

Nasal Drug Delivery In Ayurveda : A Narrative Review

Satyajit Pandurang Kulkarni, Professor^{1*}, Pallavi Satyajit Kulkarni, Assistant Professor², Dr. Amar S. Kamble, Professor, HOD³, Dr. Girishkumar Malsinh Damor, Assistant Professor⁴, Dr. Deepavali K. Kasare, Associate professor⁵,

¹Department of Panchakarma, Manjushree Research Institute in Ayurvedic Science affiliated to Gujarat Ayurved University, Jamnagar, Gujarat, India, Email id - satyajitkulkarni2001@gmail.com, ORCID - <https://orcid.org/0000-0001-8154-9967> Ph.D. scholar - Datta Meghe Institute of medical science, Nagpur, Maharashtra, India

²Department of Agadtantra Avum Vidhivaidyak, Arihant Ayurved college affiliated to SWARRNIM Startup University, Gandhinagar, Gujarat, India, Email ID - dr.pallavikulkarni96@gmail.com, ORCID - <https://orcid.org/0000-0003-3528-9302>

³Department of Rachana Sharir, Faculty - Gujrat Ayurved University, Chanakya Nagar, Jamnagar, Gujrat 361008.
PhD Scholar - Dr. D. Y. Patil University, Sant Tukaram Nagar, Pimpri colony, Pimpri Chinchwad, Pune, Maharashtra - 411018, Mail id - dramarkamble@gmail.com, Phone no - 8087299461, Orcid - 0000-0001-5448-3173

⁴Panchakarma, Gujarat Ayurved University, Jamnagar, Chanakya Bhavan, Gurudwara Road, opp. City B Division, Jamnagar, Gujarat 361008, Mail ID: girishdamor.ayu@gmail.com, Phone No: 9427816844 Ph.D. scholar - Datta Meghe medical university, (Sawangi M) Dist. - Wardha, Maharashtra, India ORCID - <https://orcid.org/0000-0001-8521-8807>

⁵Department of Swasthavritta & Yoga, Faculty - Gujrat Ayurved University, Chanakya Nagar, Jamnagar, Gujrat 361008.
Mail id - deepakasare@gmail.com, Phone no - 8805477519, Orcid - <https://orcid.org/0000-0003-2959-0908>

*Corresponding Author: Satyajit Pandurang Kulkarni, Professor

¹Department of Panchakarma, Manjushree Research Institute in Ayurvedic Science affiliated to Gujarat Ayurved University, Jamnagar, Gujarat, India, Email id - satyajitkulkarni2001@gmail.com, ORCID - <https://orcid.org/0000-0001-8154-9967>

DOI: 10.47750/pnr.2022.13.505.214

Abstract

Ayurveda is the ancient medical system in India that uses nasal therapy. During COVID -19 pandemic, the ministry of AYUSH provided guidelines to boost immunity. The Nasya (nasal delivery) was one of the recommendations by the AYUSH ministry to boost immunity. Nasya has been still in practice for various ailments like chronic rhinitis, headache, cervical spondylosis, Dyspnea, etc., but the knowledge about how Nasya works is still unclear.

This review article discusses the practice and current advances in nasal delivery in modern science. It also discusses the possible mechanism of how Nasya can act and boost immunity and what research can be done in the form of clinical and experimental studies to increase the knowledge and understanding of Nasya.

INTRODUCTION

Ayurveda is an ancient medical system of India which is become popular worldwide in recent times. During COVID - 19 pandemic, Ayurveda become more popular, and many people sought Ayurvedic medicines to prevent and cure COVID-19^[1]

The ministry of AYUSH gave some general instructions for the prevention and cure of COVID-19.^[2] In the guidelines, the practice of nasal administration of Ayurvedic oil in small quantities was advised.

