



Analysis of concept of *Kala* for biomedical perspective- A Review of Ayurvedic classics

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Abstract:

Time is witness for the evolution and all sort of transformation. The creation of life, the aging process we undergo, the ripening of a fruit, the changes of season, the evolution of past, present & future everything is under the control of time. Time is eternal, self manifested and responsible for transformation of life and death. All the activities taking place in the world are under the control of time. The rhythm of life on earth is shaped by seasonal & diurnal changes in the environment. Plants and animals show profound annual cycles in physiology, morphology, behavior and demography in response to environmental cues. Seasonal biology impacts ecosystems and agriculture with consequences for human health & disease and biodiversity. Seasonal as well as diurnal rhythm play significant role for the coordination of physiological, immunological and behavioral process. Hence understanding seasonal biology for biomedical perspective is the need of hour to prevent many contemporary global health issues. Epidemiologic triad consists of agent, host and environmental factors interrelate in a variety of complex ways to produce disease. *Ayurveda* broadly depicts the concept of *Kala* and its unavoidable & irreversible effect towards various physiological, pathological and immune functions. Need of understanding the biodiversity as one of the vital health determinants and adaptation of preventive and therapeutic measure accordingly and consideration of time factor has been emphasized in Ayurvedic classics. A study has been made by the author to explore the role of *Kala* (time factor) to understand the rhythm of life in response to patho physiological phenomena.

Key words: *Nityaga Kala, Avasthika Kala, Kriyakala, Sansodhana Kala, Vaya*

Introduction:

The rhythm of life on earth is shaped by diurnal and seasonal changes in the environment. Plants and animals show profound annual cycles in physiology, health morphology, behavior and demography in response to environmental cues. Diurnal as well as seasonal rhythm affect the environmental variables such as temperature, rainfall, length of the day & night which can be considered as vital concern in the regulation of many physiological and behavioral processes. Seasonal variation shifts this distribution towards large outbreaks with the difference dependent on the amplitude and form of seasonal variation in transmission. Epidemiologic triad consists of agent, host and environmental factors interrelate in a variety of complex ways to produce disease. *Ayurveda* the ancient system of Indian Medicine broadly depicts the concept of *Kala* and importance has been given on evaluation of *Kala* in understanding various path physiological phenomena, impact of best appropriate time for administration of therapeutic measure, suitability of time for collection of drugs and various pharmaceutical preparations.

Aims & objectives:

- 1) Exploration of concept of *Kala* in Ayurvedic classics and understanding its relevancy in practical application of preventive, promotive and therapeutic measure.

Materials & methods:

- 1) A critical contextual analysis of Charaka Samhita, Sushruta Samhita and Astanga Hridaya along with Ayurveda Deepika commentary has been made by the author for exploration of concept of *Kala* as vital concern from physiological, Pathological, therapeutic & preventive point of view.
- 2) Different web journals are referred to understand the significant impact of *Kala* or time factor in triggering the path physiologic conditions.

Review of literature:

Ayurveda ancient system of Indian medicine has holistic approach towards prevention of disease and restoration of health. *Ayurveda* broadly depicts some eternal truth which has been universally accepted. The concept of *Kala* is one of such eternal truth which has been universally accepted for all sort of transformation. Birth, existence of life cycle and gradual dissolution of living beings all are accelerated by time factor^[1]. Being a part of evolution of creation an individual has been considered as the epitome of universe. Time factor can be considered as one of the vital concern for cause of birth (*Hetu*), growth (*Vridhhi*), decay (*Upaplava*) and dissolution (*Viyoga*) not only of human being but also of all matter of universe. Time is eternal, self manifested, pervasive and responsible for all sort of transformation during life cycle^[2]. The rhythm of life with response to acceleration of various physiological entities inside the body, incubation of pathological entities & their timely manifestation etc are influenced by *Kala*. *Kala* (time factor) has been considered as foremost factor among the three fold causes for manifestation of all ailments in *Ayurvedic* classics. Excessive, none or over utilization of *Kala* play significant role in manifestation of various ailments^[3]. In the other way proper utilization of seasonal or diurnal rhythm in response to biological cycle are meant for restoration of health. From biomedical prospective point of view '*Kala Pareekshya*' has been incorporated in *Dasavidha Pareekshya Bhava* (ten important topics of investigation)^[4]. The term '*Kala*' has been conceptualized in reference to *Nityaga* (*Samvastara*) i.e. seasonal and diurnal rhythm and *Avasthika* i.e. related to stages of disease & stages of *Ayu* (life span)^[5]. The circadian system has been shown to be fundamentally important in human health and disease. Understanding all aspect of

Kala i.e. seasonal & diurnal as well as age factor, stages of disease etc and its relevancy in human physiology as well as in manifestation of all pathological variables is essential.

