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Divāsvapna and Artificial Light at Night: An Ayurvedic–Modern Perspective on Santarpaṇajanya Disorders, Obesity and Prameha

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ABSTRACT: **Background**. Ayurveda treats appropriate sleep (Nidra) as one of the three supporting pillars of life and regards inappropriate daytime sleep (Divāsvapna) as a lifestyle factor that aggravates Kapha and promotes the accumulation of Meda and Kleda. These ideas underpin the Ayurvedic understanding of Santarpaṇajanya Vikāra, including Sthaulya and Prameha. In modern chronobiology, the natural light–dark cycle entrains the circadian clock, and light exposed during the biological night can disturb hormonal secretion, sleep and metabolic regulation.

Objective. To explore the relationship between the Ayurvedic concept of Divāsvapna and modern evidence on sleeping with artificial light at night (ALAN), with particular reference to Santarpaṇajanya Vikāra, obesity and Prameha.

Materials and Methods. A narrative review was undertaken. Classical Ayurvedic concepts of Nidra, Divāsvapna, Santarpaṇa, Kapha, Meda, Kleda, Sthaulya and Prameha were examined alongside Ayurvedic review literature. Modern evidence was drawn from experimental, epidemiological and clinical chronobiology, with particular emphasis on the prospective cohort study.

Results. Ayurveda describes inappropriate daytime sleep as capable of increasing Kapha and contributing to Meda and Kleda accumulation. Modern research shows that artificial light during sleep is associated with weight gain and obesity. In 43,722 women aged 35–74 years followed for about 5.7 years, sleeping with a light or television in the room was

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associated with a 17% higher relative risk of gaining 5 kg or more, a 22% higher risk of incident overweight and a 33% higher risk of incident obesity, compared with sleeping without artificial light (Park et al., 2019). Experimental studies in animals and humans offer plausible mechanisms, including melatonin suppression, circadian misalignment and impaired glucose handling.

Conclusion. Divāsvapna and exposure to artificial light during the biological night are not identical phenomena. Both, however, can be discussed within an integrative framework of disturbed sleep–wake timing and metabolic homeostasis. The Ayurvedic concepts of Kapha, Meda, Kleda and Santarpaṇa offer a conceptual language for metabolic disorders, while modern evidence indicates that ALAN may be a modifiable obesity risk factor. Clinical and experimental studies are needed to test whether sleep timing and light exposure influence Prameha and its Ayurvedic indicators.

1. INTRODUCTION

Sleep is a central determinant of health in both Ayurveda and contemporary biomedical science. Ayurveda counts Nidra among the three supporting pillars of life (Trayopastambha), together with Āhāra and Brahmacarya, and gives detailed guidance on when, how long and under what conditions a person should sleep. Modern physiology, for its part, has moved from viewing sleep as passive rest to recognising it as an actively regulated state in which hormones are secreted, energy metabolism is recalibrated and tissues are repaired.

The present era has altered the conditions of sleep more rapidly than any earlier period in human history. Electric lighting, television, smartphones and illuminated cities have blurred the boundary between day and night. One attempt to examine a consequence of this change is the prospective cohort study by Park et al., 2019, which asked whether sleeping with artificial light in the room is associated with obesity and weight gain in women (Park et al., 2019). The study was summarised for the general public by the National Institutes of Health, which stressed both its findings and its limits (National Institutes of Health, 2019).

Ayurveda approaches metabolic disease through a different vocabulary. Divāsvapna, broadly understood as sleep taken during the daytime, is not condemned in all circumstances. Its effects depend on season, constitution, age, physical exertion and the condition of the individual. Nevertheless, inappropriate or habitual daytime sleep is described as increasing Kapha and influencing Meda and Kleda. This matters because Kapha–Meda accumulation lies at the centre of the Ayurvedic understanding of Santarpaṇajanya Vikāra, the group of disorders attributed to over-nourishment and a sedentary way of life. Sthaulya (obesity) and Prameha (a group of disorders with abnormal urinary and metabolic features that includes, but is not limited to, what modern medicine calls diabetes mellitus) are prominent among them. Contemporary Ayurvedic review literature has proposed a conceptual correlation between Santarpaṇotta Vikāra and modern metabolic disease (Pooja et al., 2020).

The classical sources that frame this discussion are the Charaka Saṃhitā (Sharma and Dash, 2014), the Suśruta Saṃhitā (Sharma, 2010) and the Aṣṭāṅga Hṛdaya (Murthy, 2012). Each addresses sleep, the regulation of daily routine, and the genesis of Sthaulya and Prameha, although with differing emphasis and organisation.

In modern physiology, sleep is tightly linked to the circadian rhythm, an endogenous cycle of about 24 hours that is synchronised principally by the environmental light–dark cycle. Light reaching the eye during the biological night, whether from a bedside lamp, a television, a mobile device or a streetlight outside the window, can interfere with normal circadian signalling. The consequences of this interference for body weight and metabolic risk are now a matter of active epidemiological and experimental investigation.

