

A Conceptual Review on Circadian Rhythm

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Abstract

Ayurveda is one of the oldest traditional heritages of our country which encloses very deep secrets of positive health and longevity. It is like a reservoir of all the healthy secrets of life which helps in attaining the ultimate goal of Ayurveda. The *acharyas* or *rishis* based on their keen observation explore the world of ayurveda and hence provide us with great knowledge in the form of treatises. Nowadays, circadian rhythm or biological clock is gaining very much popularity as it is defined as 24 hour cyclical changes that happen in our body and its clinical significance. But, this same thing is mentioned in our treatises which never gain that much attention. It clearly states the cycle of *doshas* that keep on changing from time to time and reflects their symptoms on the body. Based on these *doshas*, *acharyas* mentioned the day regimens, night regimens, seasonal regimens that help our body to remain fit throughout the life and each and every regimen has its own clinical significance. This article draws attention towards the concepts of the biological clock mentioned in our ancient science and how it is related to modern facts.

Keywords: *dosha, dincharya, agni, nidra, ritucharya, purvahna, madhyahna, pradosha, pratyusha*

Introduction

Ayurveda is an age-old science which is based on keen observations of *rishis*. It is the science of lifestyle to prevent disorders primarily and secondarily the system of medicine. This serves the ultimate goal of Ayurveda. One of the basic principles of Ayurveda known as *Lok-Purusha*

Samya which states that a living being is the tiny replica of the Universe which is simply defined as all the activities that happen in the outer world resembles the processes inside the human body as everything in this world is composed of *Panchamahabhutas*. The variation in body as per Ayurveda is based upon the status of *doshas*, *agni*, *sharira bala*, *vaya* (age), seasonal changes etc. Acharyas mentioned *Dincharya*, *Ratricharya*, *Ritucharya*, *Sadvritta*, *Achara rasayan* etc. in order to prevent diseases and to promote longevity and healthy life. In Modern Science, all the physical, mental, behavioral changes in all the physiological processes of the body are termed as biological rhythms. The circadian term is composed of two words, *circa* denote approximately and *dies* denote day which together derives the meaning "one day". It is simply defined as the 24 hour cycle of all physiological processes, behavioral changes, molecular changes as well as all the chemical changes along with all the activities that go on in the body in the whole day and night cycle. This biological clock is regulated by light and darkness of the day. It comprises sleep-wake cycle, temperature regulation, digestion process, hormonal secretions, synthesis of enzymes etc. that is controlled by a specific nucleus named as supra-chiasmatic nucleus situated in hypothalamus. This center is also known as a master center for maintaining the proper integration in all the rhythms of the living being. Melatonin, a hormone that is produced by the pineal gland in response to darkness plays a very significant role in the 24 hour internal clock.

Concept Review

Acharya Vagbhat^[1] has stated variations of doshas in its normal state as per the site, *vaya*, *kala*, digestion state etc. For example: *Vata dosha* is situated below *nabhi*, dominant in *aprahan kala* (i.e. 2am to 6am) of day time, *pratyusha kala* (i.e. 2pm to 6pm) of night time and act more strongly during the end of digestion and in *vridhavastha* of life. *Pitta dosha* is situated between *nabhi* and *hridaya*, dominant in *madhyahna* (i.e. 10am to 2pm) and *ardharatri* (i.e. 10pm to 2 am) and strongly acts during digestion and *youvana avastha* (adult stage) of life. *Kapha dosha* is located above *hridya*, dominant in *poorvahna* (6am to 10am) and *pradosha kala* (6pm to 10pm) and strongly acts during beginning of digestion and *balya avastha* (childhood).

He also stated that *vata kopa* (aggravation) and *kapha chaya* (accumulation) with *tikshna agni* (strong digestive fire) and *pravara bala* (strong digestive fire) in shishir ritu, *Kapha prakopa*

(aggravation) with *madhyam agni* and *bala* (medium agni and strength) in *vasanta ritu*, *vata chaya* (accumulation)-*pitta prakopa* (aggravation)-*kapha prasham* (alleviation) with *manda agni* (slow digestive fire) and *avara bala* (less strength) in *greeshma ritu*, *vata prakopa* (aggravation)-*pitta chaya* (accumulation)-*tridosha kopa* (aggravation) with *manda agni* (slow digestive fire) and *avara bala* (less strength) in *varsha ritu*, *vata prasama* (alleviation)-*pitta prakopa* (aggravation) with *madhyam agni* and *bala* (medium digestive fire and strength) in *sharad ritu* and *vata chaya* (accumulation)-*kapha chaya* (accumulation)-*pitta prasham* (alleviation) with *teekshna agni* (strong digestive fire) and *pravara bala* (strong digestive fire) in *hemant ritu*^[2].