Consideration of Kala in understanding biological rhythm of life:

The basic fundamental principle of *Ayurveda* is based on *Dosha*, *Dhatu* & *Mala Siddhanta*. The *Dosha* the basic bodily humors are influenced by diurnal & nocturnal rhythm and seasonal rhythm ^[6]. Variation in the strategy of *Dosha* like *Sanchaya* (accumulation), *Prakopa* (aggravation) etc and their physiological function are greatly influenced by *Kala Prabhava*. As per the predominance of respective *Dosha* in disease process, the features are manifested in respective time of aggravation of involved *Dosha*. *Vata*, *Pitta* & *Kapha* are aggravated in end, middle and early part of day & night. The variation of *Dosha* as per diurnal, seasonal rhythm is as per follows.

The *Vayu* aggravates during weather with cold, clouds and winds and particularly after summer (in rainy season) and also in early morning afternoon ^[7]. The *Pitta* aggravates by heat, in summer and particularly in autumn and also in noon & midnight ^[8]. *Kapha* aggravates by cold, in cold weather, particularly in spring and also in forenoon, early hours and night ^[9]. The human body is well known for its ability to acclimatize to adverse and unfavorable conditions. Climatic change is widely acknowledged to be one of the most serious global threats for human population health. Heat exhaustion and its progression heatstroke along with dehydration and electrolyte disorder are common during heat waves. In cardio vascular system at the beginning of hypothermia the sympathetic tone increases due to decrease in the body core temperature in cold stressful environment. Similarly in gastro intestinal system intestinal motility decreases progressively as temperature does too and resulting in acute gastric dilatation, distension of colon. Hypothermia induces secretion of gastric acid and inhibits duodenal bicarbonate secretion leading to mucosal damage in the stomach and duodenum. Hypothermia related serum amylase elevation leading to edematous or necrohaemorrhagic pancreatitis. In the renal system hypothermia is usually accompanied by a general mild degree of renal insufficiency because of renal vasoconstriction ^[10]. Common changes in the electro cardiogram when suffering from extreme hyperthermia include prolonged QT interval, rhythm disturbances, conduction defect and ST segment change. In many species reproduction is seasonal, presumably a mechanism to ensure survival of the offspring. The human menstrual cycle is repeated on average 28 days, reflecting the time required for follicular maturation and ovulation. Essentially all pituitary hormone rhythms are entrained with seasons of the year and daily light-dark cycle. Exhibition of peaks of ACTH and cortisol will take place between late afternoon and midnight. The patients with Cushing's syndrome exhibit inappropriately increased midnight cortisol levels ^[11].

The circadian system has been shown to be fundamentally important in human health and disease also. Understanding daily rhythm city and its relevance in human physiology and pathogenesis of many ailments is essential in biomedical perspective. For ex cardiovascular tissue such as heart & blood vessels show remarkable daily variation in gene expression, metabolism, gut activity etc. The temporal profile of sHR & BP follows diurnal variation of our autonomic nervous system and is lowest during the period of vagal dominance at night time, during sleep and early morning hour. Hence the occurrence of adverse cardiovascular events such as sudden cardiac death & MI exhibit diurnal variation with a pick incidence in the morning hours, just before or after awakening.

Consideration of Kala in understanding the pathophysiological phenomenon:

The concept of *Dosha* has been considered as subtle phenomena. The predominance of *Dosha* involved in a disease process has to be inferred only on the basis of manifested features and time of manifestation. Hence 'BalakalaSamprapti' has been incorporated in classification of pathogenesis^[12]. Time of Aggravation of involved *Dosha* and manifestation of disease in specific time can be evaluated in reference to variation in seasons (*Ritu*), timing of day, night (*Ahoratra*) and intake of food (*Bhuktavastha*), age factor (*Vaya*) etc which can be helpful in confirmative diagnosis based on *Doshic* variety.