This article brings the two traditions into conversation, with three guiding principles. First, it distinguishes carefully between Divāsvapna, a classical Ayurvedic concept, and artificial light exposure during night sleep, a modern environmental exposure. They are not synonyms, and the article does not treat them as such. Second, it separates doctrine from evidence: Ayurvedic pathophysiology is presented as an interpretive framework, not as a biomedical causal pathway, and the modern findings are presented as associations from observational and experimental studies. Third, it treats the integration as hypothesis-generating.

The aim is to identify questions that deserve testing, particularly regarding Prameha, rather than to claim that either body of knowledge has proved the other.

The article proceeds as follows. Section 2 sets out the Ayurvedic concept of Divāsvapna, Section 3 its relation to Kapha, Meda and Kleda, and Section 4 Santarpaṇa and Santarpaṇajanya Vikāra. Section 5 reviews the modern biology of light, the circadian clock and artificial light at night. Section 6 examines the evidence linking ALAN to obesity and metabolic dysfunction, Section 7 develops the Ayurvedic–modern correlation, Section 8 addresses Prameha and Section 9 compares Divāsvapna with ALAN. Section 10 discusses clinical and preventive implications, and Sections 11 to 13 present limitations, research directions and conclusions.

2. THE AYURVEDIC CONCEPT OF DIVĀSVAPNA

Definition and etymology

The term Divāsvapna is a compound of *divā* (daytime) and *svapna* (sleep, from the root *svap*, to sleep). It therefore denotes sleep taken during the day. The classical texts treat it as a topic within the broader discussion of Nidra and of the daily and seasonal regimens (Dinacaryā and Ṛtucaryā), and they return to it in the context of the causes of Sthaulya and Prameha (Sharma and Dash, 2014; Sharma, 2010; Murthy, 2012).

A scientific discussion must recognise that Ayurveda does not classify every episode of daytime sleep as pathological. The classics describe circumstances in which daytime sleep is permitted or even recommended, and circumstances in which it is contraindicated. For the purposes of this article, Divāsvapna refers specifically to habitual or inappropriate daytime sleep in individuals for whom it is not indicated.

Nidra as a pillar of life

In the Charaka Saṃhitā, Nidra is named with Āhāra and Brahmacarya as one of the three *upastambha*, the supports that sustain the body when they are properly regulated (Sharma and Dash, 2014). Appropriate sleep is associated with happiness, nourishment, strength, vitality, knowledge and long life, whereas inappropriate sleep, whether too much, too little or at the wrong time, is associated with unhappiness, emaciation, weakness, loss of vitality and disease. The same text describes Nidra as a state in which the mind (*manas*) and the sense organs withdraw from their objects because of exhaustion, and it relates the quality of sleep to the balance of the doshas.

The Suśruta Saṃhitā and the Aṣṭāṅga Hṛdaya elaborate this picture. Nidra is traditionally linked with the predominance of *tamas* and with Kapha in the body, and the classics classify sleep by its origin, for example sleep arising from natural bodily processes, from the accumulation of Kapha, from mental or physical exhaustion, and from disease (Sharma, 2010; Murthy, 2012). This classification makes clear that Ayurveda regards the timing and the cause of sleep as clinically meaningful, not merely its duration.

Daytime sleep: permitted, restricted and prohibited

The classical position can be summarised in three statements.

1. **Daytime sleep is generally discouraged.** In most seasons and for most healthy individuals it is considered to aggravate Kapha and Pitta, to produce heaviness, to impair digestion and to contribute to disorders such as drowsiness, headache, swelling, nausea, loss of appetite and skin and metabolic disorders (Sharma and Dash, 2014; Murthy, 2012).
2. **Daytime sleep is permitted in summer.** In the hot season (*grīṣma*), the body is depleted of moisture, Vata tends to increase and Kapha tends to decrease, and the nights are short. Daytime sleep is therefore permitted, and in that season it is not expected to produce the harms described above.
3. **Daytime sleep is permitted for particular groups and circumstances.** The classics list those who are exhausted by singing, study, alcohol, sexual activity, evacuative therapies, carrying heavy loads, long walks or vigorous exertion; those who are suffering from grief, anger or fear; those who are very young or very old; the emaciated; and those who have injuries, chronic respiratory disease, colic, diarrhoea, hiccups, indigestion or who have been deprived of night sleep. For them, day sleep is considered to support the tissues and restore Vata.

In these classical accounts, the same act (sleeping by day) is therefore beneficial, neutral or harmful according to the person and the setting. This individualisation is characteristic of Ayurveda, which assesses a behaviour in relation to the season (*kāla*), the individual constitution (*prakṛti*), the state of the doshas (*doṣa-avastha*) and the person's habits (*sātmya*).

It is worth noting that contemporary epidemiology also finds that daytime napping is not uniformly harmful. A dose–response meta-analysis found a J-shaped relationship between nap duration and the risk of type 2 diabetes and metabolic syndrome: short naps were not associated with increased risk, whereas long naps were (Yamada et al., 2016). This resonates with the Ayurvedic insistence on appropriate and inappropriate daytime sleep, although the two bodies of knowledge differ in method, definition and purpose, and no equivalence should be drawn.