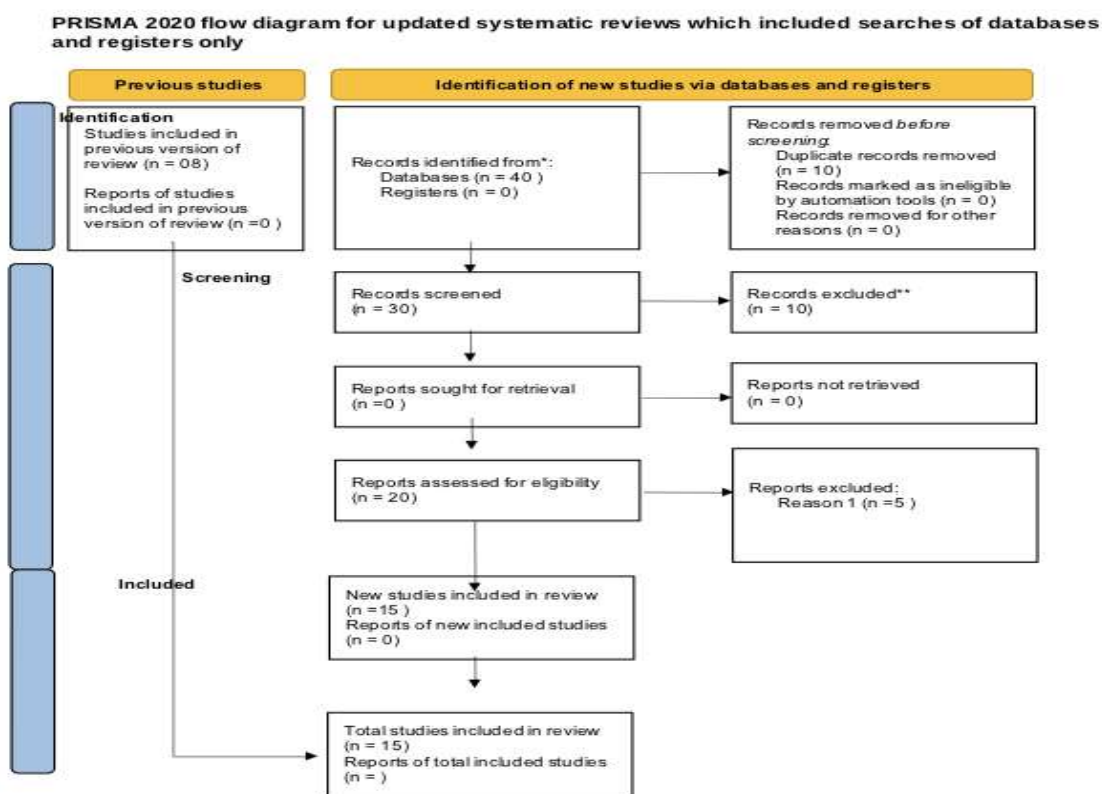
So, there was a question if the nasal administration of medicated oil can affect immunity. In Ayurveda nose is said a gateway to the brain, is this supported by the current literature? To answer this question a literature review was done, the relevant literature was collected, and critical analysis was done to open several questions and knowledge gaps the in the understanding of nasal drug administration in Ayurveda

METHOD

There has been already published literature on the mode of action of Nasya. We searched and analyzed the papers published earlier. Most of them have been described as theoretical parts of Nasya karma in Ayurveda, the types of Nasya by different texts, drugs used in Nasya, and the efficacy of Nasya Karma in various diseases or conditions. Some of the papers also discussed the possible mode of action of Nasya karma, but the exact model has been not identified. Some previous papers highlight the nose–brain connections. But their critical appraisal to understand the Nasya is not done so far. Therefore, this review was needed.

we identified various records and those eligible records were critically studied. we were interested to find out the absorption of nasal-delivered drugs in Ayurveda. So, those studies which have added new information to these subjects were only included. following keywords were used “Nasal drug delivery. Nose – brain connections” “Nose Brain connections” “Nasya Karma” “Nasal Drug Delivery in Ayurveda” in ‘PubMed’ ‘PubMed central’ and ‘google scholar’.

we found many similarities in the Ayurvedic concept and appraisal of nasal drug delivery in modern medicine. Modern science also supports Nasal drug delivery systems. The procedure of Nasya, each step in the procedure, the preparatory procedure, the main procedure, and the post-operative procedure of Nasya can be very well explained based on descriptions in physiology, pathology, and pharmacology.



