



CONCEPTUALIZATION OF HUMAN PHYSIOLOGY IN TERMS OF *KSHEERADADHI NYAYA*

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ABSTRACT

Many theories have been put forth by Ayurveda to explain the human body functions. *Ksheeradadhi Nyaya*, a theory to explain *Dhatu* formation has been explained based on the process of bio conversion of *Ksheera* (milk) to *Dadhi* (curd) and so on till the final product *Ghritha Manda* (clarified portion of ghee) is formed. This theory suggests that for an entity to get formed, it needs the complete transformation of a precursor. Likewise the precursor *Rasa Dhatu* transforms into another *Dhatu* ultimately forms *Shukra Dhatu*. Hence such theories are efficient to conceptualize Ayurveda's idea on functioning of human body. But a comprehensive study of Ayurveda and modern human physiology aids to discover the fact that such theories are not only valid in understanding Ayurveda but also helps in conceptualizing processes involved in human body as emphasized in modern science. Human physiology comprises some of basic to complex process involving conversion from one form to another form like gluconeogenesis, gene expression, embryogenesis, erythropoiesis and thrombopoiesis. A comprehensive study of these processes discloses that they operate as per the theory of *Ksheeradadhi Nyaya*. It gets clinical significance as it is able to describe how a defective progenitor can lead to formation of defective entity which can lead to failure of the process causing disease, an example of which is macrocytic anemia occurring due to defective erythropoiesis.

KEYWORDS: *Ksheeradadhi Nyaya*, *Dhatuposhana*, *Ayurveda*, *Physiology*, *Erythropoiesis*.

INTRODUCTION

Ayurveda has proposed numerous theories to explain the normal functioning that occur in the human body. *Dhatuposhana Nyaya* is one such theory set which describes the formation and nourishment of *Dhatu* (fundamental structural component). The set includes *Ksheeradadhi Nyaya* (theory of sequential transformation), *Kedari Kulya Nyaya* (theory of serial distribution) and *Khale Kapota Nyaya* (theory of selective uptake). *Ksheeradadhi Nyaya* elucidates the process of sequential transformation of *Dhatu* from *Ahara Rasa* (primary product of digestion) just as *Ksheera* (milk) is transformed into *Dadhi* (curd) and so on. *Rasa Dhatu* (primary circulating nutrient fluid) is transformed by *Rasadhatwagni* (metabolic factors located in primary circulating nutrient fluid) and completely gets converted into *Raktha Dhatu* (blood). *Raktha Dhatu* by the action of *Rakthadhatwagni* (metabolic factors located in blood) gets completely transformed into *Mamsa Dhatu* (muscle) and proceeds likewise with *Meda Dhatu* (fat), *Asthi Dhatu* (bone), *Majja Dhatu* (bone marrow) till the formation of *Shukra Dhatu* (reproductive fluids) which produces the *Garbha* (embryo)¹. The preceding *Dhatu* accounts for the formation and nourishment of the succeeding *Dhatu* by this process of sequential transformation. It is explained by the simile of bio transformation of *Ksheera* (milk) to *Dadhi* (curd), *Dadhi* to *Navaneeta* (butter), *Navaneeta* to *Ghritha* (ghee) and *Ghritha* to *Ghritha Manda*

(clarified portion of ghee). This is complete conversion of one entity to another. Hence it is given the name *Sarvatmana Parinama*² (total bio conversion law). The theory holds a significance in explaining the fact that a defective progenitor can lead to formation of a defective product as told in the pathogenesis of *Rajayakma* (consumption disorder complex) where obstruction in *Raktha Dhatu* causes waning of *Mamsa Dhatu*³. A critical analysis on this theory prescribes two postulates viz. firstly a precursor element gets transformed into completely new element and secondly the transformation is irreversible. The human physiology involves processes where sequential transformation occurs at level of biochemical, genes and cells. So an attempt is made to gather these processes involving irreversible sequential transformations occurring in the human body and expound them in the context of *Ksheera Dadhi Nyaya*.

AIMS AND OBJECTIVES

To comprehensively understand and conceptualize processes involved in human physiology under the context of *Ksheeradadhi Nyaya*

METHODOLOGY

Ayurveda compendium like *Charaka Samhitha* with its respective *Ayurveda Deepika* commentary and other text books related to *Kriya Shareera* and research articles with critical analysis



regarding *Dhatu Poshana Nyaya* were studied to understand *Ksheeradadhi Nyaya*. Physiology text books and modern physiology journals were scrutinized to gather the physiological processes in human body which involved sequential transformation and are irreversible. Then an effort is made to discuss, comprehensively understand and conceptualize such physiological processes in terms of *Ksheeradadhi Nyaya*.

DISCUSSION

Science reveals that multiple biochemical and other physical process are involved in the conversion of *Ksheera* (milk) to its bi-products. *Ksheera* undergoes fermentation initiating several biochemical changes to form *Dadhi* (curd). When *Dadhi* is churned it gets converted to *Navaneeta* (butter). Heating converts *Navaneeta* to *Ghrita* (ghee). When *Ghrita* is allowed for sedimentation it converts to *Ghrita Manda* (clarified portion of ghee). Although the precursor and new product formed differs in physical state and chemical composition but the precursor's role is essential in this process. Similarly as in the conversion of one *Dhatu* to another where the precursor holds the role to get transformed into the succeeding *Dhatu*. Human physiology comprises some of basic to complex process involving conversion from one form to another form which once occurred cannot be reversed. Thorough observations lead to examples for such process which include gluconeogenesis, gene expression, embryogenesis, erythropoiesis and thrombopoiesis which can be used to substantiate the postulate of *Ksheeradadhi Nyaya*.