Divāsvapna among the causes of Sthaulya and Prameha

In the classical aetiologies of Sthaulya, the Charaka Saṃhitā lists habitual overeating of heavy, sweet, cold and unctuous foods, lack of physical exercise, lack of sexual activity, daytime sleep, a constantly cheerful and carefree disposition, absence of mental exertion and hereditary factors (Sharma and Dash, 2014). The Sthaulya of this description is a condition in which Meda increases disproportionately and the person is said to be compromised in movement, longevity, vitality, sexual function and efficiency, and to experience excess sweating, odour, hunger and thirst.

The aetiology of Prameha is similarly characterised by a regimen that favours Kapha: sedentary habits, a preference for sleeping and sitting, curds, the meat of animals of marshy or aquatic habitat, milk preparations, new grains and sweet, unctuous and cold foods, together with an overall absence of exercise (Sharma and Dash, 2014; Sharma, 2010). Divāsvapna and the comfort of sleep and rest therefore appear in the classical lists of causes, as part of a broader lifestyle pattern.

3. DIVĀSVAPNA AND THE DOṢA–DŪṢYA FRAMEWORK

Why Kapha?

In Ayurvedic physiology, Kapha is characterised by the qualities of heaviness (*guru*), coldness (*śīta*), unctuousness (*snigdha*), stability (*sthira*) and sliminess (*picchila*). Its functions are lubrication, cohesion, stability and nourishment of the body. Qualities in the environment, food or behaviour that resemble those of Kapha increase it, on the principle of *sāmānya* (similarity), whereas contrary qualities reduce it.

Nidra, as a state of reduced activity, sensory withdrawal and heaviness, is considered to share these Kapha qualities. Sleep during the daytime, particularly outside summer and in the absence of exhaustion, is therefore said to add stagnation and heaviness to a system that is naturally more active and warm. Because Kapha predominates in the morning and in the early part of the day and night, as described in the classical account of the daily cycle, sleeping at those times is a further reinforcement of Kapha quality.

From Kapha to Meda and Kleda

The dhātu (tissue) framework describes seven successive tissues, in which Meda (adipose and related tissue) is the fourth. Meda is nourished by Rasa and Rakta and by the quality of Agni, and, like other dhātus, can increase when its nourishing and regulating processes are disturbed. Kleda, a term that denotes moisture, fluidity or an unctuous, sticky waste-like quality, accumulates in the body when digestion and metabolism are inefficient (Agnimāndya), and is a key intermediary in the formation of Prameha.

The Ayurvedic interpretation can therefore be written as a sequence:

Inappropriate Divāsvapna → Kapha increase → Agnimāndya and Meda/Kleda involvement → metabolic disturbance

This sequence is an Ayurvedic pathophysiological interpretation. It is not a directly established biomedical causal pathway and should not be presented as one. Its value is that it places sleep timing into the same explanatory structure as diet and activity, so that a clinician can reason about all three together.

The role of Agni and Srotas

Two further concepts complete the picture. The first is Agni, the digestive and metabolic fire. Heaviness and stagnation associated with Kapha excess are held to depress Agni, resulting in incomplete digestion, the production of *āma* (incompletely processed material) and further accumulation of Kleda. The second is Srotas, the channels through which tissues and substances

move. The Medovaha srotas (channels of fat metabolism) and Mūtravaha srotas (channels of urine formation and excretion) are particularly implicated in Sthaulya and Prameha. Obstruction of these channels (*srotorodha* or *srotoduṣṭi*) by Kapha, Meda and Kleda is described as one of the pathways by which excess adiposity and abnormal urinary and metabolic features arise.

4. SANTARPAṆA AND SANTARPAṆAJANYA VIKĀRA

The concept of Santarpaṇa

Santarpaṇa means nourishment or satiation, and in the Charaka Saṃhitā it stands as one of the two fundamental therapeutic principles, the other being Apatarpaṇa (depletion or lightening) (Sharma and Dash, 2014). Santarpaṇa is the opposite of Langhana. It is therapeutically used in depleted, emaciated or weakened persons. When it occurs in excess, through overeating, through a diet dominated by heavy, sweet, unctuous or cold items, or in combination with inactivity, it becomes pathogenic and produces what the texts call Santarpaṇajanya (or Santarpaṇotta) Vikāra.

The classical enumeration of such disorders includes Prameha, Kuṣṭha, Pāṇḍu, Sthaulya, a variety of skin eruptions and boils, abnormal sensations of heaviness and lethargy, and various disorders attributed to the blockage of channels. Many of these are conditions that modern medicine would assign to the territory of metabolic and lifestyle-related disease.

