

A CONCEPTUAL STUDY ON PROBABLE MODE OF ACTION OF KARNPOORAN

Kotwal Sheweta¹, Bisht Komal², Singh Dayashankar³

¹MS Final Year Scholar, ²MS Final Year Scholar, ³Associate Professor;

^{1,2,3}PG Department of Shalakyta Tantra, Patanjali Ayurvedic College, Haridwar, Uttarkhand - 249405, India

Email: shweta.kotwal007@gmail.com

ABSTRACT

In Ayurveda, *Snehana* (oelation) is the major preparatory procedure to be performed before *Shodhana* (detoxification process). *Snehana* is of two types i.e. *Abhyantra* (internal) and *Bahya* (external) *Snehana*. *Karnpooran* is a type of *Bahya Snehana* which pacifies the morbid *Dosha*. Different *Acharyas* have quoted its importance by mentioning it to administer as a daily regime, thereby preventing all kind of *Karna* (ear) *Rogas*. It is particularly useful in the treatment of diseases occurring in the ear but it also work on the adjacent areas like face, head region etc. by improving the blood circulation of that particular area. As *Karnpooran* is the best treatment modality in *Karna Rogas*, its probable mode of action need to be discussed for its scientific validity. So, its mode of action both in Ayurveda and modern science will be discussed in detail in this paper.

Keywords: *Abhyantra Snehana, Karnpooran, Karna Rogas, Ear disease.*

INTRODUCTION

Panchkarma is the backbone of Ayurveda and all *Panchkarma* procedures are always performed in three phases- *Purva Karma, Pradhana Karma* and *Paschat Karma*. *Purva Karma* prepares the body for *Pradhan Karma* by proper mobilization of *Doshas* from *Shakha* to *Kostha* to be eliminated outside the body. Our *Acharyas* have also mentioned the importance of *Purva karma (Snehana and Swedana)* as in a vessel smeared with oil, water falls down without sticking to the vessel, similarly *Kapha* and other morbid *Doshas* are expelled out easily in a body which has undergone *Snehana*.¹ Also, *Sanshodhan* given without *Snehana* and *Swedana* would destroy the body like the bending of dry stick causes breaking of stick.² *Snehana* is of two types i.e. *Abhyantra* (inter-

nal) and *Bahya* (external) *Snehana*. *Karnpooran* is one of the types of *Bahya Snehana* which helps in pacifying the vitiated *Doshas*. It is considered as a superior and effective treatment in *Karnarogas* as explained by all classical text. *Karna Taila, Karna Tarpana* or *Karna Basti* is used synonymously with *Karnpooran*. It is particularly useful in the treatment of diseases occurring in the ear but it also work on the adjacent areas of the face and head region, therefore it is said to be a prime topical procedure in various *Karnarogas, Shirorogas* and in *Manyarogas*.

Definition: *Karnpooran* is the act of filling up of the *Karna* with medicated *Swaras, Tailas* or other medicated liquids for a stipulated period of time.

Karnpooran is mentioned in all Ayurvedic texts but its procedure has been described only by *Acharya Vagbhatt* and *Acharya Sharangdhara*.

- As per *Ashtanga Hridaya*, *Karnpooran* is told as a daily regimen to be followed.³
- According to *Acharya Sushruta*, *Karnpooran* eliminates *Hanu*, *Manya*, *Shirashoola*.⁴
- According to *Acharya Charaka*, Ear diseases due to *Vata*, torticollis, lockjaw, hardness of hearing and deafness are prevented if oil is regularly dropped into the ears.⁵
- *Acharya Sharangdhara*⁶ has explained the detail description about *Karnpooran* as follows- The patient should lie to one side (non affected side) and *Swedana* of *Karna Desha* is done. Then *Poorana* with lukewarm *Mootra*, *Sneha* or *Rasa* is done. *Acharya Vagbhatt* has also mentioned the same procedure but *Karna Vimardana* (mild massage of ear) has to be done during procedure.⁷ He has also indicated that the *Abhyanga* is done in *Karna Pradesh* in regular practice.³

Time of Karnpooran:⁸

- *Rasa* and other *Drava Padarthas* should be used for *Karnpooran* before food.
- *Taila* etc. should be used at the time of *Sooryaastha*.

