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A STUDY OF *DOSHA* DOMINANCE DURING SLEEP – A REVIEW

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ABSTRACT

Aim: To study the *Dosha* dominance in different stages of sleep. **Background:** According to *Ayurveda* night has 3 periods of *Dosha* dominances *kapha, pitta* and *vata* in sequence. Physiologically sleep is divided into 2 stages - Non rapid eyeball movement (NREM) & Rapid eyeball movement (REM). Depth of sleep is more in the first part of sleep which is of NREM type & REM type duration increases at end part of sleep at the expense of stage 4 of NREM. In between the NREM & REM types alternate each other. **Materials:** The *Dosha* dominance during day, night, age & food is clearly mentioned by *Vagbhatacharya*. Also other *Ayurvedic* classics are searched for other relations of *Dosha* with sleep and their diurnal variations. **Result:** Period of longer duration & depth, physiological changes & Electroencephalogram (EEG) changes in NREM sleep are coinciding with *Kapha Dosha* dominance & that of REM sleep coincides with *Vata Dosha* dominance. **Conclusion:** The NREM sleep is correlated with *Kapha Dosha* & REM sleep is correlated with the *Vata Dosha* physiologically.

Keywords: NREM sleep, REM sleep, *Dosha* dominance, *Vagbhatacharya*

INTRODUCTION: For humans sleep is one of the most fascinating of all natural changes in behaviour. The average human is actively engaged in sleep for 20 to 25 years of his total lifetime. A variety of studies have been done to understand the mysteries of sleep. Now a days due to different profession sleep is not limited as night phenomenon only. But considering here the sleep is at night.

Ayurveda is a comprehensive system of health care. According to Ayurveda *Aahar* (food), *Nidra* (sleep) and *Brahmacharya* (celibacy/abstinence) are the *Trayopsthamba* (three basic pillars) of healthy living. Healthy life depends on consumption of these three factors. But 'Time' plays a crucial role in their optimal benefits. According to the *Ayurvedic* Clock, there are six periods of the day, each one influenced by one of the three *Doshas*. These *Doshas* match with the changes happening in the environment with time to maintain the homeostasis.

There are 2 stages of sleep NREM & REM. The whole sleep period is NREM type with bouts of REM type in between. First part of sleep is dominated by NREM type mostly & the last part by REM type. In between the NREM & REM types alternate each other with progressive increase in REM duration & decrease in stage 4 of NREM sleep. According to *Ayurveda*, sleep period starts with *Kapha Dosha* dominance and ends with *Vata Dosha* dominance. So there is a need of study whether the 2 stages of sleep coincide or correlate with the *Dosha* dominances mentioned in *Ayurveda.* The physiological changes during these sleep stages can be used as scale to decide

Dosha dominance as per the functions of different types of *Doshas*.

For this correlation the basic reference of *Ayurveda* is from *Ashtang Hridayam* of *Vagbhatacharya*.[1] In oldest *Charak samhita* & *Sushruta Samhita* the diurnal variation of *Dosha* is mentioned in context to disease pathology or symptoms. Summarizing this information in one single verse by *Vagbhatacharya* is the key to understand *Dosha* diurnal variation. This is an attempt to apply the *Dosha* dominance mentioned in this verse to sleep stages.

AIMS AND OBJECTIVES

1. To study the circadian rhythm of *Dosha*
2. To study the stages of sleep with respect to time & physiological changes
3. To correlate the stages of sleep in relation with *Dosha* dominance

MATERIALS & METHODS

1. Ayurvedic classics to study different aspects of sleep
2. Ayurvedic text to study functions of different types of *Dosha* in relation with physiological changes in sleep
3. Modern literature to study sleep architecture & physiological changes in its different stages

OBSERVATIONS & DISCUSSION:

A. Circadian Rhythm of *TriDosha*

In a day and night (separately), the first part is dominated by *Kapha*, second part is dominated by *Pitta* and last part is dominated by *Vata* inside the body. While eating and during digestion also, the first, second and third part are dominated by *Kapha*, *Pitta* and *Vata* respectively. [1] *Sushrutacharya* has stated that the symptoms of 6 Seasons can be seen during daytime. [2]

Table no. 1. Characteristics of seasons in circadian rhythm

Period of a 24 hour day	***Dosha* Dominance according to *Vagbhatacharya***	**Symptoms of daytime similar to 6 Seasons according to *Sushrutacharya*** [2]	**Peculiarities**
Morning	*Kapha*	Spring (*Vasanta*)	*Aadanakal* , *Uttarayana* , *Aagneya*
Afternoon	*Pitta*	Summer (*Greeshma*)	
Evening	*Vata*	Early Rainy (*Pravrut*)	
First part of night	*Kapha*	Rainy (*Varsha*)	*Visargakal* , *Dakshinayan* , *Saumya*
Midnight	*Pitta*	Autumn (*Sharada*)	
Last part of night	*Vata*	Winter (*Hemanta*)	