Ayurvedic review evidence on Santarpaṇotta Vikāra and metabolic disease

The relationship between Santarpaṇotta Vikāra and contemporary metabolic disorders has been explored in the Ayurvedic review literature. Pooja et al., 2020, in a review article published in the Journal of Ayurveda and Integrated Medical Sciences, examined the relationship between excessive nourishment, impaired metabolism and metabolic disorders, and proposed that Santarpaṇajanya Vikāra may be conceptually correlated with metabolic disorders arising from over-nourishment and metabolic impairment (Pooja et al., 2020). The authors discussed several disorders, including Prameha, Pāṇḍu, Ati-sthaulya and Kuṣṭha, within the broader framework of Santarpaṇotta Vikāra. They emphasised the role of lifestyle factors in the development of metabolic disorders and described Apatarpaṇa, particularly Laṅghana, as an important therapeutic approach.

This review is valuable because it supplies an Ayurvedic conceptual foundation that complements the modern human observational evidence discussed later in this article. It must, however, be read for what it is. It is a narrative and conceptual correlation, not an experimental demonstration, and it does not establish that any specific exposure causes any specific Ayurvedic disorder.

Sleep as one component of a lifestyle pattern

A central point emerges from the classical sources and the review literature: inappropriate sleep habits are discussed as one component of a broader pattern, not as an isolated cause. A person who sleeps in the daytime without need, eats heavy and sweet food in excess, does not exercise and has little mental or physical stimulation is the person in whom the classical texts expect Kapha–Meda accumulation. In this reading, reducing inappropriate Divāsvapna is one part of an Apatarpaṇa-oriented regimen that also includes appropriate diet, exercise and attention to daily routine. This is consistent with the practical aims of the article: to identify modifiable behaviours, not to single out one behaviour as the cause of disease.

5. LIGHT, THE CIRCADIAN CLOCK AND ARTIFICIAL LIGHT AT NIGHT

The circadian system

The human circadian system is a hierarchy of biological clocks. The master pacemaker lies in the suprachiasmatic nucleus (SCN) of the hypothalamus, and subsidiary clocks operate in nearly every tissue, including the liver, pancreas, muscle and adipose tissue. The SCN is synchronised to the external day mainly by light, and it in turn coordinates the timing of sleep, body temperature, hormone release, appetite, digestion and glucose metabolism. Environmental light and darkness are the most powerful *zeitgebers* (time-givers) of this system, which is why sleeping at night and being awake and active in the day is described as a light-related circadian rhythm.

The daily rhythm of melatonin is the best known output. Melatonin is secreted by the pineal gland during darkness, and its levels rise in the evening, peak in the middle of the night and fall toward morning. It signals the "biological night" to the rest of the body, and it is rapidly suppressed by light. In addition to its role in the timing of sleep, melatonin is thought to influence

glucose metabolism, energy expenditure and the function of adipose tissue, which is one reason it features in hypotheses linking light at night with metabolic disease.

How light reaches the clock

Light information reaches the SCN through a dedicated retinal pathway. A subset of retinal ganglion cells containing the photopigment melanopsin responds directly to light and projects to the SCN. These intrinsically photosensitive cells are most sensitive to short-wavelength (blue) light, and they set the circadian clock independently of the rods and cones that mediate vision (Berson et al., 2002). Human studies of the action spectrum for melatonin suppression found peak sensitivity near 460–480 nm, in the blue part of the spectrum (Brainard et al., 2001). This explains why the wavelength composition of an artificial light source, as well as its intensity, matters for its circadian impact.

An important implication is that circadian effects of light do not require the person to be aware of it. Eyelids transmit a measurable fraction of light, so a person who is asleep in a lit room still receives some retinal illumination. Brightness, duration, timing and spectrum all contribute, and the clock can be influenced by lighting levels well below those required for comfortable reading.

What counts as artificial light at night?

Artificial light at night (ALAN) arises from several sources, and it is useful to separate indoor from outdoor exposure.

- **Indoor sources:** room lights left on, television screens, computers, tablets, smartphones and e-readers, and small standby or night-lights.
- **Light entering from outside:** streetlights, illuminated signs and vehicle headlamps that pass through windows.
- **Environmental sky glow:** the diffuse brightening of the night sky over populated areas.

The scale of the phenomenon is considerable. The *New World Atlas of Artificial Night Sky Brightness* estimated that more than 80% of the world's population, and more than 99% of the population of the United States and Europe, live under light-polluted skies, and that about one-third of humanity can no longer see the Milky Way (Falchi et al., 2016). Light at night is therefore not a rare exposure. It is the default condition of modern urban life, and its biological implications apply to a very large number of people.

Evidence that light at night alters circadian physiology

Experimental studies in humans show that evening and night light has measurable effects on the clock. In one laboratory study, exposure to ordinary room light before habitual bedtime suppressed melatonin onset and shortened the duration of melatonin secretion, compared with exposure to dim light (Gooley et al., 2011). In another, participants who read from light-emitting e-readers before bed took longer to fall asleep, had reduced evening melatonin, showed delayed circadian timing and were less alert the following morning than when they read printed books (Chang et al., 2015). These results show that common domestic lighting is sufficient to alter the timing and quality of sleep.

