ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 9| September 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

A REVIEW ON APPLIED ANATOMY AND PHYSIOLOGY RELATED TO NASA HI SIRASO DVARAM

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ABSTRACT
In Ayurveda, the phrase "Nāsa hi Śiraso Dvāram" emphasizes the significance of the nasal pathway as the primary gateway to the head and its structures. The nose serves not only as the organ of respiration and olfaction but also as a vital channel for therapeutic procedures like Nasya karma. Anatomically, the nasal cavity is closely connected to the paranasal sinuses, olfactory apparatus, and cranial cavity. Physiologically, it regulates respiration, olfaction, filtration, humidification, phonation, and protection of the respiratory tract. From an Ayurvedic perspective, the nasal route directly influences the śiras (head region), governing higher centers including indriyas (sense organs) and manas (mind). Modern anatomy validates this by highlighting the close proximity of the nose to the central nervous system through the olfactory nerve and vascular-lymphatic communications. Thus, the nose acts as a bridge between the external environment and the internal higher centers of the body, justifying its role as the "gateway to the head."

INTRODUCTION

The statement *"Nāsa hi Śiraso Dvāram"* originates from classical Ayurvedic texts, underlining the therapeutic and physiological importance of the nasal passage. The nose is not merely an organ of smell but a crucial channel through which *prāṇa vāyu* enters the body, influencing the functioning of the brain and sensory organs. In Ayurveda, this forms the basis for *Nasya karma*, a Panchakarma therapy wherein medicated oils, powders, or juices are administered through the nasal route to treat diseases of the head, senses, and nervous system.

From a modern perspective, the anatomy of the nasal cavity reveals its extensive vascularity, rich innervation, and continuity with paranasal sinuses and cranial structures. The olfactory nerve directly connects the nasal mucosa with the brain, explaining the influence of nasal therapies on higher centers. Physiologically, the nose conditions inspired air by filtration, humidification, and temperature regulation, while also playing roles in immunity, phonation, and sensory perception.

Therefore, the concept of *Nāsa hi Śiraso Dvāram* bridges traditional Ayurvedic wisdom and modern anatomical-physiological understanding, emphasizing the nose as both a protective organ and a therapeutic gateway to maintain health and treat disorders of the head and senses.

METHODOLOGY

1) Ayurvedic View

a) Synonyms of Nasa - Nasika, Grahna, Gandhavaha, Ghona.

b) Nasa - Made up of Cartilage bone (Gonasthi), Nasaputa is 2 anguli pramana, inner circumference of nostril is 1/3rd anguli. It is 1 among the Gyanyaindriya helps for Gandhagyana. Gyanyandriya - Grana, Indriyadhisthana - Nasika, Indriyadravya - Akasha, vayu, teja, ap, prithvi, Indriyartha - Gandha, Indriyabuddhi -Nasabuddhi. Smell receptors are situated in Granamula. Opening of nostrils are called Granarandra, has 2 gandavaha damaniya, Tarpaka kapha situated in head helps for indriya tarpana, Pranavayu does indriya dharana

c) Shira - Murdha, mastaka, mastishka, uttamanga, the portion above the neck or supraclavicular region is known as Murdha or Utamanga. Bhela - Hrudaya, Mustulunga – csf or sirasta majja Shiras is made up of kapla asthi and nasa is its door, eyes, ears, nose, throat, sringataka all open into the brain. The disease causing organisms enter brain usually through nose. Sirovikarajanya dusta srava drains through nose.

2) Applied Anatomy & Physiology Related to Nasa Hi Siraso Dvaram:-

a) Anatomy of Nose:-

Nose is mainly divided into External nose contains of Nostrils divided by nasal septum and Nasal cavity.

External nose is made up of nasal bones, frontal process of maxilla, nasal part of frontal bone and hyaline cartilage. The rigidity of bones, cartilages and mucosa provides surface area for absorption.

Nasal cavity also known as nasal vestibule, olfactory area is made up of Floor – palatine process of maxilla and palatine bones

Roof – Nasal and frontal bones, cribriform plate and part of sphenoid bone.