Dharana Kala (Duration of retention of sneha in ear):

Acharya Sharangdhara explains the *Dharana Kala* of *Karnpooran* as follows-⁹

The medicine is retained by the patient for duration of 100 or 500 or 1000 *Matra Kala* respectively for *Shrotra*, *Kantha* and *Shiro Roga*. *Matra* is the time required to move the fist around one's knee quickly. *Acharya Vagbhata* has also mentioned the *dharana kala* as follows:⁷

In Painful condition till pain relives and,

In *Swastha* 100 *Matra*

Indications for Karnpooran: Pain in the *Hanu*, *Manya*, *Shira* and *Karna* is its general indication. Specifically it is indicated in conditions like *Vataja Karna Shula*, *Pittaja* and *Kaphaja Karnaroga*. In

Pootikarna, *Karnanada*, *Karnasrava*, *Karna Pratinaha*, *Krimikarna*, *Badhirya*, *Karna Ksweda* etc.

Procedure of Karnpooran:

Whole procedure can be broadly divided in to three parts.

1) Purva Karma:

- Patient should be made to lie down on his/her lateral side opposite to affected ear.
- Then, mild massage should be done with luke warm medicated oil (mostly *Tila Taila*) around the ear and pinna for a short duration of time (Approx.5min) Massage should also be done to lateral portion of neck, inferior to ear.
- After this, *mridu swedana* (hot fomentation) is done around ear with towel soaked in boiling water by touching and pressing for some time (Approx.5-7 min.)

2) Pradhan Karma:

- Then *Pradhan Karma* is to be done, firstly medicated liquid (oil) should be heated in water bath to make luke warm.
- The external auditory canal should be straightened by pulling the pinna backward and upwards and the liquid (oil) is poured slowly till the ear canal is filled up to the base of concha.
- The root of ear should be gently massaged for better absorption through the skin.
- Patient is advised to be in same position for prescribed time limit approximate 3 minutes (100 *Matra* = 3 min.)¹⁰ and asked to do chewing movements for a while.
- Ear lobes should be rubbed and pulled with oiled fingers. Followed by a gentle rubbing and pressing of the ear cartilage itself and the folds of the outer ear.

3) Pashchat Karma:

- After this, the excess oil should be taken out of the external auditory canal with the help of dry cotton mopping.
- In bilateral case, the same procedure should be followed in the fellow ear also.

Probable mode of action of Karnpooran: (Figure 1):

A) Ayurvedic view: *Snehana* is the principle line of treatment for controlling *Vata*. *Karnpooran* is a

type of *Bahya snehana*. Thus it is a best treatment for *vata nigraha*. *Acharya Charaka* has mentioned that *Vata Roga* doesn't stay in *Koshta* which is softened by *Snehana*. Detailed description regarding mode of action of *Karnpooran* is not available in our Ayurvedic texts but *Karntaila* (i.e. *Karnpooran*) is mentioned under 24 *Sneha Pravicharana*,¹¹ so its mode of action can be understood as *Sthanik Snehana*, only if, *Sneha Dravya* is used in this process.

Probable mode of action of Poorva Karma of Karnpooran: The mode of action of *Abhyanga* can also be understood by the properties of *Snehana* drugs that are used for *Abhyanga* as the properties of the *Snehana* drugs are opposite to *Vata*, so it is useful in all ear diseases caused by vitiated *Vata*.