From a broader ecological and physiological perspective, the review by Navara and Nelson, 2007, summarised the consequences of light at night across species, describing disruption of circadian rhythms, endocrine function and behaviour, and drawing attention to epidemiological associations with metabolic disorders and certain cancers (Navara and Nelson, 2007). This broader literature explains why public health researchers began to examine light exposure as an environmental determinant of chronic disease.

Outdoor ALAN has also been studied at the population level. In a large cross-sectional analysis of middle-to-older aged adults in the NIH-AARP Diet and Health Study, higher levels of satellite-measured outdoor ALAN at the residence were associated with shorter sleep duration (Xiao et al., 2020). Such findings link environmental lighting to sleep outcomes that are themselves associated with metabolic risk, as discussed in the next section.

Relevance to the Ayurvedic framework

Ayurveda describes a daily cycle (*Dina–Rātri*) in which activity, food and sleep are arranged in relation to the sun, and it recommends that the day begin early and sleep occur at night. Whether or not the classical authors had a concept equivalent to melatonin, their regimen reflects an understanding that the rhythm of the natural world is a determinant of health. Modern

chronobiology confirms the importance of that rhythm in precise physiological terms, and it also reveals a modern disturbance, that of artificial light during the night, that the classical texts could not have described. For this reason the present article treats ALAN as a contemporary parallel to classical concerns about disturbed sleep timing, not as a classical entity.

6. EVIDENCE LINKING ARTIFICIAL LIGHT AT NIGHT WITH OBESITY AND METABOLIC DYSFUNCTION

The Sister Study cohort analysis

The most direct human evidence for the present discussion comes from the study of Park et al., 2019, a prospective cohort analysis using data from the Sister Study, a national cohort of women whose sisters had been diagnosed with breast cancer (Park et al., 2019). The final analysis included 43,722 women aged 35–74 years who were not shift workers, daytime sleepers or pregnant at baseline. Participants reported their exposure to artificial light while sleeping in four categories:

1. No light.
2. A small night-light in the room.
3. Light coming from outside the room.
4. A light or television on in the room.

At baseline, investigators collected weight, height, waist and hip circumference and body mass index (BMI), along with a wide range of covariates. Participants were followed for an average of approximately 5.7 years, after which weight was reassessed. Women who slept with any artificial light were more likely to be obese at baseline, and any artificial light exposure during sleep was associated with incident obesity during follow-up. In particular, compared with sleeping without artificial light, sleeping with a television or light on in the room was associated with:

- a 17% higher relative risk of gaining 5 kg (about 11 lb) or more;
- a 22% higher relative risk of incident overweight; and
- a 33% higher relative risk of incident obesity (Park et al., 2019).

The gradient across exposure categories is informative. According to the NIH summary, the association for light coming from outside the room was more modest, and using a small night-light was not associated with more weight gain than sleeping with no light (National Institutes of Health, 2019). This pattern suggests that the intensity and proximity of the light matter, a feature consistent with a biological, dose-related effect.

The robustness of the findings is also relevant. The associations did not change substantially after adjustment for age, having an older spouse or children in the home, race, socioeconomic status, area of residence, caloric intake, night-time snacking, physical activity, and sleep duration and quality. As the senior investigator observed, poor sleep on its own was associated with obesity and weight gain but did not explain the association between artificial light during sleep and weight (National Institutes of Health, 2019). The authors nonetheless acknowledged that they could not exclude residual confounding, and called for further prospective and interventional studies (Park et al., 2019).

Two cautions are essential. First, this is an observational cohort study, so its findings demonstrate association, not causation. Second, the participants were women aged 35–74 years, so the findings should not be generalised automatically to men, children or older adults. These points recur throughout this article.

Experimental evidence from animal models

The plausibility of the epidemiological finding is strengthened by controlled experiments in animals. In a widely cited study in mice, exposure to dim light at night, as compared with a standard light–dark cycle and equal caloric intake and activity, increased body mass and adiposity, and the effect was accompanied by a shift in the timing of food intake toward the usual rest phase (Fonken et al., 2010). When food access was restricted to the normal active phase, the weight-promoting effect of light at night was prevented. The experiment suggests that mistimed feeding is an important mediator, a finding consistent with the NIH observation that experimental animal studies point to changes in circadian rhythm and altered eating patterns.

Genetic studies point in the same direction. Mice carrying a mutation of the *Clock* gene, a core component of the molecular circadian oscillator, develop hyperphagia, obesity, hyperleptinaemia, hyperlipidaemia, hepatic steatosis and hyperglycaemia, a cluster that closely resembles the metabolic syndrome (Turek et al., 2005). Circadian physiology and metabolism are, in other

words, mechanistically interwoven: nutrient sensing, hormone secretion and fuel handling are all under circadian control (Panda, 2016). The review by Panda, 2016, describes how the timing of food intake, activity and light shapes the metabolism of the liver, pancreas, muscle and fat, and why disruption of these rhythms can promote obesity and insulin resistance.

