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CRITICAL ANALYSIS OF THE CONCEPT OF VIPAK IN CORRELATION TO GUT MICROBIOTA: A NEW DIRECTION FOR TREATMENT PROTOCOL

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ABSTRACT

Microbes are a community of micro-organisms that reside and co-exist in human body. It includes a variety of organism such as bacteria, virus and archaea. Microbiomes are interactive microbial community, known as microbiota in an environment that includes components such as structural element and metabolites produced by microbial activity. The human microbiota is known to inhabit in several organs including gut, skin, mouth, nasal cavities, lungs and vagina and referred collectively as genomes of existing microorganisms in the specific sites in the body.[1] The largest collection of microorganism is located in gastrointestinal (GI) tract, referred as *Gut Microbiota*, which provides several function for the host including developmental, immunological, physiological and nutritional activities which may affect our life in health and disease.[2] Once these microbiomes were considered independent organism but they are now considered to be an integral part of human body that plays a role in health and therefore sometimes these are also referred as the ‘ forgotten organ’.[1] Gut microbiota plays a role in decreasing as well as increasing drug activity.[5] Vipak is the biotransformative phase of rasa of dravya through the action of jatharagni. Ahar undergoes two phases of transformation inside the body.[4] The Madhur, Amla and Katu Vipak of drug is formed after

consumption of drug, depending on the nature of drug consumed which manifests in karma (action) of the drug. A deep correlation can be established between Vipak and Gut Microbiota which will give a new insight for the treatment protocol.

KEYWORDS: Gut microbiota, microbiota, vipak.

INTRODUCTION

Concept of Gut microbiota: The human gastrointestinal (GI) tract harbours a complex and dynamic population of microorganisms called the Gut microbiota which has coevolved with the host over thousands of years to form an intricate and mutually beneficial relationship. The microbiota offers many benefits to the host, through a range of physiological functions such as strengthening gut integrity, shaping the intestinal epithelium, harvesting energy, protection against pathogens and regulating host immunity. The gut microbiota composition is shaped by diet, environment and possibly by host genetics also. The density and composition of microbiota are affected by chemical, nutritional and immunological gradients along the gut. The development of the microbiota is generally believed to begin from birth, although this dogma is challenged by a limited number of studies in which microbes were detected in womb tissue, such as placenta. The mode of delivery also appears to affect the microbiota composition, with vaginally delivered infants microbiota containing a high abundance of lactobaccilus during the first few days, a reflection of high load lactobaccilus in vaginal flora. In contrast the microbiota of infants delivered by caesarean-section is depleted and delayed in colonised by facultative anaerobes such as clostridium species. After birth the GI tract is rapidly colonised with life events such as illness, antibiotic treatment and changes in diet causing chaotic shifts in the microbiota. Current research suggests that diet exerts a large effect on the gut microbiota. Shaping of the colonic microbiota is subject to the availability of microbiota accessible carbohydrates (MACs) that are found in dietary fibre. Extreme animal based or plant based diets result in wide ranging alteration of the gut microbiota in humans. The influence of fibre was demonstrated in a crossover study showing that otherwise matched diets high in resistant starch or in non-starch polysaccharide fibre (wheat bran) results in the strong and reproducible enrichment of different bacterial species in human gut. Intestinal mucus provide a source of carbohydrate to gut microbiota. Owing to its large genomic content and metabolic complement, the gut microbiota provides a range of beneficial properties to the host. Some of the most important roles of these microbes are to help to maintain the integrity of the mucosal barrier, to provide nutrients such as vitamins and

protection against pathogens. Gut microbiota plays a role in decreasing as well as increasing drug activity.[5] In addition, the interaction between commensal microbiota and mucosal immune system is crucial for proper immune function.[3]

Concept of Vipak: Vipak is biotransformative phase of rasa of a dravya through the action of *jatharagni.* Ahar undergoes two phases of transformation inside the body viz. initial phase (*Avasthapaka*) and the final phase (*Nishtapaka).*

Avasthapaka: When the food comes in contact with jatharagni, then the process of Avasthapaka begins with *madhurpaka* or *prapaka* in the *amasaya* (from oral cavity to first part of duodenum). Later food is ejected into *pachyamanasaya* (from second part of duodenum to ileum), where it undergoes *amlapaka* (the acid phase). Finally the food reaches the *pakwasaya* (from caecum to rectum) where the process of digestion ends with *katupaka* (alkaline phase).