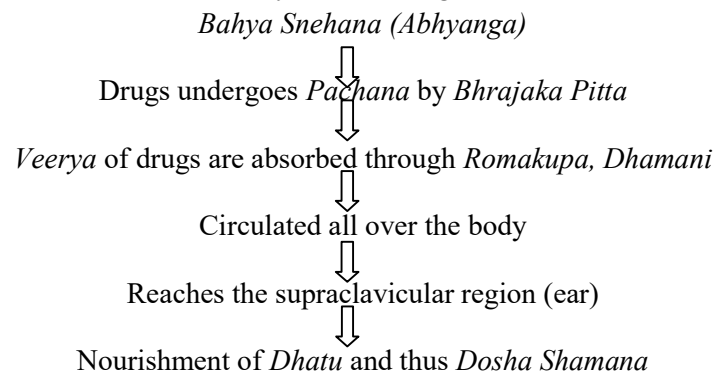
- *Abhyanga* with *Tila Taila* (mostly used as it is best *Vata Shamak*) alleviates *Vata*, at the same time doesn't aggravate *Kapha*. It has *Ushna*, *Tikshna* and *Vyavayi gunas*, so it has good capacity to penetrate through small channels in the body so that it will open the obstructed path (channels or *srotas*) and facilitate the drainage of vitiated *Doshas*.
- *Acharya Sushruta* described the mode of action of *Abhyanga* as *Bahya Snehana* on which *Dalhana* commented as follows-

The four *Tiryak Dhamani*, each divides gradually hundred and thousand times to become innumerable. These cover the body like a network and their openings are attached to *Romakupa*. And through these *Romakupas*, the *veerya* of drugs present in *Abhyanga*, *Parisheka*, *Avagaha*, *Lepa* etc. are absorbed into the skin after undergoing *Paka* by *Bhrajaka Pitta* in skin, thereby entering into the body and produces desired therapeutic action.¹²

Commentator *Dalhana* also explained in detail about the absorption of *Sneha* used in *Abhyanga* procedure. According to this, the oil used in *Abhyanga* can reach upto the different *Dhatu* if applied for the sufficient time. Hence, it is clear that the potency of drug used in oil gets absorbed by the skin.

Acharya Dalhana also mentions that when *Snehana* drug reaches to particular *Dhatu*, it subsides or cures the diseases of that particular *Dhatu*.¹³ *Acharya Sushruta* has also mentioned that *Sneha* used in *Avagahana*, through *Siramukha* (opening of the veins), *Romakupa* (root of the hairs) and *Dhamani* (arteries) nourishes the body and thus provides strength.¹⁴ Same can be understood for *Abhyanga* which is also a type of *Bahya Snehana*.

The whole process can be better understood by the flow diagram mentioned below:¹⁵



b) Swedana: *Acharya Charaka* has described the mechanism of *Swedana Karma* as given below¹⁶

- ❖ *Srotaha Su Abhiviliyate*: It helps to dissolve *Kapha* which is in a dense stage (*Grathita*) stuck to the channels firmly. Further it liquefies *Kapha*

allowing it to move freely. Due to *Ushna Guna* of *Swedana*, *Kapha Dosha* gets liquefied.

- ❖ *Khāni Mardavam Ayanti*: It makes the channels soften, by which *Vata* flows in normal direction (*Anulomana*)

- ❖ *Slesma Vishyandate*: It increases the secretion of vitiated *Kapha* through the channel.
- *Swedana* by its *Ushna* and *Tikshna Guna* are capable of penetrating the microcirculatory channels (*Srotas*) where they activate the sweat glands to produce more sweat. *Ushna Guna* of *Swedana* dilates the capillaries thus it increases circulation. Increased circulation enhances the elimination of waste products and more absorption of *Sneha* or drugs through the skin.
- Due to the effect of *Sara* and *Sūkshma Guna* of *Swedana*, the *Līna Dosha* are liquefied in our body and they come out through micropores, which are present over the skin as pores of sweat glands. Moreover, these *guna* enable them to act on the *Dosha* in the channels, remove stagnation (*Sanga*) in the form of *Kapha*, making the sticky contents mobile and direct them to move towards micro pores of the skin to excrete in the form of sweat, resulting in *Srotoshodhana*. Thus, *Swedana* do cleansing effect in the body.
- When lukewarm oil enters into the *Shabdavaha Srotas*, network of *Srotas* carry the *Taila* towards the desired sites and cleanses the channel.
- Due to *Srotoshodhana* and *Vata-Kapha Shamana*; *Avarana* and *Sanga* of *Vata & Kapha Dosha* is removed and nutrition is brought to the respective sites and micro circulation of ear is restored properly.

So, after breaking the *Aavarna* and *Sanga* by *Abhyang* and *Swedana karma*, *Karnpooran* with medicated *sneha* has been carried out in *Karna rogas* patients.