Human evidence on circadian misalignment

Human experiments on circadian misalignment provide a parallel line of evidence. In a controlled laboratory protocol in which participants were scheduled to eat and sleep 12 hours out of phase with their internal clock, circadian misalignment increased postprandial glucose despite increased insulin, reduced leptin, reversed the cortisol rhythm and increased mean arterial pressure, and a number of participants entered a prediabetic range of postprandial glucose during the misaligned condition (Scheer et al., 2009). Although the stress of an extreme laboratory shift schedule is much greater than that of a bedside lamp, the study shows that human glucose regulation depends on alignment of behaviour with the internal clock.

Melatonin, chronodisruption and metabolic syndrome

Melatonin has been proposed as a link between light at night and metabolic disease. Reiter et al., 2012, reviewed evidence that chronodisruption (disturbance of normal circadian organisation), sleep deprivation and suppressed melatonin are associated with obesity and the metabolic syndrome, and discussed how melatonin influences insulin sensitivity, lipid metabolism and the function of brown adipose tissue (Reiter et al., 2012). They also noted that light at night, which lowers melatonin, may be a contributor to the epidemic of metabolic disease. It should be added that the strength of the evidence for melatonin as the sole or main mediator in humans is limited, and that other pathways, including altered sleep architecture, sympathetic activation and mistimed eating, probably operate in parallel.

Other observational studies

The Sister Study finding is not isolated. In the HEIJO-KYO cohort of elderly Japanese adults, objectively measured bedroom light exposure during sleep was associated with obesity, assessed by BMI and abdominal adiposity, and with dyslipidaemia in a cross-sectional analysis (Obayashi et al., 2013). In the Korean Genome and Epidemiology Study, higher levels of outdoor ALAN were associated with obesity and with sleep-related outcomes in adults (Koo et al., 2016). Each of these studies has limitations, notably cross-sectional designs and the difficulty of excluding confounding by socioeconomic status, urban living and lifestyle, but they come from different populations and use different methods of measuring exposure. That convergence increases confidence that the association is not simply an artefact of one dataset.

Direct experimental evidence on light during sleep

Perhaps the most relevant human experiment for the present topic comes from a controlled laboratory study in which healthy young adults slept for one night in dim light and for another night in a room with moderate overhead lighting. Sleeping with room light increased heart rate during the night, altered sleep architecture, and increased insulin resistance the following morning, indicating that even a single night of light exposure during sleep can impair cardiometabolic function (Mason et al., 2022). The study is small and short-term, but it demonstrates a physiological pathway that is plausible, rapid and measurable, and it provides a human experimental complement to the cohort data of Park et al., 2019.

Sleep duration, appetite and metabolic risk

Part of the effect of ALAN may operate through sleep itself, although the Sister Study found that sleep duration and quality did not account for the association. The wider literature on sleep and metabolism remains relevant. In a laboratory experiment, healthy young men restricted to four hours of sleep for two nights had lower leptin, higher ghrelin and increased hunger and appetite, especially for energy-dense carbohydrate-rich foods, compared with a longer sleep condition (Spiegel et al., 2004). A meta-analysis of studies in children and adults found that short sleep duration was associated with a significantly increased likelihood of obesity (Cappuccio et al., 2008), and a systematic review and meta-analysis found that both short and long sleep duration were associated with an increased incidence of type 2 diabetes (Cappuccio et al., 2010). Taken together, these findings indicate that sleep quantity, quality and timing are each connected with obesity and diabetes risk, and that exposures which fragment or mistime sleep deserve attention as potential contributors.

A modern pathway, stated cautiously

Integrating these strands, the following modern pathway can be proposed as a working hypothesis:

1. Artificial light reaches the retina during the biological night, even through closed eyelids.
2. Circadian signalling is disturbed, melatonin is suppressed or its duration shortened, and sleep architecture may change.
3. Sleep-related hormonal and metabolic regulation is altered, with effects on insulin sensitivity, leptin and ghrelin, sympathetic tone and the timing of appetite.
4. Appetite, behaviour and the timing of food intake change, and energy expenditure may be reduced.
5. A sustained positive energy balance develops, favouring weight gain and obesity.

This pathway remains an area of active research. It should not be interpreted as a conclusively established mechanism for every individual exposed to ALAN, and different steps are supported by different strengths of evidence, ranging from strong in animals to suggestive in humans.

7. THE AYURVEDIC–MODERN CORRELATION

Two pathways, two languages

An integrative interpretation can place the two explanatory chains side by side.

Ayurvedic perspective

Inappropriate Divāsvapna → Kapha predominance → Meda/Kleda accumulation → involvement of Medovaha and Mūtravaha srotas → Sthaulya / Prameha

Modern perspective

Artificial light during the biological night → circadian disruption → altered sleep and metabolic regulation → possible positive energy balance → weight gain / obesity

These pathways should not be treated as identical or as directly interchangeable. They are different explanatory frameworks that address the relationship between sleep, environmental timing and metabolic health. The Ayurvedic chain is derived from doctrine and clinical observation within a classical system. The modern chain is derived from experimental physiology and epidemiology. What they share is the recognition that when the timing and conditions of sleep depart from the natural pattern, metabolic consequences may follow.