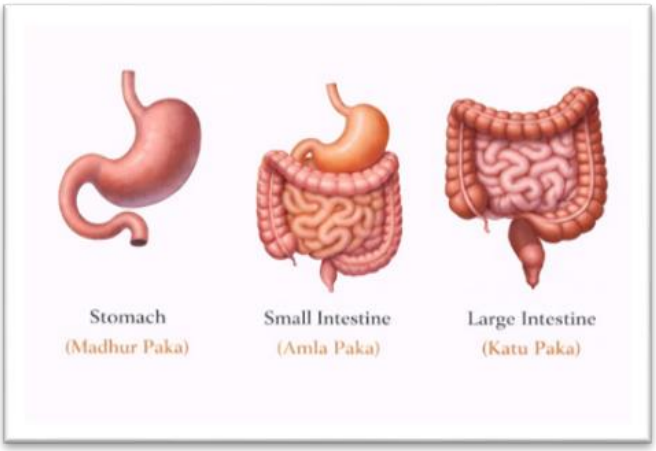

Figure 1: Avasthapaka stages in GI system.

Nishta paka: After the food is subjected to *jataragnipak*a and *bhutagnipaka*, the nutrients absorbed along with *chyle* from the small intestine (*adho amasaysa*) will have a further transformation known as Nishtapaka. *Karmanishta* is the conclusive action of a Dravya. Chakrapani explains Nishtapaka or vipak as Karma Pratisamapti i.e., conclusion of action in its entirety. Even though various rasas undergo transformative changes, the contribution made by their special functions due to further transformative changes is known as vipak or Nisthapaka. The final action will increase the symptoms of kapha, sukra etc. The concept of Nishta paka vis-à-vis post digestive changes which occurs in adho amasaya after absorption is performed under the influence of *bhutagnipaka* and *dhatvagnipaka*. The Madhur

nishtapaka results in the final formation of glucose and its conversion into glycogen for the utility of tissue. Metabolic end-products characterized as Amla nishtapaka and Katu nishtapaka may be outcome of cellular respiration. The term Amla vipak may refer to intermediate metabolites (keto acids) as the lactic acid and pyruvic acids which are the 3-carbon compounds. These are laghu in nature when compared to amino acids, glucose, glyceral and fatty acids, as compared to the end product of cellular respiration which are characterized as Katu vipak. The drug effect produced through the process of metabolism shall be considered as Vipak. The concept of Vipak in Ayurveda covers the drug metabolism or pharmacokinetics dealt in modern pharmacology.[4]

Katu Vipak (Pungent post digestive effect): This type of vipak is generally hot and stimulating. It is associated with substance that possess a pungent taste. These substance tend to balance excess kapha and help improve circulation and digestion.

Amla Vipak (Sour post digestive effect): This is commonly observed in substances that have sour taste. It typically has a cooling effect and is known for increasing pitta dosha, influencing bile production and assisting in the digestion of fats.

Madhur Vipak (Sweet post digestive effect): Substance with a sweet taste produce this type of vipak. These are typically cooling, nourishing, and stabilizing, helping to pacify vata and pitta while promoting tissue regeneration and strength.[6]

MATERIAL AND METHODS

An extensive literature review has been carried out related to vipaka, micro biome, gut microbiota and related topics from various ayurvedic texts as well as modern textbooks and various journals from pubmed, google scholar, research gate etc. The information have been collected and presented in a systemic way.

RESULT AND DISCUSSION

Gut microbiota and Vipak correlation: The transformation of rasa after complete digestion of food in the *koshtanga* by the help of *jatharagni* is called Vipak. Acharya Vagbhatta exclusively defined Vipak as the factor which is final outcome of bio transformation of rasa through the action of *jatharagni*. Vipak is assessed finally after the complete metabolism of drug and through the final effect of the drug. That means the end phase of biotransformation resulting in ultimate therapeutic effect is the source to assess vipak. Vipak can't be perceived

directly but it can be assessed with the help of *anuman* (inference).The microflora themselves are source of *agni* which reside in *mahasrota* (gastrointestinal tract) are responsible for the metabolism of the drug. Gut microflora in total exhibits certain specificity in ultimate production of short chain fatty acids (SCFAs) and other nutrients depending on the quality and nature of diet and medicine. Similarly the Madhur, Amla and Katu Vipak of drug (food or medicine) have been denoted to possess qualitative degree (*Taratama bhava*) depending on the nature of drug consumed which manifests in karma (action) of the drug.