Probable mode of action of Pradhana karma of Karnpooran:

According to *Kedarikulya Nyaya*, Blood supply will improve in ear first and then, later on the adjacent structures. Patient is asked to do chewing movements during the procedure. Chewing movements and *Karmmoola Vimardan* facilitates good absorption of drug. According to *Ayurveda*, When the *Sneha* is instilled into the ear, drugs in the *Sneha* get absorbed by *Bhrajaka Pitta* present in and around the *Twak* (skin) of *Karna*. From there drug is spread in to the deeper tissues through (*Rasa & Rakta*) *Shabdavaha Sira* i.e. from epithelial tissue of external ear canal, tympanic membrane to systemic blood flow. The medicine used should be luke warm and by counter effect of *Ushna Guna* of heat, it helps in relieving the *Shoth* (inflammation), thereby reduces ear ache (*karnashool*) and pain in adjacent areas.

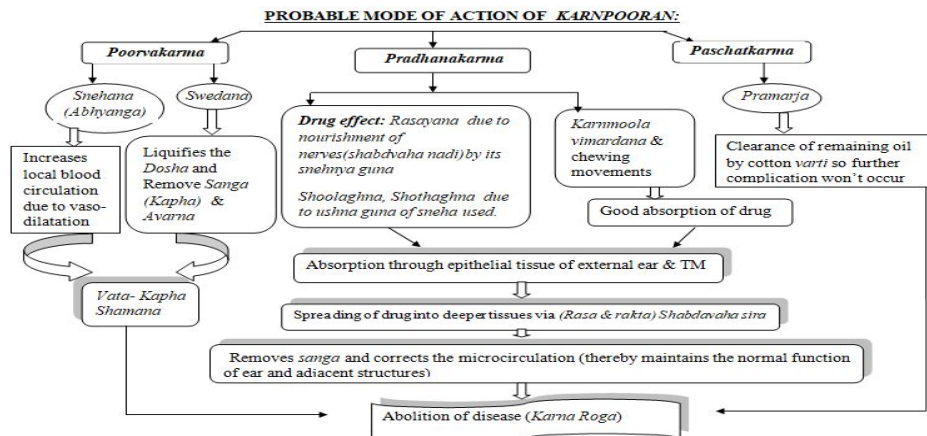


Figure 1: Probable mode of action of Karnpooran

B) Modern View: Mode of action of *Karnpooran* can be best understood by the mechanism of whole procedure in which *Bahya snehana (Abhyanga)*, *Swedana* and the *Pradhankarma* (instilling medicine into ears) is done.

1) **Abhyanga(Massage)** is specifically done in the *Murdha Pradesha* and the effect of *Abhyanga* can be assumed in two ways i.e,

- a) Through Physical manipulations, and
- b) Via effect of the drug in the medicated oil.

- Physical manipulation in the form of massage stimulates the receptors of the sympathetic nervous system which causes vasodilatation in skin and muscles. It increases the circulation of blood and plasma, thereby stimulate & strengthen the lymphatic system and remove internal waste products.
- The strokes used in *Abhyanga* like kneading and friction also have effects like-
 - ❖ Increase in flow of circulation to the local area treated.
 - ❖ Reduction of tone in muscles which are in a state of excess tension.
 - ❖ Relief in pain is obtained by releasing acute or chronic tension in muscles and by affecting pressure of touch on nerve endings.

2) **Swedana (hot fomentation):** During fomentation, temperature rises and due to increased body temperature sympathetic activities rises and in turn releases hormones like Epinephrine, Norepinephrine, cortisol. They in response, accelerate the metabolic rate. Due to which there is an increased demand for oxygen, energy (food stuffs) and output of waste products including metabolites from the body. Increased temperature also stimulates the sweat glands of the skin through hypothalamic activation of sympathetic nerves which results in sweating and removal of waste products. In *Swedana*, its properties like *Sara* and *Sukshma Guna* liquefies the *Lina Dosha* in our body, which come out through micropores of sweat glands through sweating (*Swedana*). Thus helps in *Srotoshodhana*. As the efferent vasodilator nerves are spread out on the superficial surface of the face, they also receive

stimulation by hot fomentation which may increase blood flow to the brain.