Three levels of evidence

It is helpful to be explicit about the kinds of evidence each tradition contributes and the role each plays in the argument.

Level	Source of evidence	Role in this article
Classical Ayurveda	Charaka Saṃhitā, Suśruta Saṃhitā, Aṣṭāṅga Hṛdaya	Establishes Divāsvapna, Santarpaṇa, Kapha–Meda–Kleda, Sthaulya and Prameha
Ayurvedic review literature	Pooja et al., 2020	Supports the conceptual correlation of Santarpaṇotta Vikāra with metabolic diseases
Modern clinical and experimental evidence	Park et al., 2019; Mason et al., 2022; Fonken et al., 2010	Provides human and animal evidence linking light at night with weight gain, obesity and cardiometabolic changes

No single level proves the whole hypothesis. The Ayurvedic review is a conceptual correlation, and the Sister Study is an observational cohort. Together they support a hypothesis, namely that artificial light during the biological night may represent a modern lifestyle factor that contributes to metabolic dysregulation, which can in turn be interpreted within the Ayurvedic framework of Santarpaṇotta Vikāra. They do not prove that artificial light causes Santarpaṇotta Vikāra or Prameha.

A thesis for integrative discussion

The most defensible statement of the correlation is the following. While Divāsvapna represents sleep during an inappropriate biological period in the Ayurvedic framework, exposure to artificial light during the biological night may represent a different,

modern form of disturbance of the natural sleep–wake cycle. Both situations can be discussed in relation to metabolic imbalance, but they should not be considered identical phenomena.

One way to extend the argument is to observe that both exposures interfere with the contrast between a bright, active day and a dark, restful night. Daytime sleep places rest in the period that the classical regimen assigns to activity, whereas night-time light places a daytime-like signal in the period assigned to rest. Both reduce the amplitude of the daily cycle. This is a hypothesis about shared structure, not a claim of shared mechanism, and it is testable through measurement of rhythm amplitude, sleep timing and metabolic indicators in the same individuals.

8. RELATIONSHIP WITH PRAMEHA

The Ayurvedic account

From an Ayurvedic perspective, Prameha involves complex interactions among Doṣa, Dūṣya, Srotas and metabolic factors. Kapha, Meda, Kleda and Mūtra have important roles in the pathogenesis of several forms of Prameha, and the classical texts distinguish numerous varieties according to the predominant dosha and the characteristics of the urine (Sharma and Dash, 2014; Sharma, 2010). The aetiological lists, as noted above, include sedentary habits, a preference for sleeping and sitting, and Kapha-promoting diet. The texts also describe a progression from premonitory features (*pūrvarūpa*) to established disease, and they distinguish forms that are more amenable to treatment from those that are difficult to manage.

The modern landscape

In modern medicine, obesity and excess adiposity are major risk factors for type 2 diabetes mellitus, through mechanisms that include insulin resistance, ectopic fat deposition and chronic low-grade inflammation. Sleep duration and quality are independently associated with the incidence of type 2 diabetes (Cappuccio et al., 2010), and the experimental data discussed above show that circadian misalignment and light exposure during sleep can impair glucose regulation (Scheer et al., 2009; Mason et al., 2022). The association between inappropriate sleep patterns, obesity and metabolic dysfunction therefore offers a scientifically interesting area for correlation with the Ayurvedic concept of Prameha.

What can and cannot be concluded

The available artificial-light cohort study investigated obesity and weight gain, not Prameha or diabetes itself (Park et al., 2019). It would therefore be scientifically inappropriate to state that the study proves that artificial light at night causes Prameha. Prameha, moreover, is an Ayurvedic disease category that is broader than diabetes mellitus. The appropriate statement is:

Artificial light exposure during sleep has been associated with weight gain and obesity, while obesity and metabolic dysfunction are important components of the modern pathophysiological landscape relevant to type 2 diabetes. The possible relationship between nocturnal artificial light exposure and Prameha requires specific clinical investigation.

9. DIVĀSVAPNA AND ARTIFICIAL LIGHT AT NIGHT: ARE THEY THE SAME?

They should not be considered synonymous. The comparison below summarises the main points of difference and similarity.

Parameter	Divāsvapna	Artificial light at night
Basic concept	Sleep during the daytime	Exposure to artificial light during the biological night, including while sleeping
Framework	Nidra, Kapha, Meda, Kleda and lifestyle	Not a classical Ayurvedic disease entity
Primary disturbance	Sleep occurring in the daytime	Light exposure during the normal dark period
Modern interpretation	May alter sleep timing and behaviour	May influence circadian signalling, melatonin and sleep
Evidence for obesity	Mainly Ayurvedic conceptual and pathophysiological discussion; some epidemiology on long napping	Prospective human evidence of association; supportive animal and experimental data

Evidence for Prameha	Classical Ayurvedic pathophysiological relevance	Direct evidence currently insufficient
Relationship	Inappropriate sleep timing	Nocturnal environmental light exposure

The stronger scientific argument is therefore not that "artificial light at night is Divāsvapna," but that both raise the broader question of how disruption of the natural sleep–wake cycle may influence metabolic health.

