

**HEAT ADAPTABILITY MECHANISMS & MEASURES OF
GREESHMA RITU: A REVIEW ARTICLE****Madhu Badgujar^{1*} and Anupam Pathak²**¹PG Scholar Deptt of Swasthvrutta & Yoga.²Associate Professor Deptt of Swasthvrutta & Yoga.

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ABSTRACT

India being a tropical country experiences very strong summer season for April to July in different regions of the country, there are numerous deaths are reported every year due to heat wave across the country. Nature has consistent influence on health of human beings; the body exerts its constant effort to acclimatize to varying climatic conditions. The concept of Ritucharya in Ayurveda aims to establish harmonious relation between man and his surrounding, Greeshma ritu is the strongest season of Adana kaala, during this season human beings and other animals experience huge range of thermoregulation. Understanding Greeshma ritu climatologically and the mechanism of body's thermoregulation along with seasonal regimens enable better application of Ritucharya in clinical practice.

KEYWORDS: *Adana kala, Greeshma Ritu*, Climate, Heat adaptation, Thermoregulation.

INTRODUCTION

With an advancing technological society, we are robbed of the time or inclination to synchronize our bodies with the environment and, as a result, we rarely consider that the climate is having an adverse effect on us until our physical body notifies us through ill health. The difference in climatic changes and the way in which human beings, responding to them is found since dawn of time, if it is cold, people would eat hot, and wear warm natural fibers to insulate human bodies and for hot vice versa. Nature gave the foods of the seasons those are needed to survive. Weather still plays a huge part in our environment and continues to affect

our health. The relationship between man and weather continues to be an evolving one and our reaction to the external environment is dependent on several factors, including our age, lifestyle, gender, and location. It is evident that in each season the body tends to adapt itself to maintain the homeostasis, through range of complex physiological, biochemical, and psychological modifications. India generally receives a good strength of insolation or sunlight during the summer season and most part of the country experiences a moderate to severe summer. There are reports of death due to heat wave are recorded from various parts in India, and In the year 2015, BBC news has reported that nearly 1,700 people have died in the worst-hit states of Telangana and Andhra Pradesh, where temperatures rose above 45^{0C} (113^F). In the worst-affected state of Andhra Pradesh, where temperatures have hit 47C (117^F), more than 1,300 people are reported to have died in May. And in the northern and other parts of the country over 2000 people have died in the summer of 2015. The Guardian reported, the heat and the death toll are rising in India. Is this a glimpse of Earth's future? In this scenario the public agencies of India are focusing on effective measures to counter this extreme climatic adverse effect on public health, and thus to prevent and avoid the possible health hazards. The principles of Ayurveda at the core, advocates a harmonious survival with the changing environmental conditions. Ritucharya is the designated principle which exclusively describes the adaptability measures to be taken in different seasons, but this concept is widely ignored. The present article aims to understand Greeshma ritu bio meteorologically and heat adaptability measures which are described in Greeshma ritu charya.

Review of literature

The word Greeshma is derived from 'Gris', which means, fire, fry, boil, burning, Summer, hot season the season which mainly characterized be the extreme heat climatic condition. Ushnaka, Tapa, Nidhaga, Ushnopagama, Ushna and Ushnagama, are the synonyms of the word Greeshma, which conveys the hot nature of season. Gresshma ritu is the strongest season of Adana kaala or Ushna kaala, this season is mainly characterized with extreme hot and dry weather conditions. During adana kaala, tikshna-ushna-ruksha (sharp-hot and dry) properties of the sun and air increases, which ultimately weakens the 'saumya' (moist/soft/gentle) properties of earth. There are two sets of months have been mentioned for Greeshma ritu, one is based on Rasa and bala which exists from Jyeshta to Ashada months (mid-May to mid-July) and another set is from Vaishaka to Jyeshta (mid-April to Mid-June) based on dosha chayaprakopavasta.

The tastes Tikta, Kashaya and katu will be stronger, and the living beings will consistently lose their strength. In this season the sharp sun rays will cause dryness and lightness in human beings as well as medicines, this result in subsiding provoked Kapha (Kapha prashamana) and accumulation of Vata. Greeshma ritu has the dominance of Vayu and Agni mahabhuta, due to this, the season will have hot and dry weather. This absorbs the moistness from all living beings. During this season human beings will experience poor strength. As the sun rays become more powerful, the body feels as if squeezed with increasing atmospheric temperature. This in turn weakens kapha day by day and strengthens vata.

In Greeshma Ritu, the sun's rays appear like that of flowers of atasi (*Linum usitatissimum*) (light blue in color) and are very hot, fire breaks out in the forests, the quarters and the earth seemed to be burning with heat but the breeze from the south-west direction gives comfort feeling. All animals feel like suffering from fever by the effect of hot wind, sun, and consequent sweating. The water in rivers, ponds, lakes etc, are made filthy by elephants, buffaloes, and other animals by dipping themselves in water to reduce their heat, the quantity of water in reservoirs gets reduced by the strong heat of sun. Riverbanks appear prominent due to reduced water flow, trees have no shade under them because of falling of leaves, the leaves, bark and creepers are all dried up.