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

ANATOMY AND PHYSIOLOGY IN BRIEF

The nose is an organ made for mainly 2 functions; one is it works as part of the upper respiratory system, and the other is it plays an important role in the process of olfaction.

The air enters through the nose. The nasal cavity filters the air. This function is mainly done by the cilia present in the nasal mucosa. They trap dust, fume, insects, etc., and filter air. The nasal mucosa is provided with mucosa-secreting cells, due to which it always remains wet. Thus, dust particles can be accumulated in the mucosa.

Another function of the nose is to make the air slightly warm and humidified to assist pulmonary ventilation. This is done due to the rich blood supply to the nasal mucosa and the cavities inside the nose. Due to wetness in the cavities, the air is humidified. Due to humidification, the process of pulmonary ventilation gets eased.

The nose is made of a bony part. It contains sinuses. The structure of the nose makes the skull light. It is due to the ventilation due to the sinus. The nasal cavity is like a box. The sinuses provide ventilation to the cavity inside the nose.

The nose provides mainly two functions. It acts as a passage and takes inhaled air from the cavity. During this passage, the cilia present in the cavity filtrate the air. There are numerous mucosa-secreting glands inside the mucosa membrane of the nose cavity. Due to the mucosa, the surface always remains wet. The dust, fume, and insects inhaled are trapped in the cilia and wet mucosa and thus prevented from entering the respiratory tract.

Secondly, due to the rich blood supply to the nose, when the inhaled air travels through the nose cavity, it slightly gets warm and humidified. This nose function is very important regarding the pulmonary ventilation and exchange of gases inside the alveoli in the lungs.

The sinus inside the nose provides ventilation, as discussed earlier. This ventilation is very useful in the process of phonation. The open sinus provides resonance to the air, which helps in phonation. In sinusitis, the sinus is closed to the blockage, and a change in the voice can be seen.^[3]

THE PROCEDURE OF NASYA

The procedure Nasya begins with the fitness for Nasya Karma. The early stages of rhinitis are contraindicated for the Nasya Karma as during this stage; the nasal mucosa is already secreting the secretions in larger amounts. Therefore, there is no space available for the absorption of the drug inserted through the Nasya.

In chronic rhinitis, the secretions begin to diminish, and Nasya can be performed. Therefore, Nasya is indicated in chronic rhinitis (Jeerna Pratishyaya), while it is contraindicated in early rhinitis (Nava-pratishyaya). Nasya is also contra-indicated among persons who just have eaten, or drank water or milk. In these conditions, mucosal secretions may have increased. Due to this Nasya is contra-indicated.

The nasal mucosa is a very special type of mucosa which is very sensitive to even a small change in the climate therefore Nasya is advised in a particular season when there is no extreme heat, or cold.

The position of Nasya is very significant in the efficacy of this procedure. The angle of the head allows the medicine to enter the nasal cavity and provides contact between the drug and the nasal mucosa. This position must be kept for a certain period. It also makes the sinuses in the nasal cavity open. The process of oil massage overhead, face, and shoulders followed by the hot fomentation in the increased circulation and the warmth makes easy to mucus thin and easy to get expelled.^[4]

RELATION BETWEEN DRUGS AND FORMULATIONS USED FOR NASYA AND MODE OF ACTION

There are specific drugs mentioned in Ayurveda for the Nasya Karma. Since these drugs have an affinity towards the receptors in the brain, those drugs are advised for Nasya Karma; for example, Vacha (*Acorus Calamus*) has Anti-convulsant activity.^[5] Thus, the drugs which act on certain receptors are advised for Nasya Karma.