Gluconeogenesis is the process that allows the body to form glucose from non-hexose precursors, particularly lactate, glycerol, pyruvate, propionate, and glucogenic amino acids.⁴ Lactate is converted to pyruvate during conditions like prolonged starvation. This pyruvate undergoes three irreversible reactions. First one is conversion of pyruvate to phosphoenol pyruvate leading to formation of fructose-1-6- biphosphate which undergoes second irreversible reaction to form fructose-6 phosphate. It gets converted to glucose-6-phosphate. The third irreversible reaction occurs where glucose-6-phosphate gets transformed into glucose. In this process of gluconeogenesis, the precursor compound like pyruvate gets transformed into its next form and it cannot be reversed. The series of reaction continues till glucose is obtained.

Gene expression is the process by which the information encoded in the gene is converted into functional gene product of

instruction that is used for protein synthesis.⁵ DNA gets converted to mRNA by the process of transcription. Later the mRNA directs for the synthesis of protein by the process of translation. Here the precursor DNA gets converted to mRNA which subsequently forms protein. Here the precursor DNA involves a series of irreversible transformation leading to synthesis of protein.

Human embryogenesis is a complicated process by which a fertilized egg develops into an embryo.⁶ Zygote which is formed from the fertilization of the male and female gametes gets converted into a blastomere. Blastomere converts to morula which forms the blastocyst after a series of irreversible mitotic divisions. The blastocyst finally transforms into embryo. Here initially zygote acts as progenitor for the succeeding stage. The process gets carried out in similar sequence until the formation of embryo.

Erythropoiesis is the process of origin, development and maturation of erythrocytes.⁷ The CFU-E cells undergo changes in stages to get transformed into matured RBC. Proerythroblast is first stage derived from CFU-E. Proerythroblasts get converted to early normoblasts which changes to intermediate normoblast and later to late normoblast stages. The Reticulocyte formed from late normoblast gets transformed into matured erythrocyte. From the stage of proerythroblast each stage becomes precursor for the next till the formation of matured RBC.

Formation or development of platelets is called thrombopoiesis. The pluripotent stem cell destined to form platelets is converted into colony forming units called Meg-CFU, which develop into platelets after passing through various stages.⁸ Megakaryoblast arises from Meg-CFU which gets converted into promegakaryocyte. Promegakaryocyte changes to megakaryocyte in the next stage. The pseudopodia of megakaryocyte cytoplasm get transformed into platelets. Every stage from megakaryoblast to platelets production serves as a precursor to the subsequent stage.

Ksheeradadhi Nyaya gives an assertion that in a particular process, each step acts as a prelude to the one after it. The previously outlined processes of gluconeogenesis, gene expression, embryogenesis, erythropoiesis and thrombopoiesis all operate on this similar concept. (Table1)



Table 1- Total Transformations Occurring in *Ksheeradadhi Nyaya* and other Physiological Processes

<i>Ksheeradadhi Nyaya</i>	<i>Ksheera</i> →	<i>Dadhi</i> →	<i>Navaneeta</i> →	<i>Ghrita</i> →	<i>Ghrita Manda</i>		
<i>Dhatuposhana</i>	<i>Rasa</i> →	<i>Raktha</i> →	<i>Mamsa</i> →	<i>Meda</i> →	<i>Asthi</i> →	<i>Majja</i> →	<i>Shukra</i>
Gluconeogenesis	Pyruvate →	Phosphor -enol pyruvate →	Fructose-1-6- biphosphate →	Fructose-6- phosphate →	Glucose-6- phosphate →	Glucose	
Gene expression	DNA →	mRNA →	Protein				
Embryogenesis	Zygote →	Blasto -mere →	Morula →	Blastocyst →	Embryo		
Erythropoiesis	Proerythro -blast →	Early Normo blast →	Intermediate Normoblast →	Late Normo -blast →	Reticulocyte →	Matured RBC	
Thrombopoiesis	Megakaryo -blast →	Promega karyocyte →	Megakaryo -cyte →	Platelets			

The clinical application of *Ksheeradadhi Nyaya*, that a deficient prelude results in formation of deficient product is also valid in case of these processes. Evidence to this fact is macrocytic anemia where erythropoiesis gets hampered due to deficiency of cyanocobalamin and folic acid. The erythroblastic cells of the bone marrow, in addition to failing to proliferate rapidly, produce mainly larger than normal red cells called macrocytes, and the cell itself has a flimsy membrane and is often irregular, large, and oval instead of the usual biconcave disc. These poorly formed cells, after entering the circulating blood, are capable of carrying oxygen normally, but their fragility causes them to have a short life, one half to one third normal.⁹ This proves that an insufficient erythroblast produces insufficient erythrocytes leading to manifestation of disease. This fact holds true even in case of other processes like gluconeogenesis, gene expression, embryogenesis and thrombopoiesis where defective precursors can form defective entities leading to failure of the process.

CONCLUSION

Ksheeradadhi Nyaya (theory of sequential transformation), is a concept derived in *Ayurveda* to explain the sequential formation of seven *Dhatu*. It is the metaphor to understand *Dhatuposhana* where the transformation of *Ksheera* (milk) to *Dadhi* (curd) is literally related to the transformation of one *Dhatu* to another. A series of irreversible conversion changes occur in process like gluconeogenesis, gene expression, embryogenesis, erythropoiesis and thrombopoiesis as well. When analyzed, it reveals that these processes occurring in the human body also obey the postulates

of *Ksheeradadhi Nyaya* proving that the need to study theories of *Ayurveda* are not only useful for understanding *Ayurvedic* concepts, but are also significant for conceptualization of processes involved in human physiology.

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