Similarity of vipak and gut microbiota

Vipak is the result of digestion in the digestive tract, where food and medicinal plants undergoes a series of transformation.[6] Similarly gut microbiota is the end product produced by the food taken. The gut microbiota is largely affected by diet.[3] Modern pharmacology often explains the therapeutic effect of plant compounds through their bioactive constituent and their molecular mechanism whereas Ayurveda explains it on a deeper level i.e. on the level of vipak. For example, the katu vipak of ginger and turmeric can be linked to their stimulant properties on the digestive system, which are supported by the modern research showing their effect on increasing bile production, digestive juice secretion and enhancing gastrointestinal motility.[6] The human gut contain trillion of bacterial cells that are reported to be at a ratio of approximately 1:1 with our own cells. They thus form a vibrant living population that has a metabolic activity similar to liver. Their intimate association with the intestinal mucosa which is also biologically active with a high cellular turnover rate can be expected to have a major impact on human health and the prevention and precipitation of the disease.[7] The process of vipak mainly takes place in large intestine after the nutrients gets absorbed along with *chyle* from the small intestine. The large intestine is main house of gut microbiota which are beneficial for the body. Gut microbiota can convert food component into different metabolites, which affect the vipak of the substance.

Manifestation of vipak and formation of microbiota

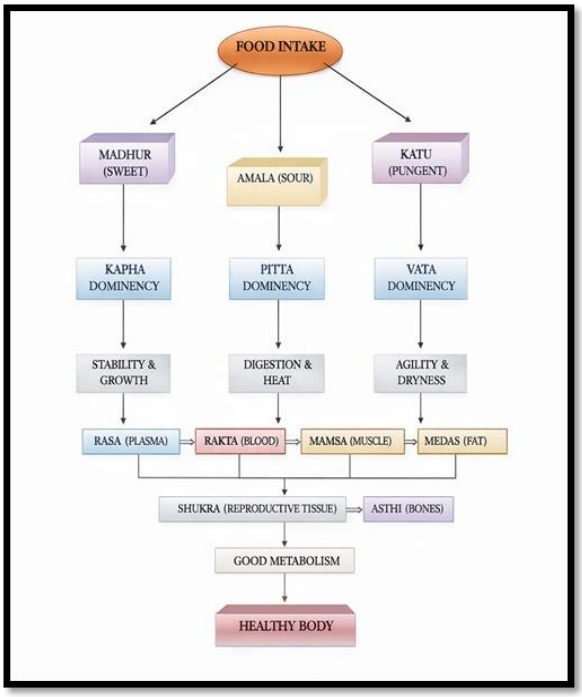

Figure 2: Importance of Vipak.[6]

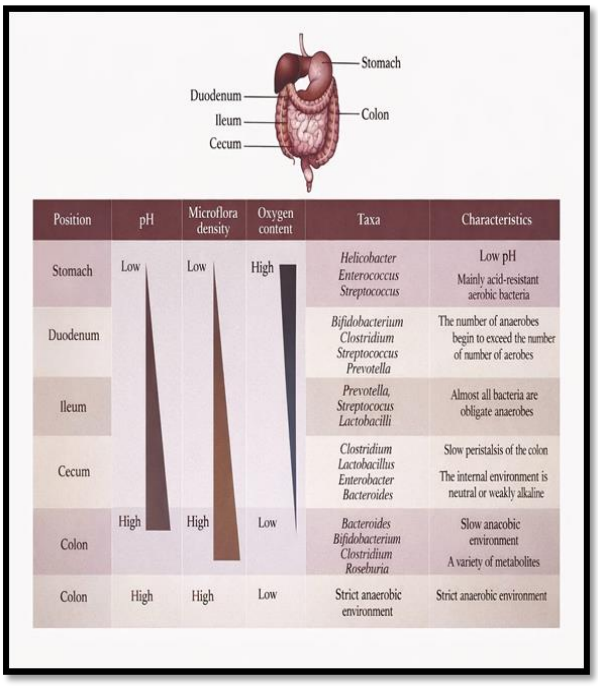

Figure 3: Biogeography of Gut Microbiota.[8]

CONCLUSION

Gut microbiota has an inherent bond with vipak. Vipak and microbiota are the end product of the diet we take. Microbiota affects the vipak of the substance. New research in this field can add more importance to vipak which is one of the basic part of Dravyaguna. The above concept can surely give an insight in the path of drug discovery and more close study is required to find the relationship in broader aspect.

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