The suprachiasmatic nucleus of the hypothalamus serves as the body's internal biological clock because it establishes circadian rhythms. The stimulus for this nucleus is from the eyes (retina) and output signals are sent to other hypothalamic nuclei, the reticular formation, and the pineal gland. So exposure to light plays major role in causing dynamic changes in circadian rhythm

B. Stages of sleep according to modern physiology:

- **Stages of Sleep**: - Sleep is an integrative function of cerebrum. Sleep is a state of altered consciousness or partial unconsciousness from which an individual can be aroused. Normal sleep consists of two components:

1. NREM sleep – Non rapid eyeball movement sleep
2. REM sleep – Rapid Eyeball movement sleep

1. **NREM sleep / Synchronised sleep / Deep sleep**:-

It is a restful sleep which includes decrease in both peripheral vascular tone and many other functions of the body. Though this sleep is frequently called "dreamless sleep", dreams occur often during NREM also. Only the process of consolidation of the dreams in memory does not occur. So these dreams cannot be recalled.

NREM sleep consists of four gradually merging stages:

Stage 1 (Drowsiness) is a transition stage between wakefulness and sleep that normally lasts 1–7 minutes. The person is relaxed with closed eyes and fleeting thoughts.

Stage 2 or light sleep : In it, a person is a little more difficult to awaken. Dreams may be experienced, and the eyeball movement can be seen.

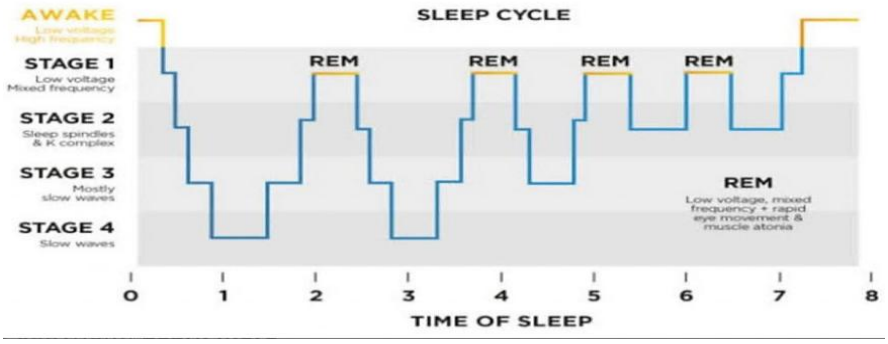
Stage 3 : M**oderately deep sleep**. Decrease in body temperature and blood pressure, and the person is difficult to awake.

Stage 4 Deep sleep: Brain metabolism decreases significantly. Most of the reflexes are intact and muscle tone is decreased only slightly. Bedwetting, night terrors or sleepwalking in children are common in this phase.

Recently stage 3 & 4 are considered as one as Slow Wave sleep (SWS), labelled as stage 3. So total 3 stages of NREM N1, N2 and N3.

2. **REM sleep** – (Desynchronized sleep):-

In REM sleep the eyes move rapidly back and forth under closed eyelids. The REM period starts outlasting from 5 to 10 minutes and gradually lengthens until the final one last about 50 minutes. The brain is highly active and overall brain metabolism may be increased as much as 20%. Because there is increased blood flow to cerebrum during REM sleep than in NREM sleep. Therefore this type of sleep is also called as paradoxical sleep, because it is paradox that a person can still be asleep despite marked activity in the brain. The EEG waves are similar to those of N1 of NREM sleep. It is usually associated with active dreaming. The person is even more difficult to arouse by sensory stimuli than during deep sleep. The muscle tone throughout the body is exceedingly depressed indicating strong inhibition of spinal projections from the excitatory areas of the brain stem. The heart rate and respiratory rate usually becomes irregular, which is characteristic of dream state. Following REM sleep the person descends again to stages 2, 3, 4 of NREM sleep.



Graph No. 1. Stages of sleep with respect to time duration [3]

Depth of sleep : Maximum depth at the end of 1st hour after a person falls asleep. In a typical 7 or 8 hours of sleep period, a person goes from stage 1 to 4 of NREM sleep in less than an hour. Then the person ascends to stage 3, stage 2 and then to REM sleep within 50 to 90 minutes. REM and NREM sleep alternate throughout the night with approximately 90 minutes intervals between REM periods. This cycle repeats itself for 3 to 5 times during the entire sleep period. The REM period starts outlasting from 5 to 10 minutes and gradually lengthens (at the expense of stage 4) until the final one lasts about 50 minutes.