Similarly, the drug formulation is also one important factor regarding the Nasya Karma. Ayurveda advised various medicated oils, including Ghee, for the Nasya Karma. As fat-soluble substances can easily enter the bilipid membranes of the nasal mucosa, fats are an important medium for nasal instillation. Therefore, Ayurveda advised various oils for Nasya Karma. Acharya Vagbhata explained that oil is the best fat among the four fats in Ayurveda (Ghrita, Taila, Vasa, and Majja) in healthy individuals.

Furthermore, it should be noted that oils used for Nasya karma are heated repeatedly, unlike the oils used for massage or enema, which are prepared by heating for only one round. But for Nasya, about 100 such rounds are followed. For example, Dhanwantaram used for enema is heated through one cycle or round only, while Dhanwantarm (101) is Dhanwantaram prepared for massage is heated with goat milk 100 more times. This process makes minute particles of the herbal extract used for the preparation, increasing bioavailability due to the small particle size.

Saindhav (rock salt), honey, and Asava (fermented products) are commonly used substances for nasya. They have different Ph values. The rock salt contains Na⁺ ions responsible for changing the drug from hypotonic to hypertonic. The Nasya drug is not expected to get absorbed every time. In the Virechana Nasya type, the Dosha is expelled. Therefore, rock salt plays an important role in Nasya.

IS THERE NOSE-BRAIN CONNECTIONS?

Yes. There is a nose – a brain connection. The cribriform plate contains many very small perforations. From these perforations, exit fibers of the ophthalmic nerve pierce. The cribriform plate is a part of the ethmoid bone and forms the roof of the nose cavity.

Sphenopalatine foramen is located at superior the level of the superior meatus, allowing communication between the nasal cavity and the pterygopalatine fossa. Blood supply the nose has a very rich vascular supply. It receives blood from both the internal and external carotid arteries. Anterior and posterior ethmoidal arteries are the internal carotid artery branches descending to the nasal cavity through the cribriform plate. These arteries form anastomoses in the anterior part of the nose.

MUCUS IN THE NOSE

It is a viscous and elastic fluid secreted by respiratory mucosa. The glands are made of mucus cells and serous cells. There are about 100000 glands in the human nose. Other goblet cells also secrete another type of mucosa. The mucosa consists of mucin, water, lipid, and proteins. These proteins are albumin, immunoglobulin, lysozymes, and lactoferrins. These immunoglobulins produced by the nasal mucosa play an important role in immunity. [6]

The mucus secreted by the serous glands and goblet cells is quite different. It consists of 2 layers of upper gel and a lower sole layer. The lower sole layer is in contact with the cilia. Thus, this difference in the viscosity of the mucus layer affects ciliary beating, thereby having a larger effect on mucociliary clearance. The mucociliary clearance depends upon the thickness of these layers. The viscosity is also subject to change in reply to even small changes in the nasal cavity. The mucociliary clearance causes removal of foreign and harmful substances from the upper respiratory tract. Thus, the nose plays a very important role in immunity. [7]

NASAL DELIVERY IN MODERN MEDICINE

Nasal delivery began in the seventies in the modern system of medicine. It attracted scientists because of its quick onset of action, high absorption of the drug, and the medicine can cross Blood-Brain Barrier (BBB).

Many drugs have been studied and it has been well accepted that nasal administration of drugs directly gets absorbed into the brain circulation. Nasal application of tobacco, cocaine, Anti-Histaminic drugs, decongestants, and Antibiotics is in practice.

There are some key benefits of nasal drug delivery that the drug avoids first-pass metabolism, polar compounds, and drugs with poor stability can be administered by nasal route.

The onset of action of drugs in nasal delivery is rapid.

