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Review Article

NASYA KARMA: A VIEW THROUGH THE ANATOMICAL EXPLORATION OF NASAL EPITHELIUM

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ABSTRACT

The nasal route of drug delivery is gaining rapid recognition these days. The modern system of medicine is more concentrating on developing the drugs and methods for the nasal administration. However, this concept has been articulated centuries ago in Ayurveda by the term '*Nasya karma*'. *Nasya Karma* is a process of administration of medicated oils, ghee, *Swarasa* or powders into the nasal cavity. *Nasya karma* is regarded as the most effective treatment in *Urdwajatrugata Vikara*, as it is quoted '*Nasa hi shiraso dwaram*' in the context of *Nasya*. The instilled *Nasya dravya* reaches the *Shringhataka marma* and thus reaches the *Shira* region. In modern anatomy, the components of administered *Nasya* reach the central nervous system through the neural pathways, vascular routes or by diffusion across nasal mucosa. This dual perspective highlights the potential of *Nasya karma,* which has a wide range of indications from *Urdwajatrugata vikara* by the means of local effect to *Pumsavana karma* as *Sarvadaihika* benefits. To understand the mode of action and maximize the therapeutic potential of *Nasya karma*, the comprehensive knowledge of anatomy of nasal epithelium and its physiology is utmost required. This paper explores the possible ways of the action of the drug instilled through nasal pathway is explained.

INTRODUCTION

The nasal route of drug delivery system is gaining more importance recent days. This is one of the primary pathways for parenteral drug delivery. The conventional medical system is actively concentrating on developing the formulations and advanced methodologies for the nasal administration of medicines owing to its numerous advantages [1]. However, in ayurveda, a time-tested holistic science has elucidated well about this route of drug administration and was given the term '*Nasya karma*'. *Nasya Karma,* a key component of the *Panchakarma,* involves the process of administration of medicated oils, ghee, herbal extracts (*Swarasa)* or powders into the nasal cavity. In ayurveda there is detailed explanation on indications, contraindications, procedure, benefits of *Nasya karma*.

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Mode of action of *Nasya karma* is also elucidated in great detail. *Nasya karma* is considered as best for *Urdwajatrugata Vikara* (disorders of head and neck), as it is quoted '*Nasa hi shiraso dwaram*' i.e., nasal cavity serves the gateway to reach the brain, in the context of *Nasya* [2]. This perspective is much scientific when we probe the mode of action of *Nasya karma* through anatomical and physiological lens. Thus, *Nasya karma* has broad spectrum of applications from treating *Urdwajatrugata vikara* (diseases related to head) as localized effects to *Pumsavana karma* as *Sarvadaihika* benefits. It is also called as *Shirovirechana* when certain potent drugs used[3]. It serves as preventive, promotive and curative therapy. Recent days nasal drug delivery is also been employed in diagnostic purpose. Given its wide array of advantages, this therapy is gaining wide acceptance. To fully comprehend its mechanism of action and to avail the maximum benefits the detailed knowledge of anatomy of nasal epithelium and its physiology is essential.

Mode of Action of *Nasya* in Ayurveda

Acharya Sushrutha and *Acharya Vagbhata* describes in the following way. *Nasya dravya* is

instilled through the external nares. Here *Nasya dravya* may be either liquids or powder or gaseous [4]. Once introduced, through *Nasa srotas*, the instilled *Nasya dravya* reaches *Shringataka marma*, which is an *Urdhwajatrugata Sadhyopranahara marma*, of *Sira marma* category[5,6]. This *Shringataka marma* has connection with *Siras* of *Nasa, Karna, Jihwa* and *Netra* [7]. Then, the medicated substance spreads though all these *Siras* and is in transported to *Shira* region, removes all the morbid doshas from the *Shira* [8]. *Shiras* is one among the three prime *Marma* mentioned by *Acharya Charaka*, which has the residence for *Prana* [9]. *Acharya Indu* identifies *Shringataka marma* as *Shiraso antarmadhya* which can be correlated to middle cranial fossa or cavernous sinus.

Mode of Action of *Nasya* with Modern Anatomical View

Nose is a vital sense organ consists of external and internal parts. The nasal cavity is divided into halves by nasal septum. The anterior opening is called external nares or nostrils and the cavity extends posteriorly to nasopharynx. This cavity is divided into three primary regions– the vestibule, respiratory region and olfactory region. The presence of three mucosal foldings called turbinates significantly increase the surface area of nasal cavity relative to its size. The nasal mucosa is categorized into two types i.e., the olfactory mucosa which is seen superior to middle nasal concha and the second is respiratory mucosa located in the rest of nasal cavity. Nasal mucosa is supplied by both ophthalmic and maxillary branches of trigeminal nerve and facial nerve also contribute to supply the region, whereas olfaction is facilitated by olfactory nerve. Thus has the action of three cranial nerves. The respiratory mucosa also has rich vascular supply but its primary role is to trap the dust particles and hence has very minimum function in the absorption of drugs.