Lateral wall – Superior, middle and inferior concha

Medial / septal wall – 1 plate of ethmoid vomer and septal cartilage

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The lateral walls having 3 conchas play an important role in absorption of nasal drug. The part below the cocha is called meatus. It is divided in to 3 parts as
Inferior meatus – nasolacrimal ducts opens in to it
Middle meatus – maxillary, frontal and anterior ethmoidal sinuses opens in to it
Superior meatus – posterior ethmoidal sinus opens into it

1. External Nose[1]
The external nose is the visible part projecting from the face.

- **Parts:** Root, dorsum, apex (tip), ala (wings), and external nares (nostrils).
- **Framework:**
  - **Bony part:** Nasal bones, frontal process of maxilla, nasal part of frontal bone.
  - **Cartilaginous part:** Lateral nasal cartilages, alar cartilages, septal cartilage, and small accessory cartilages.
- **Skin & Muscles:** Skin over the dorsum is thin, while at the ala it is thicker with sebaceous glands. Small facial muscles like *nasalis* and *levator labii superioris alaeque nasi* control nostril movements.

2. Nasal Cavity[2]
The nasal cavity is divided into **two halves** by the **nasal septum**. Each cavity extends from the nostrils (anterior nares) to the choanae (posterior openings into the nasopharynx).

a) Roof of Nasal Cavity

- Formed by: Nasal bone (front), cribriform plate of ethmoid (middle), body of sphenoid (back).
- Contains: **Olfactory region** with olfactory nerve endings.

b) Floor of Nasal Cavity

- Formed by: Palatine process of maxilla and horizontal plate of palatine bone.

c) Nasal Septum[3]

- **Bony part:** Perpendicular plate of ethmoid, vomer.
- **Cartilaginous part:** Septal cartilage.
- **Membranous part:** Fibrous tissue.

d) Lateral Wall
Highly complex with projections (conchae/turbinates) and spaces (meatuses).

- **Superior concha** → Superior meatus (opens into posterior ethmoidal sinus).
- **Middle concha** → Middle meatus (opens into frontal, maxillary, anterior ethmoidal sinuses).
- **Inferior concha** → Inferior meatus (opening of nasolacrimal duct).
- **Spheno-ethmoidal recess** → Opening of sphenoidal sinus.

3. Paranasal Sinuses
Air-filled cavities surrounding the nasal cavity:

- **Frontal sinus** – in frontal bone.
- **Maxillary sinus** – in maxilla (largest).
- **Ethmoidal air cells** – between nose and orbit.
- **Sphenoidal sinus** – in sphenoid bone.

These sinuses lighten the skull, resonate voice, and warm/filter air.

b) Physiology of Nose
Breathing - Air conditioning of inspired air by control of temperature and humidity. Protection of lower airway (Filtration and purification) by mucous ciliary blanket
Olfaction[4] – the sense of smell
Vocal resonance[5] – for nasal consonant letters
Nasal reflexes[6] – sneezing, cough, swallowing
Nasal secretions[7] – has enzyme muramidase which kills bacteria and virus, has IgA, IgE interferons which provide immunity against URT infections
Nasal resistance – to expired air

Functions

- Respiration (air passage).
- Olfaction (smell).
- Filtration, humidification, warming of inspired air.
- Resonance in speech.
- Drainage of paranasal sinuses and nasolacrimal duct.

Clinical Vital Areas of Nose Are
1) Little's Area – it is the antero - inferior part of nasal septum above vestibule with anastomoses of vascular plexus called Keisselbakh's plexus and prone for epistaxsis. The arteries that anastomose are superior labial, anterior ethmoidal, sphenopalatine and greater palatine arteries.