NASAL DRUG DELIVERY IN AYURVEDA

Nasya Karma is an important Panchakarma as mentioned in Ayurveda. Nasya Karma is very important to keep the health of the eyes, ears, and brain functions such as control over the mind and body, muscle coordination. It is of great therapeutic and preventive value. It is also indicated in local diseases of the nose and throat such as sinusitis, the diseases of the throat and larynx.

However, there is very little research work done to get more insight into Nasya's karma.

Nasya is to be administered after local massage over the head, neck, and face followed by hot fomentation. Whether these procedures affect absorption of the drug is not known.

Author	Title	Journal	Article type	Main findings
P Rahul, D Suman	Therapeutic uses of <i>Nasya karma</i> : a conceptual, critical review	International Journal of Ayurveda and Pharma Research, Nov.2020 8 (supplement.2)	Review Article	The article discussed Nasya Karma, types, pharmacodynamics, and the diseases or conditions in which Nasya Karma is indicated.
A Riju & R Manju	Significance of Nasya & Nasya – a critical review	Punarnama V Jan – Feb 2014 2 (1) p.1	Conceptual and review	Studies in detail regarding Nasya karma and probable mode of action, absorption of the drug
L Smita, P Swapnil et al.	Probable mode of action of Nasya – an overview	International Ayurvedic Medical Journal March 2016 4(3)	Review	Different types of Nasya Karma, type, and mode of action have been discussed.
K Praveen Kumar, R Rajdip, S Mahesh	Different types of Nasya karma in current practice – a review	European Journal of Biomedical And Pharmaceutical sciences November 2019	Review Article	Current research updates as per different Nasya types are described.
K Shweta, G Arjun	A critical review of the pharmacodynamics of Nasya Karma	Journal of Ayurveda and integrated medical science Jan – Feb 2020	Review	Nasya's types and mode of action concerning Shringataka Karma have been described.
Roshni KP	Critical analysis of physiological action of Nasya WSR to Sneha Nasya	World Journal of Advanced Research and Reviews Jan 2020	Review	The nose-brain connection has been discussed.
Dr. Amit Mukherjee, Dr. Sanjeev Madhukar Rao Khuje, Dr. O. P. Dwivedi	The potency of Nasya Karma	Journal of Drug Delivery and Therapeutics 2019	Review	Nasya types and Nasya vidhi is discussed in detail. There is a discussion regarding the absorption of the drugs used in Nasya.
B Navin	Concept of Sharir in Nasya Karma	Indian Journal of Pharmaceutical and Biological Research	Review	The anatomical aspect of Nasya karma is described in short.
S Gurudip	Nasya Therapy-A Pharmacological Route for Drug Delivery to Brain	Journal of Ayurveda Physicians & Surgeons July 2018	Review	The article describes the principles of nasal absorption briefly.

K Vipin	A conceptual study on the mode of action of Nasya	International Journal of Ayurveda and Pharma Research July 2017	Review	In this article, the mode of action of Nasya from Ayurveda and modern science has been discussed.
P Jatved	physiological action of Sneha Nasya - A critical review	journal of Indian system of medicine	Review	The ayurveda aspect and modern aspects of Nasya are discussed.
Dr. Shabnam Rajput, Dr. Kalpana Patni	Pharmacodynamics of Nasya Karma & Its Indications in Pediatric Disorders	International Journal of Scientific Development and Research January 2019	Review	The mode of action of Nasya in a child has been discussed in detail.
D Banamali, GE Ravi, Mishra pk G Bhuyan	A study on Apbahuka (frozen shoulder) and its management by Laghu masha Taila Nasya	Ayu	case study	The Nasya Karma in frozen shoulder is discussed.
. Lata Melkani, Dr. Mitra Shuchi Sharma Usha et al	A critical review of factors affecting the absorption of drugs in Nasya karma	World Journal of Pharmaceutical and Life Sciences, May 2019	Review	Factors affecting the absorption of the drugs in Nasya Karma have been discussed in detail.
B Ankush	Nasya Karma and its types – A review	Journal of Ayurveda & integrated medical sciences	Review	The paper discusses Nasya types mainly.

