ahara rasa permeates into all the dhatu vaha srotas concurrently. This concept is referred to as eka dhatu poshana paksha. The ahara rasa circulates throughout the entire body continuously, facilitated by the normal functioning of vyana vayu. According to Acharya Charak, the formation of dhatu from ahara rasa is a cyclic and ongoing process. Rasa is distributed across the body by vyana vata, providing nourishment to all dhatus. The Ek kala dhatu poshana nyaya elucidates that dhatu receives nourishment simultaneously through various processes such as kshira dadhi nyaya, khale kapota nyaya, and kedari kulya nyaya.

Stem Cells: -

In a similar manner, each Sthayi Dhatu selectively takes in the essential nutrients from Ahara Rasa via its specific Dhatuvaha Srotas, thereby ensuring adequate nourishment. As per Acharya Sushruta, Rasa Dhatu functions as the carrier of nutrients to the stable Dhatus. It remains in each Dhatu for 3015 Kala (around five days) before progressing to the subsequent one. Consequently, the entire process of transformation and nourishment of all six Dhatus spans approximately one month. Dhatus are categorized into two types:

1. Asthayi (Poshaka) Dhatu - These are the unstable or circulating tissues, mainly Rasa and Rakta Dhatu.

2. Sthayi Dhatu (Stable Tissue) - This includes all other Dhatus, which are permanent and depend on nourishment from Poshaka Dhatu.Tissue Nutrition During Intra-Uterine Life: -

As stated in Acharya Charak, the Ahara Ras of the mother is divided into three segments: one segment nourishes the mother's body, another contributes to the formation of Stanya, and the last one nourishes the Garbha. During the process of organogenesis, the developing organs receive nourishment through the mechanisms of Upsneha and Upsveda. The Dhamanis (vessels) in the maternal body, which carry Rasa (nutrients), extend in all directions, both laterally and longitudinally, delivering nutrition via Upsneha. The commentator Indu explains that Upsneha and Upsveda correspond to Snighatva (unctuousness) and Utkleda (moistening), respectively. The unctuous elements found in amniotic fluid, such as lipids and glycogen, play a crucial role in the growth and development of the fetus, similar to the function of Sneha (unctuousness). On the other hand, the water and electrolyte content of amniotic fluid aligns with Upsveda, ensuring adequate nourishment and hydration for fetal development. Once organogenesis is finalized, nourishment is primarily supplied through perfusion, predominantly via the umbilical cord, although it can also occur through the hair. Acharya Sushruta mentions that the Garbha-Nabhi Nadi (fetal umbilical vessels) connects one end of the fetus's umbilicus to the placenta at the other end. The placenta is also connected to the mother's heart through the Rasavaha Nadi (blood vessels), which facilitates the exchange of nutrients. In accordance with modern science, the developing fetus initially receives nutrition from endometrial secretions or the yolk sac before the placenta is established. This nutritional phase is termed histotrophic, where the trophectoderm absorbs secretions from the oviduct and subsequently from the uterus, referred to as uterine milk.

Tissue Nutrition During Post-Natal Life: -

Immediately following birth, an infant obtains nourishment from Stanya (mother's milk), which is classified as an Upadhatu (secondary tissue product) of Rasa Dhatu. As the child develops, Ahara (solid food) transitions to become the main source of sustenance. The nutrients extracted from food, referred to as Ahara Rasa (nutrient pool), are in constant circulation, supporting the body. When these nutrients reach

different tissues via their specific Shrotas (channels), they are absorbed and metabolized by Dhatvagni, which transforms them into tissue components or employs them for cellular activities. During the processes of digestion and metabolism, the formation of Doshas occurs in two distinct stages:

1. Avasthapaka (stage of digestion) - The Doshas generated in this stage are known as Mala.

2. Vipaka (post-digestive transformation) - The Doshas produced in this phase can be regarded as Dhatu Roopi. This entire process guarantees ongoing nourishment, maintenance of tissues, and metabolic equilibrium within the body. The Mala Roopi Dosha Ahara Mala and Dhatu Mala are supported by the Kitta (metabolic waste products) segment of Ahara Rasa.

Every cell type in the body possesses a unique structure and function, originating from unspecialized precursor cells. These precursor cells are termed stem cells, often called "master cells" because of their capacity to differentiate into specialized cell types. Key Characteristics of Stem Cells: Stem cells are characterized by two essential features:

1. Self-Renewal - They can perpetually divide, generating identical stem cells to sustain the stem cell population.

2. Differentiation Potential - They have the ability to produce all cell types within the tissue from which they arise. For a cell to be classified as a stem cell, it must fulfill three primary criteria: Unlimited Division - It can replicate indefinitely, even after extended periods of dormancy. Renewal of the Stem Cell Pool - Upon division, each daughter cell can either persist as a stem cell or differentiate into a specialized cell, such as a muscle cell, red blood cell (RBC), or brain cell.

Tissue-Specific Differentiation - Under specific physiological or experimental conditions, stem cells can evolve into cells that are specific to certain tissues or organs. Classification of Stem Cell Potency: Stem cells are classified according to their differentiation potential:

1. Totipotent Stem Cells - Capable of developing into all cell types, including both embryonic and extra-embryonic tissues (e.g., a fertilized egg).