2) Woodruff's area – arteries under posterior part of inferior furbinate
Pathways for nasal drug absorption:-
Aqueous route or paracellular route has slow, passive reduced absorption ex mannitol, insulin
Lipoldal route or transcellular route has better absorption rate

c) Blood & Nerve Supply to Nose
Blood supply[8]: - To the nose is provided by ophthalmic, maxillary and facial arteries. They anatomose to form Kiesselbach's plexuses the common site of nose bleeds
Roof, Nasal septum – Anterior and posterior ethmoidal artery
Alae & ridge – Dorsal nasal artery & lateral facial artery
Nasal cavity (outer walls & nasal mucosa) – spheno-palatine artery
Nasal ridge – branches of internal maxillary artery

Venous Drainage[9]
Angular vein- Drains the side of the nose
Superior labial vein – joins with angular vein
Nasal arch of frontal vein- Small veins from dorsum of nose drains into this arch
Woodruff's plexus – a venous plexus made up of large thin-walled veins

Lymph supply[10]
From vestibule – submandubular nodes
For rest of cavity – upper deep cervical nodes

Lymph drainage
Submandibular lymph nodes –anterior half of nasal cavity
Deep cervical lymph nodes – Rest of nasal cavity & paranasal sinuses
Parotid lymph nodes – back of nasal floor

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Nerve Supply[11]
The nerve supply to nose comes from ophthalmic, maxillary and trigeminal nerves. Nerves of ordinary sensation are supplied by branches of ophthalmic division and maxillary division of trigeminal nerve. Olfactory nerves from olfactory mucous membrane ascend through cribriform plate to olfactory bulbs.
The posterior part of nose is supplied by nasopalatine nerve
The lateral wall is supplied by greater palatine nerve.
The frontal upper part is supplied by nasociliary and ethmoidal nerves. External nose – infratrochelar nerve, Alae-infraorbital nerve, Maxillary sinus-superior alveolar nerves, Frontal sinus-supraotrbital, Ethmoidal sinus-nasociliary, Sphenoid sinus-posterior ethmoidal nerve

3) Olfactory Nerve & Centers[12]
The olfactory nerve is the first cranial nerve and conveys special sensory information related to smell. It is the shortest of the cranial nerves and passes in the nasal mucosa to the forebrain. It enters the skull through the cribriform plate of the ethmoid bone. It sends its impulses to be interpreted at various brain regions. Simple bedside testing of the olfactory nerve can be done using vanilla essence or coffee extracts. The sense of smell can be altered due to a variety of conditions referred to as hyperosmia, hypoosmia, anosmia, and dysosmia. However, the most common pathology to affect the olfactory nerve is the common cold.

The olfactory nerves terminate in the nasal mucosa, which occupies a small surface on the roof of the nasal cavity.
The lateral olfactory nerves (12–20) are found in the superior nasal concha. The medial olfactory nerves (12–16) descend along the nasal septum. The olfactory nerves are non-myelinated and consist of bundles of fibers held together by thin strips of connective tissue.
Olfactory nerves transmit the sensation of smell to the brain. Humans have about 350 olfactory receptor genes.
From the olfactory receptors located deep in the nasal cavity, branches pass upward through the cribriform plate of the skull to several areas of the brain and terminate at frontal cortex, hypothalamus and limbic system. The olfactory nerves' input into the limbic system, accounts for the influence of smell on psychosexual behavior and memory.

To test the olfactory nerve, the patient is asked to identify certain substances by smelling through one nostril while the examiner compresses the other nostril. Testing must be done with substances, such as coffee. Volatile and irritative substances, such as ammonia and alcohol, are not suitable because they may damage olfactory nerve. When disorders impair both olfactory nerves, patients have *anosmia,* cannot perceive smells or appreciate the aroma of food. Thus, people with anosmia, to whom food is completely bland, tend to have a decreased appetite.

One-sided anosmia may result from tumors adjacent to the olfactory nerve, such an olfactory meningioma. Anosmia is routine in anyone with nasal congestion and those who regularly smoke cigarettes.

With advancing age, more than 50% of individuals older than 65 years and 75% of those older than 80 years have some degree of anosmia. Patients with Alzheimer's disease, Parkinson's disease, or other neurodegenerative diseases have even a higher incidence of anosmia.

Olfactory System: - The olfactory system, or sense of smell, is the sensory system used for smelling (olfaction). It is mainly divided into 2 peripheral & central Peripheral - The peripheral olfactory system consists mainly of the nostrils, ethmoid bone, nasal cavity, and the olfactory epithelium (thin tissue covered in mucus that line the nasal cavity). The primary components of the layers of epithelial tissue are the mucous membranes, olfactory glands, olfactory neurons, and nerve fibers of the olfactory nerves.