SCIENTIFIC BASIS OF NASYA

Procedure	effect
preparatory procedure - local massage by oil and hot foementation	increase blood flow in head , neck and face stimulate mucociliary clearence
position of the patient - sleeping in supine with head slight tilted	makes respiratory mucosa exposed and increases the area for nasal absorption
The patient has to remain in same position after nasal instillation	increases duration of the drug contact with the respiratory mucosa
patient should not swallow the drug instilled in the nose	The drug mainly contains mucus and debris and bacteria or viruses which may enter the GI tract
hot water gargling and medicated smoke inhalation	Hot water gargling kills bacteria or viruses in the throat and medicated smoke helps to dry up the mucus in the nasal cavity

DISCUSSION

This review paper aimed to find out more insight into how Nasya Karma works and whether it affects the immune system. The nasal drug delivery is called the Nasya Karma and the nose is said to be a gateway to the brain in Ayurveda which is supported by modern anatomy and physiology as well.

The Nasya Karma is a very systematic procedure to deliver the drug into the nose and to reach it up to the brain. If the indications of Nasya Karma are seen they are related to the local diseases of the nose and the diseases related to the Central Nervous System (CNS) as well. Thus, the study explains in detail the scientific basis of this procedure.

Nasya Karma can be studied properly from the following aspects

1. Studies to get more insight on Nasya karma like its effect on CNS circulation, the effect over brain waves, the effect on the respiratory system and the cardiac system
2. Studies to find out the effects of Nasya karma on various aspects such as the effect on mucociliary clearance, the effect on mucus, effect on anatomical structures such as mucosa, nasal cartilage, paranasal sinuses
3. Studies to find out different types of Nasya like Pratimarsha Nasya which is advised for a longer period on the immune system.
- 4 Studies to find out the effect of Nasya karma on various allergic conditions and psychiatric disorders
- 5, Animal studies can be performed wherever suitable before the clinical trials. But as the Nasya has been practiced since ancient times direct clinical trials can also be done. If the evidence-based practice of Nasya karma is done, it can generate more confidence to deal with new global healthcare challenges like COVID -19.

CONCLUSION

This review article concludes that Ayurveda had a developed nasal drug delivery system and the Nasya Karma in Ayurveda is a scientific and systematic procedure for nasal drug absorption. The current literature also suggests the effect of Nasya Karma on the immune system. However, more studies in the form of animal studies or human trials are needed to detail the exact effects.