It also causes vasodilatation of the vessels to reduce the heat when the body temperature is high during hot fomentation. With the result there is increase in blood flow to the particular area, results in increased oxygen, nutritive materials and waste products removed. Here, it can be formulated that the *Ushna Guna* of *Swedana* does stimulation of sympathetic nervous system which results in *Sroto-Vispharan* (vasodilatation). As the blood circulation increases due to vasodilatation, *Ushna Guna* is responsible for the increased circulation of *Rasa* and *Rakta* in the body.

It has also been mentioned that heat is expected to enhance the transdermal delivery of various drugs by increasing skin permeability, body fluid circulation, blood vessel wall permeability, rate-limiting membrane permeability and drug solubility. Heating prior to or during topical application of a drug will dilate penetration pathways in the skin, increase kinetic energy and the movement of particles in the treated area and facilitate drug absorption. Heating the skin after the topical application of a drug will increase drug absorption into the vascular network.¹⁷ So, *Ushna Guna* helps in the better absorption of *Sneha* (oil) during or after *Swedana*. Or, we can say that result of both *Abhyanga* and *Swedana* facilitate more absorption of drug.

3) Instillation of medicine in ears (Pradhan karma): After *Swedana*, when the lukewarm oil is instilled in the ear, it absorbs into the seven layers of skin to enter into blood circulation from where the effect of drug reaches the target area. To better understand the absorption of oil in the skin of ear, we must know the anatomy of skin and its percutaneous absorption.

Anatomy of Skin:¹⁸ Skin can be divided into two layers: epidermis and dermis or corium, penetrated by hair shafts and gland ducts. The major skin layers, from inside to outside, comprise the fatty subcutaneous layer (hypodermis), the dermis of connective tissue and the stratified avascular cellular epidermis. This multilayered organ receives approximately one-third of all blood circulating through the body. Epidermis results from an active epithelial basal cell pop-

ulation and is the outermost layer of the skin, and the process of differentiation results in migration of cells from the basal layer toward the skin surface. The epidermis contains no blood vessels; therefore, nutrients and waste products must diffuse across the dermal-epidermal junction to maintain its vitality. The epidermis consists of five layers, which, from the inside to the outside, are:

- Stratum germinativum (basal layer),
- Stratum spinosum (spinous layer),
- Stratum granulosum (granular layer),
- Stratum lucidum and
- Stratum corneum (sc).

Because the SC cells are dead, the epidermis without the SC is usually termed the viable epidermis. The SC is considered as the rate-limiting barrier in transdermal permeation of most molecules. Thus, how fast or quickly something passes through this outer layer determines the overall absorption. The stratum corneum is primarily composed of lipophilic cholesterol, cholesterol esters and ceramides. Thus lipid-soluble chemicals make it through the layer and into the circulation faster, however nearly all molecules penetrate it to some minimal degree.

Drug Penetration Route: There are critically three ways in which a drug molecule can cross the intact SC:

1. Via skin appendages (shunt routes),
2. Through the intercellular lipid domains or
3. By a transcellular route.
 - 1) The appendageal route: The transappendageal routes are also known as the shunt routes, and include permeation through the sweat glands and across the hair follicles with their associated sebaceous glands. Skin appendages provide a continuous channel directly across the SC barrier.
 - 2) Transcellular route: Drugs entering the skin via the transcellular route pass through the corneocytes. Corneocytes containing highly hydrated keratin provide an aqueous environment from which hydrophilic drugs can pass. The transcellular pathway requires not only partitioning into and diffusion through the keratin bricks but also into and across the intercellular lipids.

- 3) Intercellular route: The intercellular route involves drug diffusion through the continuous lipid matrix.