Olfaction is mediated by olfactory mucosa, located in the upper third of nasal cavity. The peripheral extensions of these olfactory receptor cells are distributed across nasal mucosa, where they detect and receive the olfactory stimuli. The central processes of these olfactory cells are grouped together to form olfactory nerve, which passes through the cribriform plate of ethmoid and end in mitral cells of olfactory bulb. Axons of mitral cells form olfactory tract and carry smell to prepyriform cortex and amygdaloid nucleus, ultimately relating to consciousness. This system is also related to autonomic system by hypothalamic level.

The cribriform plate of ethmoid bone is positioned between two orbital parts of frontal bone, serves as boundary between anterior cranial fossa from nasal cavity. The Blood brain barrier (BBB) located here separates brain interstitial fluid from circulating blood. Blood cerebrospinal fluid barrier (BCB) separates blood from cerebrospinal fluid that encircles brain which creates a barrier for the passage of therapeutic agents. However, the recent studies have shown that nasal administration of therapeutic agents can facilitate the direct transport of therapeutic agents from nasal cavity to CNS, either by the action of olfactory epithelium or by trigeminal nerve. This method effectively bypasses the limitations imposed by BBB and BCB. Thus, enabling the direct connection between nasal cavity and brain and delivery of drug occurs through olfactory neuro epithelium.

The lateral wall of the nasal cavity has openings to frontal, maxillary and sphenoidal air sinuses. Sinuses are rich with blood supply; hence, nasal administration of drugs reach the sinus area and through the extensive vascular supply enters the meninges of brain. The lipid-soluble substances are readily absorbed through mucosa of olfactory and nasal epithelium. Consequently, the therapeutic action of *Nasya* operates through three distinct pathways:

(1) Neural Pathway
(2) Diffusion method
(3) Vascular Pathway

Neurological Pathway: This pathway involves stimulation of three cranial nerves i.e., Olfactory, trigeminal and facial nerve, which subsequently stimulates higher centres of brain like limbic system-hypothalamus, amygdaloidal complex, epithalamus & basal ganglia.

Diffusion method: Lipid soluble substance is easily absorbed through the nasal mucosa as they are lipophilic in nature, thus *Taila* or *Ghrita* instilled are effectively absorbed.

Vascular Pathway: The extensive mucosal surface is endowed with rich vascular supply, facilitating the rapid transportation of absorbed molecules and swift therapeutic action.

Types of *Nasya* according to various Samhitas:

S.No	According To	Types	
1	*Acharya Charaka*	3	Mode of Action: *Rechana, Tarpana, Shamana*
		5	Mode of Administration: *Navana. Avapidana, Dhmapana, Dhuma, Pratimarsha*
2	*Acharya Sushrutha*[10]	5	*Shirovirechana. Pradhamana, Avapidana, Nasya, Pratimarsha*
3	*Acharya Vagbhata*	3	*Virechana, Brimhana, Shamana*
4	*Acharya Kashyapa*	2	*Shodhana, Poorana*
5	*Acharya Sharangdhara*	2	*Rechana, Snehana*

Types of Modern Nasal Drug Delivery System

The conventional system of medicine has advanced the development of various types of formulations for nasal drug delivery. They have improvised the consistency and methods of various formulations so as to avail the maximum benefits by gaining highest absorption and bioavailability[11]. Some of the modern formulation types are:

(1) Liquid nasal drops: These are among the commonly utilized and facilitate easy self-administration.

(2) Nasal powders: This dosage form offers enhanced stability with minimal preservatives. But this type of delivery is less frequently used. This type of drug delivery is explained in Ayurveda as *Pradhamana nasya* or *Churna nasya*.

(3) Nasal sprays: Fixed dose of drug can be delivered through nasal sprays by the use of meter dose pumps. The formulation can be administered in the form of either solutions or suspensions. Hormones for anterior pituitary are instilled in the spray form.

(4) Nasal gel: Gels are characterized to be having high viscosity as they are formulated thick solutions. They cause minimal irritation and promote easy absorption due to prolonged time of retention in nasal cavity.

(5) Nasal inserts: These innovative, bio-adhesive and formulation with solid dose, are designed for extended systemic delivery of drug through nasal pathway.

Benefits of *Nasya Karma*

(1) Neurovascular benefits: *Kumkumadi ghrita nasya* in management of migraine (Adil Rais *et al*) highlights the neurovascular advantages of this therapy. The abundant vascular supply of nasal mucosa and paranasal sinuses which are closely associated with meningeal arteries helps in transporting the drugs instilled to central nervous system [12].

(2) Neuroendocrinal function: By the stimulation of olfactory pathway, the chemical receptors are being converted into action potentials and further stimulates hypothalamus. The hypothalamus in return regulates the master gland, the pituitary gland, controls the functioning of various hormones. Hyperglycaemic effect of hormone glucagon and hypoglycaemic effect by insulin hormone was found in normal and diabetic patients [13] (Pontrioli E.A. et al, 1983).