Odor molecules can enter the peripheral pathway and reach the nasal cavity either through the nostrils when inhaling (olfaction) or through the throat when the tongue pushes air to the back of the nasal cavity while chewing or swallowing (retro-nasal olfaction).
Olfactory sensory neurons in the epithelium detect odor molecules dissolved in the mucus and transmit information about the odor to the brain in a process called sensory transduction.

Olfactory nerves and fibers transmit information about odors from the peripheral olfactory system to the central olfactory system of the brain

Central:- The main olfactory bulb transmits pulses which help determine odor concentration based on 'timing code'. The olfactory cortex includes the piriform cortex (posterior orbitofrontalcortex), amygdala, olfactory tubercle, and parahippocampal gyrus. The olfactory tubercle connects to numerous areas of the amygdala, thalamus, hypothalamus, hippocampus, brainstem, retina, audi tory cortex, and olfactory system.

Clinical Significance
Loss of smell is known as anosmia. Anosmia can occur on both sides and a single side. Olfactory problems can be divided into different types based on their malfunction. The olfactory dysfunction can be total (anosmia), incomplete (partial anosmia, hyposmia, or microsmia), distorted (dysosmia), or can be characterized by spontaneous sensations like phantosmia.

Damage to the olfactory system can occur by traumatic brain injury, cancer, infection, inhalation of toxic fumes, or neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease. These conditions can cause anosmia. Doctors must exclude other diseases that inhibit or eliminate 'the sense of smell' such as chronic colds or sinusitus before making the diagnosis that there is permanent damage to the olfactory system.

Causes of Olfactory Dysfunction The common causes of olfactory dysfunction: advanced age, cigarette smoking, viral infections, exposure to toxic chemicals, head trauma, and neurodegenerative diseases.

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5) Aroma Therapy

a) Introduction: - Aromatherapy is a holistic healing treatment that uses natural plant extracts to promote health and well-being. Sometimes it's called essential oil therapy. Aromatherapy uses aromatic essential oils medicinally to improve the health of the body, mind, and spirit. It enhances both physical and emotional health. Aromatherapy is thought of as both an art and a science. Recently, aromatherapy has gained more recognition in the fields of science and medicine.

b) History: - Humans have used aromatherapy for thousands of years. Ancient cultures in China, India, Egypt, and elsewhere incorporated aromatic plant components in resins, balms, and oils. These natural substances were used for medical and religious purposes. They were known to have both physical and psychological benefits.

The term "aromatherapy" was coined by a French perfumer and chemist René-Maurice. He had previously discovered the healing potential of lavender in treating burns.

c) Action: - Aromatherapy works through the sense of smell and skin absorption using products such as diffusers, aromatic spritzers, inhalers, bathing salts, body oils, creams, or lotions for massage or topical application, facial steamers, hot and cold compresses, clay masks. You can use these alone or in any combination. There are nearly one hundred types of essential oils available. Generally, people use the most popular oils.

d) Benefits: - Manage pain, improve sleep quality, reduce stress, agitation, and anxiety, soothe sore joints, treat headaches and migraines, alleviate side effects of chemotherapy, ease discomforts of labor, fight bacteria, virus, or fungus, improve digestion, improves palliative care, & boost immunity

e) Research: - Scientific evidence for aromatherapy is considered to be limited in some areas. Research to support the use of aromatherapy in treating Alzheimer's disease, Parkinson's disease, and heart disease is lacking.

f) Indications: - Asthma, insomnia, fatigue, depression, inflammation, peripheral neuropathy, menstrual issues, alopecia, cancer, erectile dysfunction, arthritis & menopause.

g) Most popular aromatherapy oils: - Clary sage, cypress, eucalyptus, fennel, geranium, ginger, lavender, lemon, lemongrass, neroli, patchouli, peppermint, Roman chamomile, rose, rosemary, tea tree, vetiver,ylang ylang.

h) Side effects of using essential oils include: - Rashes, asthma attacks, headaches, allergic reactions, skin irritation, nausea.

i) Conditions in which used with caution: - Hay fever, asthma, epilepsy, high blood pressure, eczema, psoriasis.