In summer, the sun is intense, the wind blows from south-westerly which is unpleasant, the earth is heated to a great extent, the herds of chakravaka birds and other animals wander everywhere in search of water; Creepers, shrubs, grass are dried up and trees are bald with no leaves. Vata undergoes chaya, in grishma ritu due to predominance of laghu and rooksha properties of the season. Plants, cultivated for medicines, food and in the body of human beings also the laghu and ruksha guna increases due to similar qualities, but in this condition the Vata do not get prakopa, and remains in chaya avasta due to the hot nature of the season.

Greeshma ritucharya (Regimens of summer season)

After taking bath in refreshingly cold water, saktu (powder of parched paddy) mixed with sugar is nibbled. People should avoid physical exercise, exposure to outdoor environment (Atapa sevana), katu, amla, Lavana and ushna dravyas, Alcoholic preparations should not be taken, if at all one wants to take, may be taken little proportion diluted with much water is permitted, otherwise it shall produce edema, looseness of tissues, burning, delusion. Panaka, mantha, hima, sugar liquids are recommended, meat of birds and animals from arid regions; sweet, cold, liquids, rice, milk, ghee, grapes, tender coconut water with sugar are to be used

plenty. Exposure to cool breeze from the fan prepared of palm tree, using garlands of aromatic flowers, smearing of sandal wood paste on body are advisable. People should spend time near the places like beautiful lakes, ponds, rivers, and forests for recreation. The dress should be very thin, and light sprinkled with perfumes. And it is advised as best to sleep in house having cooling air or shita griha or house equipped with water fountain during daytime and in nighttime, after having smeared body with the paste of sandal wood, one should sleep on the open airy roof of the house which is cooled by the rays of moon. And in open space under sky with sweet aroma flowers all around. The sexual intercourse should be once in fortnight during greeshma ritu and varsha ritu, he who adheres to the regimen prescribed for each ritu does not suffer from diseases arising from the effect of seasons at all.

DISCUSSION

Kaala presents itself as seasons in the environment and state of disease in patient, being a single entity, it has the control over environment and human beings, in Susrutha samhita it is described that, in the naturally occurring seasons, the herbs grow unaffected and water, these being used to promote prana (vitality), Ayu (longevity), Bala (strength), Virya (energy and power) and ojas (the essence of seven dhatus). The progression of doshik state will be normal, it promotes well-being physical body, sense organs, psyche, self, and mind, bala is characterized by enthusiasm and development. The derangement of seasons is caused by the 'adrusta' factor, thus abnormal cold, heat, air and rains affect herbs as well as water adversely. By the usage of such water, medicines, or food there may be appearance of various diseases or epidemic leading to death of the people. The season's exists moderate to severe in nature, the severe nature of the seasons are ought to cause more health hazards than the moderate ones, In charaka samhita it is described that, the moderate seasons are characterized by moderation in cold, heat and rain. They are very enjoyable, and they do not adversely affect the conditions of body and drugs, the severe nature of seasons characterized by extreme cold, heat and rain. They are very unpleasant to body as well as medicines and it causes various health hazards.

Discussion on physical features of greeshma ritu

Greeshma ritu being a very severe hot climate season, we can observe its dominance all over the country. India being a subtropical temperate country experiences a well-defined summer season of varying degree to varying period. The temperatures start to increase all over the country in March and by April; the interior parts of the peninsula record mean daily

temperatures of 30-35°C. Central Indian land mass becomes hot with daytime maximum temperatures reaching about 40°C at many locations. Maximum temperatures rise sharply exceeding 45 °C by the end of May and early June resulting in harsh summers in the north and north-west regions of the country. However, weather remains mild in coastal areas of the country owing to the influence of land and sea breezes.

The period and severity of Greeshma Ritu is varies from regions to region in India, since India a tropical country and geographically having mixed climatic regions. To describe generally the north and north-western part of India will experience very strong to extremely strong summer, during this time these area will have an average temperature ranges between 40^{0C} 44^{0C}, Sri Ganganagar in Rajasthan has recorded 54^{0C} temperature, which is the highest temperature recorded so far in India. Whereas the east and southern region of India will experience a comparatively moderate summer, it is due to the cover of oceans around the peninsular India, which reduces the intensity of temperature, in the most part of peninsular India the average temperature is ranges between 33^{0C} to 36^{0C}, and in North-east India the summer season is very mild in nature and prolonged period of rainy season is observed.