(3) Neuropsychological action: Numerous studies have been conducted like role of *Jyotishmati taila nasya* in Parkinsons disease which showed improvement in speech and reduction in tremor [14] (Divya Kajaria *et al)*. *Nasya* with *Brahmi ghrita* in insomnia [15] (Kanika Wadhawa et al.). From the chemical stimulus, the *Nasya* drug converts to the action potential stimulates the limbic system, which is the emotional and cognitive centre of central nervous system. This helps in providing beneficial results in various psychological ailments.

MATERIALS AND METHODS

References are being collected from authoritative ayurvedic texts such as *Bruhatrayi, Laghutrayi* along with insights from modern literature, scientific publications, various digital sources and search engines. The whole concept is comprehensively analysed from various sources and presented in this paper in a systemic way.

DISCUSSION

The mode of action of *Nasya karma* is influenced by the physical state of drug, its solubility, lipophilicity, viscosity of drug. Anatomy of absorbing surface of nasal mucosa plays a pivotal role. The olfactory epithelium has major role in transportation of drugs to CNS as compared to respiratory epithelium. *Nasya Karma* has offers numerous advantages like having high bio-availability, no destruction of molecules by gastro intestinal fluids and acids, Prevents the elimination of drug during hepatic first

pass metabolism, has rapid onset of action and quick drug absorption, molecules with less absorption through GIT can be administered through nasal route. The direct connectivity of nasal cavity to CNS through nerves and rich vascular supply of nasal endothelial surface facilitate this process. Thus, nasal route of drug administration stands out as a prime alternative for traditional parenteral methods.

But there are potential disadvantages of *Nasya karma* which includes local side effects like nasal irritation, damage to cilia of nasal mucosa if drug used is inappropriate. Loss of the dosage into the respiratory system may be seen if the method of administration method is inappropriate. These drawbacks highlight the importance of careful formulation and administration techniques to maximise the benefits and minimize the adverse effects.

When viewed anatomically, the nasal pathway stands out as a sole route for the drugs to reach the central nervous system. The drug instilled here reach the brain either through the vascular system or by the diffusion method through nasal mucosal absorption or by the neurological pathway in which the stimuli in the form of chemicals are being converted into action potentials and are transmitted by the olfactory pathway. Thus, overcoming the hinderance caused by BBB and BCB.

The absorption of drug is maximum if the drug has higher viscosity. Highly viscous drug has more retention time in nasal cavity and less mucociliary clearance which gives the increased time for drug absorption which is the basic idea for the development of nasal gels. The drugs which are alkaline may cause nasal irritation thus slightly acidic pH between 4.5-6.5 is suitable as this matches with nasal mucosa which is maintained with acidic pH. The lipophilic drugs are more absorbed when compared to hydrophilic drugs, as the nasal mucosa has more tendency to absorb lipophilic drug. This becomes the basic concept for using the *Sneha dravya* like *Ghrita, Taila* etc., as *Nasya dravya*. The mucociliary clearance is the natural mechanism of the upper respiratory tract to prevent the infection and allergy, where the mucus reaches the nasopharynx and are cleared through GIT. The administered *Nasya dravya* must not hinder this mechanism which otherwise may cause infection of lower respiratory tract. The inflammation of nasal mucosa in rhinitis makes the nasal mucosal absorption decreased directly effecting the bioavailability of the drug.

Snehana in the form of local *Abhyanga* and *Swedana* to the head and neck region are the integral components of *Nasya* therapy, functioning as both preparatory (*Poorvakarma)* and post-operative procedure (*Paschat karma)* of *Nasya*. As *Poorvakarma,* they help in liquefaction of *Doshas* and thus easy elimination of *Doshas*. As *Paschat karma*, the *Snehana* and *Swedana* are proved to significantly enhance the local blood circulation as they help in *Siravivarana* which enhances the absorption capacity of nasal mucosa. Consequently, the combination of these techniques optimizes the effectiveness of *Nasya* by facilitating better delivery and efficacy of the administered therapeutic agents.

CONCLUSION

Nasya is versatile treatment modality in Ayurveda that serves as promotive, preventive and curative type of intervention. Its therapeutic range extends from addressing the management of local (*Sthanika)* to systemic (*Sarvadaihika)* disorders. Sometimes used as emergency treatment and provide alternative for invasiveness of injections and to oral medication. Here three cranial nerves are being stimulated, while the abundant vascular supply and local absorption by nasal mucosa help in surpassing the blood brain barrier and improves the functioning of endocrinal, nervous and circulatory system. Thus, ancient wisdom about *Nasya karma* explained thousands of years ago, encapsulated in the phrase as '*Nasa hi shiraso dwaram'* is still very much scientific and adopted concerning various disease conditions.

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