Sleep Requirement: Varies inversely with age. As the age advances, total sleep time decreases, percentage of REM declines.

SWS / NREM –

Stage 4 – Declines steeply during childhood, Declines slowly after age 30, Disappears completely after age 60

Stage 4 of NREM sleep decreases as the dominance of *Kapha Dosha* decreases according to age. So as the age advances sleep duration becomes less, & sleep becomes lighter.

REM sleep – Declines sharply till puberty Declines sharply after age 60, because total sleep time is reduced significantly

At age 60 – most of the sleeping time is in N1 & N2. N3 disappears

So there is less memory consolidation. So loss of memory, Amnesia, Alzheimer's like symptoms are common in old age.

Table no. 2. Sleep requirement & percentage of stages of sleep according to age:

Age	Sleep requirement	NREM		REM		*Dosha* Dominance
		%	Total duration	%	Total duration	
New born	16-20 hours	50%	8-10 hours	50%	8-10 hours	*Kapha*
Children	12-14 hours	65%	8 hours	35%	5 hours	*Kapha*
Adults	7-9 hours	75%	5 hours	25%	2 hours	*Pitta*
Old age	5 hours	75%	3 hours	25%	2 hours	*Vata*

As the person ages, average time spent during sleep decreases, in addition the percentage of REM sleep decreases. It has been suggested that, the high percentage of REM sleep in infants and children reflects increased neuronal activity, which is important for maturation of the brain. Neuronal activity is more during REM sleep than during intense mental or physical activity while awake.

From the above table, maximum time spent in sleep is occupied by NREM sleep, and REM sleep constitutes the remaining time. In Ayurveda also *Kapha Dosha* is considered as the main *Dosha* required inducing sleep. [4]

- **Physiological changes in the body during sleep:**

During sleep, activity in the parasympathetic division (Rest & Digest) of the autonomic nervous system (ANS) increases while sympathetic activity (Fight & Fright) decreases.

Table no. 3. *Dosha* dominance in Different stages of sleep

Stage of sleep	Physiological changes	Related *Dosha karma*	*Dosha* dominance
REM	Rapid eyeball movement	Increased motion	*Vata* [5]
	Memory consolidation	Memory	*Vata*
	Irregular HR, RR	Irregular motion, Desynchronised	*Vata*
	Penile erection in males	complex interaction of psychological, neural, vascular, and endocrine factors	*Vata*
NREM	RR falls	Slow motion	*Kapha* [6]
	BMR decreased	Less calorie requirement, prolonged state of physical inactivity	*Kapha*
	GI motility increased	Increased motion	*Vata*

- **Sleep according to *Prakriti*** :

Vata Prakriti individuals experience mostly light sleep. They have less sleep requirement quantitatively, [7] *Kapha Prakriti* individuals have more amount of sleep & experience mostly deep sleep [8].

According to EEG, NREM is synchronised sleep & REM is desynchronised sleep. REM sleep is an active period marked by mixed frequency brain wave activity. Brain waves are fast and desynchronized; Beta waves are seen in both REM sleep and alert wakefulness.[9] In NREM sleep there's reduction in total physiological activity. As sleep deepens, a person's brain waves slow down and gain amplitude.

C. Time of sleep:

Particular time period for a proper sleep is mentioned in *Dakshasmruti*. If a night is divided in 4 parts, the first and last parts are reserved for *Vedabhyas* (study of *Veda*) and middle 2 parts should be indulged in sleep. [10]

If we consider the sunset approximately at 6:30 pm then one should go to sleep by 9:30 pm. And if we consider the sunrise at 6:30 am then one should get up at 3:30 am. So 9:30 pm to 3:30 am is the time of sleep according to this verse. According to *Ayurveda*, daily routine starts with wake up time at *Brahma Muhurt*. It is the first 48 minutes of period of last three hours (*Yama*) of the night because it is the best time for obtaining *Brahma* or knowledge. Any time from 3:00 AM to 6:00 AM is the time to get up from the bed. [11]

According to modern science also, one should be asleep at least six hours before the lowest body temperature. The lowest level of body temperature is reached at around 4 a.m. [12]. So time of sleep is 6 hours before that i.e. at 10 pm.