Recently, it was proposed that the route through the skin appendages contributes little to the rate of skin absorption of most drugs in the steady state; however, this route enables permeation of charged molecules and large polar compounds; e.g. peptide-based drugs. The major route of skin permeation is through the intact epidermis, and two main pathways have been identified: the intercellular route and the transcellular route. In both cases, the drug must diffuse into the intercellular lipid matrix, which is recognized as the major determinant of drug absorption by the skin. Both polar and non-polar substances diffuse via transcellular and intercellular routes by different mechanisms. The polar molecules mainly diffuse through the polar pathway consisting of “bound water” within the hydrated stratum corneum whereas the non-polar molecules dissolve and diffuse through the non-aqueous lipid matrix of the stratum corneum. Thus the principal pathway taken by a penetrant is decided mainly by the partition coefficient ($\log K$). Hydrophilic drugs partition preferentially into the intracellular domains, whereas lipophilic permeants (octanol/water $\log K > 2$) traverse the *stratum corneum* via the intercellular route. Most molecules pass the stratum corneum by both routes.¹⁹

Transdermal permeation of Drug: According to Kalia and Guy (2001),²⁰ drug transport in the skin is a process involving several steps:

- a) Dissolution and release of drug from the formulation;
- b) Drug partitioning into the stratum corneum;
- c) Drug diffusion across the stratum corneum, mainly by intercellular lipids;
- d) Drug partitioning from the stratum corneum into viable epidermis layers;
- e) Diffusion across the viable epidermis layers into the dermis, and
- f) Drug absorption by capillary vessels, which achieves systemic circulation.

So, in *Karnpooran*, the drug absorbs via skin during *Abhyanga* (massage) or after instilling it inside the

External Acoustic canal, it goes through the above processes and reaches the blood circulation, from there it hit the target area (ear and its adjacent areas).

Permeation Enhancers:²¹ Permeation enhancers are the substances that functions by lowering the potential of the barrier characteristics of skin so that it turns more permeable for the drug molecules to traverse the skin rapidly. It works by increasing the drug diffusivity in the stratum corneum (SC) by liquefying the skin lipids or by denaturing skin proteins. Types of enhancers are:

1. Physical enhancers, 2. Particulate systems, 3. Chemical enhancers, 4. Drug vehicle based, 5. Natural penetration enhancers, and 6. Biochemical Approach.

Natural Oils comes under Natural penetration enhancers. Oil is any neutral, non-polar chemical substance which is a thick liquid at room temperature. It is lipophilic ("fat loving" or miscible with oils) and also hydrophobic ("water fearing" or water immiscible) in nature. Natural oils play a promising role as permeation enhancers in TDDS (Transdermal Drug System). Oil contains Free fatty acids (FFAs), specifically monounsaturated FFAs such as oleic acid, may disrupt skin barrier and act as permeability enhancers for other compounds present in plant oils.²² Natural oils include fixed oils and essential oils. Essential oils are also known as volatile oils which get evaporated in the external environment unlike fixed oils, whereas fixed oils are obtained from seeds. Fixed oils are studied to be efficacious permeation enhancers of skin and are considered as safe and non-toxic. Their examples are *Tila Taila* (sesame oil), *Sarshapa Taila* (mustard oil) etc. In most Ayurvedic medicated oils, *Tila Taila* (sesame oil) is used as a base in preparing oil by special method of processing (*Murchhana*). According to some research studies, this process increases the saponification value and reduces the acid value. This increases the absorption of the medicated oil in the body because increased saponification value increases the concentration of fatty acids that have low molecular weight and reduced acid value decreases the percentage of free fatty acids. Hence, natural oils indi-

vidually or processed with herbs easily get absorbs in the skin and give the desired effect.

CONCLUSION

Karnpooran is best treatment modality in all ear *rogas* except in rupture tympanic membrane, any injury to ear, Cuts and Burns that affects ears. *Acharya Charaka* and *Acharya Vagbhata* has quoted its importance in daily routine to avoid any diseases related to *Karna*, *Hanu*, *Manya*, *Shira* and *Vata Dosha* related disorders. Its mode of action in both Ayurvedic and modern perspective should be discussed to enhance its scientific validity in the field of research. Keeping in view of the above said facts, it can be concluded that the *Veerya* (essence or effect) of drugs reaches the blood circulation via skin absorption process and from there to target areas of ear and its adjacent parts.