2. Pluripotent Stem Cells - Able to differentiate into any cell type and give rise to the three germ layers - ectoderm, endoderm, and mesoderm, but cannot produce extra-embryonic tissues like the placenta.

3. Multipotent Stem Cells - Can generate multiple cell types within a limited range of cell types based on the tissue of origin. They are not pluripotent as they have lost the ability to become cells of all three germ layers and are found in nearly all tissues. (e.g., Hematopoietic stem cells produce various types of blood cells. Mesenchymal stem cells give rise to fat, bone, muscle, and cartilage. Neural stem cells develop into neurons and oligodendrocytes.)

4. Oligopotent Stem Cells - Capable of differentiating into a limited number of closely related cell types, such as myeloid stem cells.

5. Unipotent Stem Cells - Able to generate only cells of their specific type while maintaining the ability for self-renewal (for example, muscle stem cells).

DISCUSSION: -

Dhatu Poshan Nyaya, which means tissue nutrition and differentiation, describes the creation and preservation of the seven Dhatus (body tissues) throughout an individual's life. Although the development of Dhatus starts during the embryonic phase (Garbha), their nourishment and maintenance persist throughout life. The differentiation of tissues in the developing fetus at various stages is influenced by the type of stem cells present. Application of Dhatu Poshan Nyaya in Stem Cell Differentiation-

Ksheera Dadhi Nyaya- This concept indicates that one type of cell can completely transform into another, akin to milk (Kshira) converting into curd (Dadhi). It represents total differentiation, where an initial cell type relinquishes its original structure to evolve into another specialized form. This can be likened to the differentiation process of pluripotent stem cells and extra embryonic (placental) stem cells. Although these cells are not immortal, they exhibit a significant division potential and sequentially differentiate into specific cell types, contributing to the formation of various tissues during embryogenesis and continuing to provide nourishment after birth. This theory implies the presence of a common parent cell for all bodily elements.

Kedari Kulya Nyaya - This principle can be likened to multipotent and oligopotent stem cells, which can differentiate into multiple, yet limited, cell types based on their location. For instance, hematopoietic stem cells (multipotent) can give rise to various blood cell lineages, such as myeloid stem cells and lymphoid stem cells (oligopotent). These, in turn, sequentially generate red blood cells (RBCs), white blood cells (WBCs), and platelets. This theory demonstrates how nutrients are selectively transported and utilized by specific tissues and their functional requirements.

Khale Kapot Nyaya - This principle corresponds with unipotent stem cells, which have the ability to differentiate into a single specific cell type while maintaining their self-renewal capabilities. Examples of such cells include epidermal stem cells (responsible for skin regeneration) and spermatogonial stem cells (which generate sperm). According to this Nyaya, each Dhatu independently receives nourishment from Ahara Rasa (the nutrient essence derived from food), thereby facilitating targeted tissue development. Furthermore, this principle indicates that Shukra Dhatu (reproductive tissue) is directly nourished by milk, owing to the presence of Shukra Poshak Amsha (the nutritional essence that supports Shukra), as per the Ayurvedic Guna Samanya-Vishesh Siddhanta (the principle of similarity and dissimilarity in nutrition).

Ek Kala Dhatu Poshan Nyaya - This concept is related to the distribution of all nutrients via the bloodstream, propelled by the heart. With each systolic contraction, nutrients are delivered to all tissues, providing simultaneous nourishment.

CONCLUSION: -

Various biochemical transformation processes, such as the Glycolysis Pathway and Kreb's cycle, support the kshira dhadhi nyaya. Any process that necessitates energy (Active Transport) to uphold the body's homeostasis aligns with the khale kapot nyaya. Passive transport mechanisms, including diffusion, facilitated diffusion, filtration, and osmosis, correspond to the kedari kulya nyaya. According to the ek-kala dhatu poshan nyaya, dhatus receive nourishment through all three processes—kshira dhadhi nyaya, khale kapot nyaya, and kedari kulya nyaya—simultaneously. Therefore, it can be concluded that the classical concept of nyaya is analogous to various physiological processes outlined in the metabolic transformations of food, indicating that classical principles remain relevant today. In Ayurveda, nyaya pertains to the principles that elucidate the processes of tissue nourishment and differentiation via multiple channels. No single nyaya can comprehensively account for this intricate process; rather, all nyayas must be integrated to grasp the sequential nourishment and transformation of dhatus. Tissue nutrition and differentiation is an ongoing process that commences immediately after conception and continues throughout life. Nonetheless, the stages of tissue differentiation differ across various developmental phases. With this understanding, Ayurveda offers a thorough explanation of tissue nourishment and

differentiation that closely parallels contemporary scientific concepts. During the initial stages of embryonic development, totipotent and pluripotent stem cells differentiate into the three germ layers: endoderm, mesoderm, and ectoderm. This transformation adheres to the Ksheera Dadhi Nyaya (Law of Complete Transformation), which indicates that one form entirely converts into another. In a similar vein, the Kedari Kulya Nyaya (Law of Transportation) illustrates the sequential flow of nutrients, akin to water traversing through canals. This can be likened to the actions of multipotent and oligopotent stem cells, which evolve into specific cell types while maintaining their self-renewal capabilities. Consequently, various types of stem cells play a role in the development of different structures within the body, embodying the Ayurvedic concepts of tissue nutrition and differentiation.

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