Acharya mentioned *ritu bhava*^[3] in a day itself and state of doshas in that particular time in association with particular *ritu* i.e. during *poorvahna* (6am to 10am) *kapha prakopa* (aggravation) will be there and activities like *vasanta ritu* should be done, in *madhyahna* (10am to 2pm), *pitta chaya* (accumulation) will be there and *greeshma ritucharya* will be followed, in *aprahna* (2am to 6 am) *vata prakopa* (aggravation) takes place and *pravrit ritucharya* should be followed, in *pradosha* (6pm to 10pm) *pitta chaya* (accumulation) takes place and *varsha ritu* regimes should be followed, in *madhyaratri* (10pm to 2am) *pitta prakopa* (aggravation) will be there and regimens mentioned in *sharad ritu* should be followed and in *pratyusha kala* (2pm to 6pm), *shaman* (alleviation) of *pitta* will be there and regimens like *hemanta* will be followed.

There are certain factors that influence circadian rhythm like *dincharya*, *ritucharya*, *sadvritta*, *achara rasayan*, rules related to diet intake and sleep etc. are very well stated in the Ayurveda treatise which aimed to balance the rhythms of all doshas in the body.

Dincharya - it includes all daily routine activities like waking up in *brahma-muhurta*, proper cleaning of the body, applying collyrium-fragrances, body massage, *kshaur karma* (cutting of nails, beard) etc. as per the particular timings of doshas to promote longevity and healthy life. The rotation of the sun around the axis is mainly involved in the diurnal variations which resemble the *doshic* rhythms in the body.

Ritucharya - there are six *ritu*'s in a year in which different stages of doshas take place like stage of accumulation (*sanchaya*), stage of aggravation (*prakopa*), stage of suppression (*prashama*). Based on this, acharyas stated a particular diet and lifestyle regime as per the particular season. Various researches proved that the variation from the natural cycle of

doshas due to improper adaptation of weather changes leads to various pathologies, mood swings etc.

Sleep cycle - it plays a significant role in proper functioning of the body's biological clock. It proves to be very beneficial for the memory consolidation, proper healing of wear and tear of cells, digestion, metabolism, absorption of nutrients, proper release of hormones etc. The sleep-wake cycle acts as rejuvenation for the body from daily wear and tear of the cells and tissues inside the body. It provides time to the body for replenishing the energy stores as a result of which the body properly coordinates with the biological clock of each and every organ. During sleep, CNS plays a very effective role.

Discussion

All the references cited above shows that the *Tri-Doshas* i.e. *Kapha-Pitta* and *Vata* have their predominance in the early, mid and late parts of day and night respectively and hence they regulate the biological clock of circadian rhythm in our body accordingly. These *Vata-Pitta-Kapha* shows their effects on the physiological activities going on in the body which very much co-relate with the concepts of modern science being described as the circadian clock of the body.

Ayurveda says that *Kapha Prakopa Kala* show various *Lakshanas* like *Agnimandya* (weak digestion), *Sandhi Asthi Vishlesha* (joint stiffness), *Shvasa vridhhi* (breathlessness), *Praseka* (increased salivation), *Gaurav* (heaviness in body), *Tandra* (drowsiness) and *Nidra* (sleep). In the similar manner, the concept of Modern science says that in morning hours there is excessive salivary secretion, morning stiffness, predominance of symptoms of Cold and Cough and they also advise intake of light breakfast. All these co-relate with *Kapha Lakshanas* as described in Ayurveda.

Also the modern science says that the attacks of nocturnal asthma are very common in the early hours of night i.e. around 8-9 PM which again correlates with *Kapha Kala* of the early night i.e. the *Pradosh Kala*. Like this only in the mid-hours of day, there is predominance of *Pitta* and *Lakshanas* like *Tikshanagni Shitakamitva* are *Kshudha Trishna* described in this time. Modern science also advises intake of heavy meals during these hours so as to cope up with the heavy acid secretion in the mid-hours b/w 12 noon to 1 PM.

In the similar manner the *Ardhratri Kala* i.e. the time b/w 10 PM to 2 AM also have dominance of *Pitta* and modern science says this time to be of active metabolic activities which well correlate with *Pitta* predominance as all the metabolism in body is said to be due to *Pitta*.

Lastly to describe about the *Vata kala*, this *Kala* according to Ayurveda is between 2 PM – 6 PM (*Aprahan*) and between 2 AM – 6 AM (*Pratyusha*). Modern science says that the time of 2 PM to 6 PM is the highly creative time where an individual has an alert and creative mind. There increase in Peristaltic movements at this time which will coincide with the *Lakshanas* of *Anaha* and *Aatopa* described in Ayurveda.