For ex If occurrence or aggravation of the features of fever will be manifested particularly after the digestion of food (*Jirnant*), in the afternoon or during dawn and at the end of the summer season then the predominance of *Vata Dosha* can be taken into consideration and the disease can be diagnosed as *Vatika* Variety of *Jvara*^[13]. Since the above mentioned time is related to natural aggravation of *Vata Dosha*, hence the strength of *Vatika* variety of *Jvara* will be triggered in those respective *Kala*. Ailments are triggered in more tensely due to the advent of the maturity of respective time.

In general according to fundamental principles of *Ayurveda* diseases caused by *Vata Dosha* predominance are as a rule manifested during the end stage of digestion, afternoon, post midnight and in end of summer (*Gharmante*) and early part of Rainy (*Pravrit*).

Various types of *Visama Jvara* (intermittent fever) are also to be listed among *Vyadhi* specifically manifested in due effect of *Kalaja* (diseases caused by the advent of the maturity of the effect of time) diseases. *Anyedyuska* or quotidian fever manifests itself in a fixed hour every day. *Dvayagrahi* (reversed quotidian) occurs in two days continuously with remission on first and fourth days. *Tritiyaka* type of fever manifests itself in the third (alternate), *Chaturthaka* (quartan) occurs on the fourth day at an interval of two days^[14]. These diseases get aggravated at the appointed hours as they gain strength only on such hours. Hence the physician should acquainted with the strength of time of occurrence of diseases. Natural diseases are to be included under *Kalaja* category as they get manifested in definite time. Natural manifestations are irremediable in the sense as they cannot be treated by any other therapeutic devices^[15]. Among all other triggering factors the support of the strength of time has been emphasized in *Ayurvedic* classics to be taken into consideration in understanding the evolution of disease. As a seed remain dormant on the soil till arrival of suitable time to germinate, the dormant *Dosha* become active and gain strength in appropriate time^[16]. Hence evaluation of time factor must be considered as a vital concern for understanding *Balakala Samprapti* of any disease. It has been emphasized the clinical importance of incubation period that the time elapsed between exposure to a pathogenic organism and manifestation of apparent signs & symptoms. Accurate knowledge of incubation period is important to investigate and to control infectious diseases and their transmission. Annual cycle in vulnerability to infectious disease can be considered as an established feature of human epidemiology.

Modern science has also emphasized in understanding seasonal pattern of diseases and related triggering factors which may lead the clinician in developing effective measures for preventing these diseases and can also help policy makers plan for appropriate health care resource distribution and seasonal availability during peak incidence of seasonal disorders. It also has been emphasized in *Ayurvedic* classics on adaptation of seasonal regimen (*Ritu charya*) with due consideration to prevent the ailments made by *Kala Krita Dosha Vaisamya*. Existence of seasonal variability of gastrointestinal diseases has been observed in various part of the world. To examine global trends in the seasonality of gastro intestinal diseases a review has been made on the result of epidemiological studies of gastrointestinal diseases from wide range of countries on the seasonal & monthly incidence of IBD (Inflammatory Bowel disease), Peptic ulcer disease etc.

It has been observed that most patients with IBD runs relapsing course in spring and summer ^[17]. Similarly upper respiratory tract infection shows seasonal distribution with high frequency in winter ^[18]. RA activity in the upper and lower extremities may be highest in spring followed by winter ^[19]. Hence seasonal changes should be considered in a patient with RA to better understand their symptoms. Nor virus is more common in winter and diarrhea, vomiting etc being caused by Nor virus and common cold, Pneumonia, acute ear infection by Streptococcus Pneumonia have been considered as common winter ailments. Cholera caused by contaminated food & water and Typhoid caused by Salmonella water born bacterial infection has considered as common monsoon ailments ^[20]. Seasonal diseases arise due to the change in environmental condition during different season. To avoid seasonal diseases the people must be informed and get aware about the causes & symptoms to detect it at early and other precautionary measures. The human body is well known for its ability to acclimatize to adverse and unfavorable conditions.