REFERENCES

1. A A Mahmood Ali, B Andea, G Reena, Ayurvedic formulations : potential COVID-19 therapeutics ? *Phytomedicine plus* Aug 2 (3) ; 100286
2. http://ht.nlm.nih.gov/pmc/articles/PMC9020642/#__ffn_sectitle
3. K Rajesh The journey with COVID 19 : initiatives by ministry of AYUSH *Journal of Ayurveda* 2021 jan mar , 12 (1) and *Integrative medicine*
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8011587/#__ffn_sectitle
5. J Nick, The nose and paranasal sinuses physiology and anatomy, *Advanced drug delivery review* 51 (2001) 5 -19
6. [https://doi.org/10.1016/S0169-409X\(01\)00172-7](https://doi.org/10.1016/S0169-409X(01)00172-7)
7. A H Vagbhata Chaukhambha Pratishthan Varanasi Sutrashtana 2009
8. KUMAR A. Medicinal Properties of *Acorus calamus*. JDDT [Internet]. 13May2013 [cited 18Oct.2022];3(3):143-4.
9. <http://jddtonline.info/index.php/jddt/article/view/528>
10. Richard Grake et al. Gray's anatomy (2007) Head and Neck chapter 967
11. Ramesh R. Putheti*1, Mahesh C. Patil2 and O. Obire3 Nasal Drug delivery in Pharmaceutical and biotechnology: present and future, *e-Journal of Science & Technology (e-JST)*
12. https://www.researchgate.net/publication/228559889_Nasal_Drug_delivery_in_Pharmaceutical_and_biotechnology_Present_and_future
13. Rahul Parihar, & Suman Dadhich. (2020). THERAPEUTIC USES OF NASYA KARMA: CONCEPTUAL CRITICAL REVIEW. *International Journal of Ayurveda and Pharma Research*, 8(Supply2), 126-132.
14. A Riju, K Manju Significance of Nasa and Nasya Punarnav 2 (1) P 1 – 7
15. https://www.researchgate.net/profile/Riju-Agarwal/publication/327789467_SIGNIFICANCE_OF_NASA_NASYA-A-CRITICAL_REVIEW/links/5ba45638299bf13e6040edf1/SIGNIFICANCE-OF-NASA-NASYA-A-CRITICAL-REVIEW.pdf
16. L Smita, P Swapnil, C Avinash, P Vishal, probable mode of action of Nasya Karma- An pverview *Int Ayu Med* 2016 J 4(3) p 359 – 66
17. KS Praveen kumar, R Pradeep, S Mahesh, T Anup , different types of Nasya Karma in current practice - A review *European journal of biomedical and pharmaceutical sciences*6 (13) 225 -28
18. https://www.researchgate.net/profile/Praveen-Kumar-K-S/publication/339602870_DIFFERENT_TYPES_OF_NASYA_KARMA_IN_CURRENT_PRACTICE_-_A_REVIEW/links/5e5bdecc4585152ce8ff0670/DIFFERENT-TYPES-OF-NASYA-KARMA-IN-CURRENT-PRACTICE-A-REVIEW.pdf
19. Dr. Sheweta Kotwal, & Dr. Arjun Gupta. (2020). A critical review on the pharmacodynamics of Nasya Karma. *Journal of Ayurveda and Integrated Medical Sciences*, 5(01), 237-243. Retrieved from <http://www.jaims.in/jaims/article/view/845>
20. Roshni KP. (2020). Critical Analysis of Physiological Action of Nasya w.s.r to Sneha Nasya. *World Journal of Advanced Research and Reviews*, 5(2), 07-10
21. Mukherjee A, Khuje SMR, Dwivedi OP, Jain J. Potency of Nasya Karma. JDDT [Internet]. 15Dec.2019 [cited 19Oct.2022];9(6-s):261-6. Available from: <http://.info/index.php/jddt/article/view/3799>
22. Banarase N. Concept of Sharir in Nasya karma. IJPBR [Internet]. 31Mar.2019 [cited 19Oct.2022];7(01):05-6. Available from: <http://ijpbr.in/index.php/IJPBR/article/view/727>
23. Nasya therapy - A Pharmacological Route for Dug Delivery to Brain. *Journal of Ayurveda Physicians & Surgeons*, July, 2018, Vol. 5 (3) Page No 76.
24. Kumar, V. (2017). A CONCEPTUAL STUDY ON MODE OF ACTION OF NASYA. *International Journal of Ayurveda and Pharma Research*, 5(7). Retrieved from <http://www.ijaprs.com/index.php/ijaprt/article/view/728>
25. P Jatvef physiological action of Sneha Nasya A critical review *Journal of Indian system of medicine* 2016 (4) 4 226 – 29
26. <https://www.joinsysmed.com/article.asp?issn=2320-4419;year=2016;volume=4;issue=4;spage=226;epage=229;aulast=Pawar;type=0>
27. D Banamali, GE Ravi, Mishra pk G Bhuyan A study on Apabahuka (frozen shoulder) and it's management by Laghumasha Taila Nasya *Ayu Oct-Dec*;31(4) 488-494.20.