Similarly, other symptoms of Ayurveda of *Vata Kala* like *Alpa Bala*, *gatra sphurana*, *nidranasha* also correlates with increased mental alertness during this time. Now the question arises, what is the science involved behind this circadian clock. It is found that the circadian clock is a biochemical oscillator which is dependent on light for getting in active mode irrespective of the fact that what is the source of light. The light acts as input and resets the circadian clock of the body by simulating the oscillator and setting the physiological and behavioral rhythms of the body.

The circadian pacemaker is the suprachiasmatic nucleus^[4] (SCN) of the hypothalamus. As the body transitions from light to dark, the body sends inputs to the retinohypothalamic pineal pathway. During the light cycle, axons from the retinal ganglionic cells deliver signals that activate the suprachiasmatic nucleus via cranial nerve II, the optic nerve. The SCN then delivers a signal via the inhibitory neurotransmitter GABA (gamma-amino-butyric acid) that inhibits the paraventricular nucleus. Axons subsequently send impulses through the intermediate lateral column to inhibit the superior cervical ganglion thus inhibiting the sympathetic nervous system.

As a result, melatonin does not get released from the pineal gland into circulation. As night approaches, the departure of light signals the retinal ganglion cells to inhibit the suprachiasmatic nucleus activating the paraventricular nucleus which then sends axons through the intermediolateral nucleus (IML) to the superior cervical ganglion stimulating the sympathetic nervous system which induces sleepiness. The pineal gland is mobilized to secrete melatonin into circulation.

Conclusion

Many factors like lifestyle, geological events and biological molecules impact the circadian rhythms. Uncertain sleep-waking times can disrupt circadian rhythm and the unregulated schedules definitely increase risk of chronic diseases. Therefore, lifestyle is the most important factor and we have to focus on changing our lifestyle to achieve the goal of *swasthya rakshana*.

Factors that disturb the circadian rhythm are jet lag or night shift work, *Prajnaparadha* by excess use of the electronic device at night confusing our internal clock, stress, improper conduct with self and social interaction, not following a proper routine of day or seasons, etc. These causes affect the human body negatively by reducing the SCN output which hampers the functionality of various body clocks leading to various circadian rhythm disorders causing imbalances, stress, and various lifestyle disorders. To ensure proper functioning of Biological Clock with Ayurveda an elaborate routine has been described in the classical texts of Ayurveda which specifies a daily as well as a seasonal routine, for people to follow so as to maintain good health. The concepts mentioned in Ayurveda make us understand the best time for daily routines by keeping *Doshic* rhythms at optimal levels.

Morning Routine of *Kapha* Time (6 - 10 AM)

Wake up at *Brahma Muhurta* before *Kapha Kala* begins to avoid laziness, *mala tyaga*

(Evacuation of excreta), *Danta dhavana* (brushing of teeth with *daatuna*), *Jivha nirlekhana* (cleansing of tongue), *Gandusha* and *Kavala* (holding medicated fluids in mouth), *Nasya* (nasal drops instillation), *Pranayama* (breathing exercises), *abhyanga* (massage), *Snana* (bathing) etc.

Mid - Day Routine of *Pitta* Time (10 AM to 2 PM)

This is the time of the main meal of the day. Ayurveda says that *Pitta* is at its peak during this time so it facilitates proper digestion. *Ahara vidhi vidhana*^[5] and *Asta vidhi Aahara Vidhi Visheshayatana*^[6] mentioned in *Charaka Samhita* should be adopted while intake of food.

Late Afternoon Regimen of *Vata* Time (2 PM to 6 PM)

It is the most efficient time of day to get engaged in creative activity, daily and heavy tasks can be done during this time of the day as body is full with energy due to active *Vata* during this time.

Evening Regimen of Kapha Time (6 PM to 10 PM)

Laghu ahara, Laghu Vihara and early to bed should be followed during this phase of the night. Avoid the use of artificial light and exposure to light of electronic devices which can hamper the melatonin production from pineal gland and disturb the biological clock of the body.

Based on the above facts, it could be concluded that three *doshas* govern our biological clock. If they are in their state of equilibrium, circadian rhythm of body works in sync, any impairment in doshas can lead to pathology. The *tridoshas* maintain our circadian body physiology i.e. early morning awakening, hunger, thirst, body vigor, slumber etc. Hence it can be rightly said that the circadian rhythm or biological clock is functional in every individual which is governed by Homeostasis of doshas and any disbalance of doshas can alter this biological rhythm.

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