Evaluation of Kala in manifestation of disease feature:

Manifestation of disease future to some extent greatly influenced by time factor. For ex Attack of epilepsy is stated to take place after a fortnight or after twelve days or after a month or sometimes the attack may take place even before or after these stipulated periods ^[21]. Duration of *Santata Jvara* will continue to manifest its features up to 7, 10 or 12 days and subsided ^[22]. Similarly in *Vataja & Kaphaja* variety of *Sotha*, the swelling is of greater tensivity during the day and night time respectively ^[23].

Evaluation of Kala and prognosis of the disease:

Time factor can be considered as vital concern in prognosis of many diseases. Manifestation of acute fever with *Vata, Pitta & Kapha Dosha* predominance and exhibition of delirium, giddiness and asthma causes fatality and even death of the patient on the seventh, tenth or twelve days respectively. *Santata* type of *Visama jvara* manifests its symptoms very quickly and either gets cured or kills the patient on 12th, 10th or 7th days. Time factor or *Kala* has been considered as prime factor for incurability of some diseases. For ex *Baddhagudodara* (abdominal swelling caused by the obstruction in the intestines) generally becomes incurable after a fortnight ^[24]. Elephantiasis (*Sleepada*) will be incurable if it has crossed one year of duration ^[25]. Similarly existence of Pile in second fold and extending for a year can be cured with difficulty.

Evaluation of Kala in reference to Aturavastha & advice of appropriate therapeutic advice:

Another connotation of the term '*Kala*' has been described in reference to state of the patient or stages of the disease (*Aturavastha*) which determines the initiation of timely action and prohibition of untimely one. Determination of specific therapy or selection of specific drug and its utility or non utility depends upon the state of the patient or disease (*Aturavastha* or *VyadhiKala*). For ex in *Navajvara* (beginning stage of fever) decoctions are not considered to be useful whereas after sixth day of the onset of fever decoctions which are either *Pachana* or *Samana* have been advised to be useful ^[26]. *Langhana* can be considered as first line of treatment in *Jvara Cikitsa* where as mild elimination therapies and *Yapana* type of *Vasti* should be administered in *Punaravartaka Jvara* ^[27]. Similarly since the patients suffering from *Raktaja Gulma* shares some signs & symptoms of pregnancy; it might be difficult to arrive at the correct diagnosis before the tenth month and therefore the treatment of this condition should be undertaken thereafter ^[28]. The importance of *Kriyakala* has been emphasized by *Acharya Sushruta* i.e. every physician should aware about best appropriate time for administration of appropriate therapeutic measures ^[29]. Hence the clinician should aware about the *VyadhiKala* for implementation of therapeutic measure rationally. Administration of best appropriate therapeutic measure in earlier stage is easier than in later stage. Again the treatment principle varies with the stages of disease. All the great preceptors of *Ayurveda* like *Acharya Charaka, Sushruta* etc

has emphasized in evaluation of stages of *Dosha* or *Vyadhi* before proceeding for any therapeutic measure. From surgery point of view it has been emphasized that the real surgeon should well acknowledged about the stages of inflammation like immature, maturing and mature stages ^[30]. Incision of immature inflammation indecisively by the ignorant surgeon lead to manifestation of traumatic abscess and on the other hand big lap-like space (cavity) is developed when a mature inflammation is neglected ^[31]. Similarly in amelioration of burn treatment varies as per type of burn. For ex in scorched type burn(*Plusta*) hot pastes, food & drinks has been advised where as in blister type of burn(*Durdagdha*) both cold and hot remedies has been advised ^[32].

Consideration of *Kala* in *CikitsaUpakrama*:

It has been emphasized on '*Kala*' while administering Samsodhana therapy or purificatory measure to obtain their desired effect. Elimination therapies like *Vamana* (emesis) etc should be administered only in seasons of moderate nature. Moderate seasons are characterized by moderation in cold, heat and rain. In the other way such therapies should not be administered in other seasons having extreme cold, heat or rain. For ex during the *Hemanta* or winter season, the body is exposed to great discomfort because of affliction by excessive cold. The *Dosha* do not get detached and remain adhered to the channels in the body due to their excessive firmness caused by the contact with the terrific cold-wind. Medicaments used for elimination therapy are by nature hot but because of affliction with excessive cold their therapeutic effectiveness is diminished. When these therapeutically less potent drugs are administered to an individual it does not produce the desired effect. During the *Varsa* or Rainy season, bodies of animals become excessively deliquescent because of their exposure to rain water, invisibility of the Sun, moon and stars, over-casting of the sky by clouds and the presence of mud and water all over the earth. There is impairment of all medicaments because of their contact with water and the moist wind associated with clouds. Hence the drugs being used for the manifestation of urges of emesis etc does not produce the desired effect of elimination therapies. But if emergency arises during these seasons necessitating the immediate administration of these therapies, this should be done in artificially furnished (air conditioned) rooms which remain cold in summer and hot in winter. Similarly suitable changes should be brought about in medicaments by combination with other drugs which would not be incompatible in potency with each other, so that they will properly cater to the needs of the patients even in these adverse seasons. It has been advised by Cakrapani, the commentator of *Charaka Samhita* that Trivrit (*Operculina turpethun*) should be mixed with cow's urine and the therapy should be given in larger dose ^[33].

Consideration of *Kala avadhi* (Duration of time)) in therapeutic advice:

Specific duration has been advised in reference to administration of therapeutic measure in specific disease condition. The desired effect of various therapeutics is manifested within a definite period of time. For ex the maximum and minimum periods for the administration of oleation therapy is seven and three days respectively. The oleation therapy which is said to produce unctuousness instantaneously may take minimum three days and maximum seven days to produce desired effect. If the oleation therapy is administered for more than seven days, the patient will get used to it and such therapy will cease to produce the desired effect ^[34]. According to *Acharya Vagbhata* desired effect (*Samyak Snigdha Lakshana*) of oleation therapy may manifest within three days in *Mridukostha* and maximum in seven days in *Krurakostha*. Similarly the decoction being administered for the purpose of emesis is tending to produce its first effect at least after one *Muhurta* (i.e. 48 minutes). After this definite time period of intake of emetic decoction, the *Dosha* has started melting ^[35]. While a patient has been advised one or more purificatory measure then Purgative therapy (*Virechana*) should be administered after 15 days of emetic therapy and enema therapy (*Niruha Vasti*) after the 15 days of purgation therapy ^[36]. Consideration of time factor by the

clinician or therapist has been considered as a vital concern during course of administration of any therapeutic measure or medicament. Similarly minimum duration of days or months has been advised in reference to various ailments to get rid free from disease future or restoration of homeostasis of the body. For ex in reference to *Jalodara Cikitsa*, at least six month dietary restriction is strictly advised in *Jalodari* after the fluid gets drained from the abdomen. For six month the patient should take *Peya* (thin gruel) without adding salt & the patient should invariably be given milk for maintaining the harmony of *Dosha* and for promoting strength as well as stability of the body^[37]. Langhana (fasting) and *Yavagu* (Gruel) prepared by the drugs of bitter taste has been advised at least for first seven days of attack of *Jvara* for metabolic transformation of *Apakva Dosha*. But in certain circumstances when the *Apakva* (*Ama lakshana*) state of *Dosha* continues even after the 8th day, *Pachana Kashaya* (decoctions) can be used after 8th day [38].

Ousadha Sevana Kala: Time critical scheduled medications are those where early or delayed administration of maintenance doses of greater than 30 minutes before or after the scheduled dose may cause harm or result in substantial suboptimal therapy or pharmacological effect. For ex blood pressure commonly exhibits a diurnal variation, peaking during the morning and then declining. Hence antihypertensive medication is usually prescribed to be taken in the morning. Many stimulant laxatives are often advised in bed time. Ancient wisdom also focuses on advice of best appropriate time in specific disease condition to obtain desired efficacy of the prescribed drug. Drug administered on empty stomach becomes highly potent and in *Kapha* predominating disorders it is advised to administer in empty stomach. In *Apana Vayu Vikriti* it is advised to take medicine before meal where as in *Samana Vayu Vikriti* in middle of the meal. Repeated administration is recommended in dyspnoea, severe cough, hiccough and vomiting^[39].