Discussion on heat adaptive measures in greeshma ritu

The human body has a very dynamic intelligent system, which modifies its physiological responses to balance the natural extremes, so that the homeostasis can be kept intact. During Greeshma Ritu the human body undergoes into a large range of thermoregulation mechanism, Humans have an immense capacity to adapt anatomically, biochemically, and physiologically to a broad range of environmental states, these characteristics have been critical to the survival and advancement of the human species. Since all organisms are in a state of dynamic equilibrium with the environment, thermal energy can readily be gained or lost. Humans possess regulatory mechanisms that ensure the stability of the internal environment, with such stability being conducive to life and optimal physiological function. Exposure to exogenous and endogenous (metabolic) heat sources displaces body temperatures upwards. Homeostatic mechanisms, comprised of sensors, signal integrators, effector organs and a communication network, respond by modulating effectors organ function to regulate body temperature within a narrow range. Repeated exposure to heat stress (an adaptation stimulus), either through exogenous sources or high-intensity exercise, elicits adaptations that result in a more effective defense of body temperature.

The temperature of the deep tissues inside body, the “core” of the body remains constant within a narrow range of 0.5°C , i.e. the core temperature of normal human beings ranges from 36.0 to 37.5°C , except in heat stress conditions, Indeed, a nude person can be exposed to temperatures as low as 55°F or as high as 130°F in dry air and still maintain an almost constant core temperature, human body tends to maintain the internal temperature within a narrow range of .05 degree Celsius. Skin is the major organ which regulates the heat balance in the body in relation with the surrounding environment, skin acts as a regulator between the body’s core temperature and the environmental temperature. When the environment temperature is below the comfort range (below 20°C) the skin acts as insulator, thus it protects the internal body temperature. And when the environmental temperature exceeds the maximum tolerance limit of about 40°C , the skin expels more heat from the body through different mechanisms. Heat conduction to the skin by the blood is controlled by the degree of vasoconstriction of the arterioles and the arteriovenous anastomoses that supply blood to the venous plexus of the skin. This process is entirely controlled by sympathetic nervous system in response to changes in body core temperature and changes in environmental temperature, the amount of blood flow and vasoconstriction rate increases in par with increasing environmental temperature.

The body loses heat very much when the environmental temperature is lower than body temperature and gains heat, when the environmental temperature is higher than body temperature. The methods by which heat is lost from skin to the surrounding are 1. Radiation, 2. Conduction, 3. Convection, 4. Cooling effect of wind, and 5. Evaporation.

Vyayama, Vyavaya and Nidra in Greeshma Ritu: It is very specifically mentioned in Greeshma ritucharya, Vyayama should be avoided, and sexual intercourse should be once in fortnight, it seems to be very sensible looking into the nature of season. As described earlier, the body’s core maintains a very narrow range of isothermal state, a slight increase in this temperature causes severe exhaustion. During Physical exercise and sexual intercourse body temperature increases very much, the cardiovascular system serves the metabolic demands of the active muscles and delivers blood to the skin for heat removal, during prolonged exercise, thermal homeostasis is compromised. If heat storage is sufficiently high, or the exposure long enough, then the capacity of the cardiovascular system to serve both the coetaneous and muscle blood flow demands will be compromised.

Blood pressure will fall due to a reduction in central blood volume and a failure of the cardiac output and visceral vasoconstriction to adequately compensate for the intramuscular and cutaneous vasodilatation. This results in a reduction in skin blood flow and heat loss. Sweating remains functional, but there is acceleration in the rate of core temperature elevation. This will lead to fatigue and impaired performance, due to reaching a critical core temperature, a reduction in neuromuscular drive or a reduced metabolic function, hence during Greeshma ritu it advised to avoid physical exercise and sexual indulgence very often. Those who does vyayama, sthree sevana at night, who walks long distance those suffering from shoola(pain), shwasa (Dyspnoea), trishna (Thirst), shishu (Childrens), vrudha (Old aged), ajeerna rogi (Patients), who does ratri jagarana are advised to have day sleep according to their wish. It is essentially to avoid heat exhaustion in addition to physical exercise and sexual act, the patients suffering from shoola, etc, small children's and old aged people are vulnerable group for heat related health hazards, hence they are advised to sleep in daytime and stay indoors.

CONCLUSION

Greeshma Ritu is a predominant hot season in India, understanding each season ecologically, biometeorologically and physiologically enables better applicability in clinical practice. Greeshma ritu is Ati ushna kaala, a special attention must be given during panchakarma procedures, especially swedana karma. If the physician is having the knowledge regarding existing thermal stress, he can modify the swedana karma, since even a mild to moderate swedana can induce very severe heat stress. And one should avoid giving the drugs and diets which are very hot potency, dry and sharp, advice regarding physical activity, intake of alcohol, sexual activity, special instructions for children's and very old age people to stay indoors, inclusion of the peya and cold drinks which are mentioned in Greeshma ritu charya etc, would help avoiding heat stress related complications. The observations of Greeshma Ritu and its regimens documented in Ayurvedic literature is very scientific and can be well understood with thermo regulation mechanisms. It helps physician to consider the possible environmental influence on health, disease as well as treatment, and to avoid possible health hazards.

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