If the ideal sleep time is 9:30 pm to 3:30 am then first one and half hour of sleep is dominated by *Kapha* which is maximum occupied by NREM sleep, then maximum period of sleep nearly 4 hours are dominated by *Pitta Dosha* in which NREM & REM alternate each other and last one and half hour is dominated by *Vata* which is maximum occupied by REM sleep. [1]

- **Arousal**

For arousal, there should be increased activity in the Reticular Activating System (RAS). This RAS consists of sensory axons that project to

the cerebral cortex. It helps maintain consciousness & is active during awakening from sleep. It receives sensory impulses from eyes & ears, but not from nose. So even strong odours may fail to cause arousal. Sleep does not affect all the senses equally. Smell & taste are most suppressed. Pain, touch & hearing are least affected.

In *Ayurveda*, *Vata Dosha* is the stimulator for all the sense organs, it carries all the perceptions to the particular sense organs. [13] So RAS is activated by *Vata Dosha* at the last part of night which causes arousal. In a specific study, dominance of the *Vata Dosha* was reported to be associated with increased arousals at night, in persons over the age of 60 years. [14]

D. Chemicals responsible for sleep in brain:

NREM and REM sleep is mediated by different parts of the brain. Neurons in the preoptic area of the hypothalamus, the basal forebrain, and the medulla oblongata are responsible for NREM sleep; neurons in the pons and midbrain are for REM sleep. Several researches suggest the presence of sleep-inducing chemicals in the brain.

a) Adenosine: It's a neurotransmitter which causes central nervous system depression. Its amount in brain cells increase with the ATP (adenosine triphosphate) use in the awake state. It binds to the A1 receptors and inhibits certain cholinergic neurons of the RAS that are responsible for arousal.[10] At the beginning of sleep Adenosine level is high due to prolonged use of ATP during daytime. [9] This may be correlated with *Kapha Dosha* dominance in the first part of night.

b) Melatonin: Melatonin is responsible for the circadian rhythm of the body, which is controlled by the suprachiasmatic nucleus of the hypothalamus. Stimulus for its secretion is darkness, and exposure to light diminishes the hormone level. So low levels of melatonin is secreted during the day and significantly higher levels are secreted at night.[15]

Table no. 4. Time of peak levels of hormones in blood coinciding with *Dosha* dominance

***Dosha* Dominance**	**Diurnal timing**	**Hormonal changes**
Kapha	After sunset	Adenosine increases inside the brain cells, Melatonin & Thyroid Stimulating Hormone increases in blood
Pitta	Mid night	Growth Hormone, Prolactin, Adrenocorticotropic hormone peak levels in blood which are involved in many chemical processes in body.
Vata	Before sunrise	Adenosine decreases as it is converted into ATP, Melatonin decreases with sunlight

From above observation we can correlate the role of Adenosine in sleep is similar to role *Kapha Dosha* and role of melatonin is similar to that of *Tamoguna*. [16] Some other hormones are observed to be in peak blood values coinciding with the respected *Dosha* dominance. Further studies are required for the same. Sleep is actually a homeostatic mechanism of body, may it be at any point of day or night, maintains homeostasis. [17]

CONCLUSION:

- Sleep commences with stage 1 of NREM sleep. This stage lasts for about 90 minutes. Maximum depth of sleep is at the end of 1st hour. So NREM sleep coincides with the *Kapha Dosha* Dominance period.
- Duration of REM sleep increases as the sleep advances at the expense of stage 4 of NREM sleep. It may last as long as 50 minutes at the last part of sleep. *Vata Dosha* dominance is more in last part of sleep. So REM sleep coincides with the *Vata Dosha* Dominance period.
- Physiological changes in NREM sleep are very much similar to the functions of *Kapha Dosha* and that of REM sleep are similar to functions of *Vata Dosha.*
- EEG changes in REM sleep show similar waves as that of alert wakefulness which is the function of *Vata Dosha.* EEG changes in NREM sleep show slow wave pattern which is the function of *Kapha Dosha.*

CLINICAL SIGNIFICANCE:

In sleep disorders it is mandatory to take sleep history & advise the patient about ideal sleep regime. Also REM sleep disorders like narcolepsy can be treated with pacification of *Vata Dosha.* NREM sleep disorders like somnambulism, bruxism etc. can be treated with pacification of *Kapha Dosha*. This will also help in some metabolic diseases. Proper consumption of sleep at proper time may aid in their treatment & prognosis of disease. Clinically when the patient complains of insomnia, advise him to go to bed early in night. In the patient of constipation, advise him to wake up early in the morning. So *Dosha* dominance in particular stage of sleep may help clinically.

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