Consideration of Kala in reference to Vaya (age factor):

The age factors of an individual represent the state of his body depending upon the length of the time that has passed since birth. Evaluation of age factor can be considered as vital concern in understanding the patho physiological phenomenon of the body and prescribing the suitable therapeutic measure and medicaments in proper dose. For ex during the former stage i.e. up to 16 years can be characterized as immature stage as various organs of the body are not well developed, there is incomplete strength and resistance power, dominance of *Kapha Dosha* than other *Dosha*, lack of tolerability towards any adverse condition etc. Hence it has been advised mild therapies in small dose for the individuals under this age group where as in later stage of *Balavastha* which lasting up to 30 years of age, there is no such restriction regarding the selection of the therapy and its dose^[40]. Some indication and contradiction has been described in reference to administration of various therapeutic measures in different age. For ex it has been advised that *Vamana & Virechana* therapy should not be administered before 10 years and *Kavala* (Gargling) is restricted before 5 year. *Agnikarma* and *Kshara Karma* is restricted in *Balavastha* (childhood) and *Vridhdhavastha* (old age). Strategy of bodily elements as well as physiological function is accelerated naturally with the stages of life. For ex in later stage of life progressive diminution of the *Dhatu* (tissue elements), strength of sense organs, energy level, power of understanding, retention and memory power will take place^[41]. Hence the individual is suspected to suffer by respective disorders. Age factor can be recognized as one of the health determinant for susceptible manifestation of many ailments. Common ailments in older age include hearing loss, cataracts and refractive errors, osteoarthritis, depression etc. Dementia is recognized as common old age ailment characterized by impairment of memory, thinking power and cognitive changes.

Consideration of Kala in Dravya Sangraha and pharmaceutical preparation:

In Ayurveda the safety and quality of crude medicinal plants has been quoted to base upon major factors like *Desha* (geographical distribution or habitat), *Kala* (Time) etc. *Kala* i.e. the time factor (season, Lunar period and day-night cycle) play significant role in influencing pharmacotherapeutic properties and potency of medicinal plants. It has been emphasized on time factor for collection of different part of drug. For ex root, leaf, bark, latex, heart-wood and fruit should be collected in early rains, rainy season, autumn, early winter, spring and summer respectively ^[42]. The different parts of plants being used for various therapeutic purposes are enriched in respective qualities in definite time. Specific season has been advised for collection of specific drug. Derangement or sexcellence in the qualities of diet or drug is greatly influenced by *Kala*. For ex it has been instructed to collect *Madana Phala* (Best drug used for emesis) particularly between *Vasanta & Grisma* ritu ^[43]. Similarly in various pharmaceutical preparations like *Asava* and *Arista*, after preparation of medicine it is instructed that the preparation should be kept in a container for a specific period for completion of the fermentation. Then only the efficacy of the said preparation can be attained. The time from the date of manufacturing of the medicine to the time till which the medicine has sufficient potency to bring about the desired therapeutic action can be termed as shelf life or expiration date. Consideration of shelf life of Ayurvedic medicine is one of the vital concern to be evaluated by every practitioner. *Saviryta avadhi* is indicative of that specific period during which the *Virya* of the drug remains above certain threshold provided that it is stored in the mentioned condition. Beyond that time limit the drug may lose its potency up to some extent. For ex *Churna* preparations were mentioned to have only 2-3 months of stability rather than their raw herbal materials. Where as in case of *Avaleha* the concentrated sugar solution or honey are protecting the formulation from early deterioration and increase its stability up to 1-2 years.

Discussion:

In health promotion aspect time factor in reference to seasonal, lunar or diurnal-nocturnal rhythm can be considered as vital health determinant for which the people must be ensured & empowered to get control over their health against it through various primary and secondary prevention. In primary prevention service seasonal nutritional and food supplementation, various behavioral practices, vaccination, post exposure prophylaxis can be implemented for avoidance of diseases influenced by *Kala*. In secondary prevention activities populations based screening program can be implemented for early detection of disease with due respect to *Kala*.

Conclusion:

Concept of *Kala* must be analyzed as well as evaluated as health determinant in all aspect of biomedical perspective like restoration of homeostasis of the body, clinical diagnosis, prognosis, advice of various therapeutic indication or contradiction and even for pharmaceutical perspective. All the clinicians must be aware about this unavoidable influence of seasonal biology and implementation of all aspect of primary & secondary prevention for restoration of bodily elements as well as other manifested ailments.

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