10. Clinical and Preventive Implications

The integrative reading suggests that sleep hygiene deserves a place in lifestyle counselling for obesity and metabolic disorders. Recommendations that follow from both Ayurvedic principles and modern evidence include:

- Avoid unnecessary daytime sleep, and avoid prolonged or habitual Divāsvapna in those for whom it is contraindicated, while recognising the classical exceptions for summer, exhaustion, illness, age and similar circumstances.
- Maintain a regular sleep–wake schedule, in keeping with the Dina–Rātri regimen.
- Minimise unnecessary artificial light during sleep, and avoid leaving a television or room lights switched on. A small night-light was not associated with additional weight gain in the Sister Study (National Institutes of Health, 2019), so complete darkness is the ideal but a dim light for safety is not shown to be harmful.
- Reduce evening exposure to bright and blue-rich light from screens, given its effects on melatonin and sleep timing (Gooley et al., 2011; Chang et al., 2015).
- Encourage appropriate physical activity and appropriate dietary quantity and quality, in line with the Apatarpaṇa-oriented approach to Santarpaṇajanya Vikāra (Pooja et al., 2020).
- Treat sleep timing as one component of a comprehensive lifestyle approach to the prevention of obesity and metabolic disorders.

These measures are inexpensive, low-risk and easily communicated, which makes them attractive as adjuncts. They should complement, not replace, established dietary, physical-activity and medical approaches to obesity and diabetes prevention. Practitioners should also individualise advice: a night-shift worker, a person recovering from illness, an older adult with fragmented night sleep and a healthy sedentary adult in a cool season may each need different guidance on sleep timing and lighting.

Counselling should avoid blaming patients for environmental exposures that they do not fully control, such as streetlights or shared sleeping spaces. Practical low-cost steps, including blackout curtains, switching off screens and using warm, dim bedside lighting, can often be adopted without difficulty.

11. LIMITATIONS

This article is a narrative Ayurvedic–modern correlation and has several limitations.

1. Divāsvapna and artificial light exposure at night are not identical exposures.
2. The principal human study was observational and cannot establish causality (Park et al., 2019).
3. The study population was women aged 35–74 years, which limits generalisation to men, children and other age groups.
4. The study evaluated obesity and weight gain, not Prameha.
5. Ayurvedic concepts such as Kapha, Meda and Kleda cannot be directly equated with individual modern biochemical variables.
6. The Ayurvedic review literature cited is conceptual, and the review was narrative, without a systematic search or formal appraisal of study quality.
7. Specific clinical studies are required to determine whether sleep timing or nocturnal artificial light exposure has measurable effects on Ayurvedic parameters and on Prameha.

12. FUTURE RESEARCH PERSPECTIVES

Clinical studies. Prospective studies could compare regular night-time sleep, habitual daytime sleep, night-shift patterns and artificial-light exposure during sleep, with outcomes such as BMI, waist circumference, fasting glucose, HbA1c and insulin resistance. Objective light measurement, for example wearable light sensors, would be preferable to self-report.

Ayurvedic parameters. Studies could additionally assess Kapha status, Agni, Meda, Kleda, Srotoduṣṭi and Prameha pūrvarūpa using standardised and validated assessment tools.

Interventional studies. A particularly interesting question is whether reducing artificial light exposure during sleep improves metabolic parameters and Ayurvedic indicators of Kapha–Meda imbalance. Randomised or crossover designs, building on the experimental work of Mason et al., 2022, would provide stronger evidence for an integrative model.

CONCLUSION

Ayurveda emphasises appropriate sleep timing and identifies inappropriate Divāsvapna as a potentially important lifestyle factor in Kapha- and Meda-associated disorders. The concept of Santarpaṇa gives an Ayurvedic framework for understanding over-nourishment and metabolic disorders such as Sthaulya and Prameha.

Modern research has independently shown an association between artificial light exposure during sleep and obesity. In a prospective cohort of 43,722 women, sleeping with a television or light in the room was associated with increased risks of weight gain and incident obesity (Park et al., 2019). Experimental work supports the biological plausibility of this finding.

These findings do not establish that artificial light at night causes Prameha, nor that it is equivalent to Divāsvapna. They offer a scientifically interesting basis for investigating how sleep timing, environmental light, circadian biology and metabolic health are related. The Ayurvedic principle of living in accordance with natural rhythms (Dina–Rātri) can be explored alongside contemporary chronobiology, and well-designed studies are needed to determine whether these conceptual similarities translate into measurable physiological and therapeutic relationships.

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