Factors Effecting Nasal Drug Delivery

Anatomical factors are the 3 zones or functional areas of nasal cavity – vestibular 0.6cm^2, olfactory – 15cm^2, respiratory – 130 cm^2

Respiratory area with its conchae and meatus provides larger area of drug delivery and has rich vascular supply

Human nasal cavity has total volume of 16-19ml can be utilized each side up to 7.5ml

The vascular bed is especially high in density over the lower part of septum which provides a promising condition for drug absorption

Factors related to drug:-

Lipophilicity –high lipophilicity of drug provides increased permeation of drug.

Chemical form – conversion of drug into salt ester alters its absorption

Molecular weight – MW > 300 Dalton has higher rate of permeation

Factors related to formulation:-

pH value – if pH is between 4.5 to 6.5 it avoids nasal mucosa irritation

Osmolarity – isotonic solutions are better absorbed

Viscosity – Inc viscosity increases contact time between drug and nasal mucosa which in turn increases permeation

Form of drug – Nasal drops, sprays, gels and powders

Local factors like edema, cell injury reduces drug absorption

Nasal absorption promoting systems:-

Absorption enhancers- bile salts etc

Surfactants – sodium sulphate

Fatty acids

Enzyme inhibitors – bestatin, amastatia

Powders – carbopol, starch etc

Nasal Route Entry for the Cranial Cavity

The nasal route of administration has been used for different therapeutic and prophylactic purposes for millennia. The drugs, which are administered through the nose, act locally as well as systemically. The dose of drugs required is very minimal. The metabolism of the drug is not required through first passage and the action of the drug is faster and effective.

Modern medical science has accomplished advances in the administration of drugs through the nasal route by inhalation of vaporized, nebulized, powdered, or aerosolized drug, as well as by direct instillation.

The nasal cavity is bounded by floor, roof, medical and lateral walls. Important anatomical structures for consideration are mainly the floor and the roof. The roof of Nasal cavity is formed with the superior turbinate and cribriform plate. This is a specific plate which forms the floor of the anterior cranial fossa, having small pores in it. This is the specific area of olfaction formed by the superior turbinate constituted with special mucous membrane; which is called as olfactory membrane.

This olfactory epithelium, where olfactory receptors are located, is also called as olfactory area. The total area of olfaction on each side is about 250mm2.

The olfactory area (epithelium) is composed of mainly the following types of cells:

1) Supporting (Substentacular cells)

2) Receptor cells and,

3) Basal cells

Supporting cells are columnar cells which secrete mucous. The Receptor cells are those where one end forms into Axon and another end facing mucous layer, forms into cilia which perceive the object (i.e., smell). These axons join together to form the olfactory tract and the olfactory bulb.

DISCUSSION

The concept *"Nāsa hi Śiraso Dvāram"* emphasizes the vital link between the nose and the head. Classical Ayurvedic texts

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explain that the nose serves as the primary entry point to influence the brain and sense organs, forming the basis of therapies like *Nasya karma*. Modern anatomy and physiology provide a scientific basis for this traditional wisdom.

The **structural anatomy of the nose** shows its intimate connections with paranasal sinuses, nasopharynx, olfactory pathway, and cranial cavity. The olfactory nerve endings present in the roof of the nasal cavity form a direct neural connection between the external environment and the brain. Similarly, the rich vascular supply, lymphatic drainage, and venous communications explain how local nasal conditions may affect intracranial structures.

From a **physiological perspective**, the nose not only supports respiration and olfaction but also humidifies, filters, and warms inspired air, ensuring optimal function of the respiratory and central nervous systems. The resonance provided by nasal passages contributes to speech, while the mucociliary clearance protects the body against pathogens.

In Ayurveda, these scientific findings correlate with the idea that medicines administered through the nasal route directly reach and influence the *śiras* (head). This underpins the rationale for *Nasya karma* in treating disorders of the nervous system, sense organs, and upper respiratory tract.

Thus, both classical and modern viewpoints converge to establish that the nose is not merely an organ of smell or respiration but a **therapeutic gateway to the head and brain**, playing a central role in health and disease.

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