REFERENCES

1. Kushwaha H S, editor. *Charak Samhita, Siddhistan*, Ch.6, ver.11 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 1022.
2. Thakral K K, editor. *Sushruta Samhita, Chikitsasthan*, Ch.33, ver.46 (Reprint). Chaukhamba Orientalia, Varanasi, 2017; 515.
3. Tripathi B, editor. *Astanga Hrdayam of Srimadvagbhata, Sutrasthan*, Ch.2, ver.8 (Reprint). Chaukhamba Sanskrit Pratishthan, Delhi, 2017; 30.
4. Thakral KK, editor. *Sushruta Samhita, Chikitsasthan*, Ch.24, ver.29 (Reprint). Chaukhamba Orientalia, Varanasi, 2017; 422.
5. Kushwaha HS, editor. *Charak Samhita, Sutrasthan*, Ch.5, ver.84 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 85.
6. Srivastava S, editor. *Sharangdhara Samhita, Uttarkhand*, Ch.11, ver.128 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 450.
7. Tripathi B, editor. *Astanga Hrdayam of Srimadvagbhata, Sutrasthan*, Ch.22, ver.32 (Reprint). Chaukhamba Sanskrit Pratishthan, Delhi, 2017; 261.
8. Srivastava S, editor. *Sharangdhara Samhita, Uttarkhand*, Ch.11, ver.129 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 450.
9. Srivastava S, editor. *Sharangdhara Samhita, Uttarkhand*, Ch.11, ver.130-31 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 451.

10. The Ayurvedic Pharmacopoeia of India. (2009). *Weights and Measures-Part1*, Vol.6. New Delhi: Ayush G.O.I Publications.
11. Kushwaha HS, editor. *Charak Samhita, Sutrasthan*, Ch.13, ver.25 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 205.
12. Thakral KK, editor. *Sushruta Samhita, Chikitsasthan*, Ch.9, ver.9 (Reprint). Chaukhamba Orientalia, Varanasi, 2017; 134.
13. Thakral KK, editor. *Sushruta Samhita, Chikitsasthan*, Ch.24, ver.30 (Reprint). Chaukhamba Orientalia, Varanasi, 2017; 422.
14. Thakral KK, editor. *Sushruta Samhita, Chikitsasthan*, Ch.24, ver.33 (Reprint). Chaukhamba Orientalia, Varanasi, 2017; 423.
15. Vasant CP. Principles and Practice of Panchkarma. (Fifth edition). Chaukhamba Publications, New Delhi, 2015; 185.
16. Kushwaha HS, editor. *Charak Samhita, Chikitsasthan*, Ch.17, ver.71-76 (Reprint). Chaukhamba Orientalia, Varanasi, 2016; 457.
17. Wade Hull. Heat-Enhanced Transdermal Drug Delivery: A Survey Paper. The journal of applied research. 2002;2(1):XXIII-XXIV. Available from: <http://www.jarcet.com/articles/Vol2Iss1/Hull.htm>
18. Rastogi V, Yadav P. Transdermal drug delivery system: An overview. Asian J Pharm. 2012;6:161-70
19. Tanwar H and Sachdeva R. Transdermal Drug Delivery System: A Review. Int J Pharm Sci Res. 2016;7(6): 2274-90. doi: 10.13040/IJPSR.0975-8232.7(6).2274-90
20. Kalia YN, Guy RH. Modeling transdermal drug release. Advanced drug delivery reviews. 2001 Jun 11;48(2-3):159-72.
21. Lakshmi P K et al. Oils as penetration enhancers for improved transdermal drug delivery: A review. Int. Res. J. Pharm. 2017;8(4):9-17 <http://dx.doi.org/10.7897/2230-8407.080440>
22. Mack Correa, MC, Mao G, Saad P, Flach CR, Mendelsohn R, Walters, RM. Molecular interactions of plant oil components with stratum corneum lipids correlate with clinical measures of skin barrier function. Exp Dermatol. 2014 Jan; 23 (1):39-44. DOI:10.1111/exd.12296

Source of Support: Nil

Conflict Of Interest: None Declared

How to cite this URL: Kotwal Sheweta et al: A Conceptual Study On Probable Mode Of Action Of Karnpooran. International Ayurvedic Medical Journal {online} 2019 {cited October, 2019} Available from: http://www.iamj.in/posts/images/upload/1904_1911.pdf