

ROLE OF BASTI ON INFLAMMATORY MARKERS

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INTRODUCTION:

According to *Ayurveda*, *Basti Karma* is one of the five Purification/Expulsive/Biocleansing/Detoxifying Therapy (*Samshodhana Chikitsa*) advocated under *Panchakarma*. In *Basti Karma*, medicated oils or decoction are to be administered via rectal, vaginal, urethral route. Basti is classified into various types according to the ingredients used, action of *basti*, and numbers of days a *basti* is being given, in which medicines are being used based on the medical condition. *Basti* is commonly administered alone or along with herbal medication in all *Nanatamja Vatavyadhi* (Musculo-neurological disorders), *Amavata* (Rheumatoid arthritis), *Katishoola* (Lumbosacral spondylosis), *Apanavayu Dushti* like *Anaha* (Distended Abdomen), *Malavrodha* (Constipation), *Artavakshaya* (Amenorrhoea), *Shukrakshaya* (Azoospermia), and various types of other diseases i.e. *Vatarakta* (Gout), *Pleehavidhi* (*Splenomegaly*) etc. *Basti Karma* is divided in two types based on drugs, *Anuvasana* (*Sneha pradhana*) and *Aasthapana* (*kwatha pradhana*). In *Anuvasana Basti*, medicated Oils/*Ghrita* are used, word *Anuvasana* indicates “To stay”, means which stay inside body for a longer duration, but still do not cause any complication. In *Asthapana Basti*, decoctions of herbal plants are the main content while other ingredients like Honey, Salt, and Oil and other drugs are incorporated to form a suspension. Word *Niruha*, indicates “To eliminate” or eliminate morbid *Doshas* or Disease from body and its synonym word “*Asthapana*” indicates “establish life span and age by *Acharya Sushruta*.”

Not only are the effects of *Vasti* therapy limited to the rectum and *Samshodhana* of feces, but it also produces widespread systemic effects, i.e. ultimately, with the addition of various types of medicines, it influences all *Doshas*. Depending upon the use of different drugs, *vasti* affects the *Samshodhana* of *Dosha* while also having *samshamana* effects. It performs the *Shodhana* of *Vata*, *Pitta*, *Kapha*, and *Vit*, and hence it is *Tridoshahara*.

While enema solutions have a significant spreading potential, foam and suppositories have been demonstrated to be mostly retained in the rectum and sigmoid colon. Short-chain fatty acids are absorbed from the rectum more in the presence of sodium and potassium. Unionized lipid-soluble substances are absorbed in the colon by simple diffusion across a lipoidal barrier mucosa. These are certain points put forward in favor of the rectal route of drug absorption.

The phytochemicals present in the *Vasti* preparations are indeed absorbed into the overall bloodstream.

The extent and speed of this absorption process are influenced by the characteristics of the ingredients, such as their *Prakshepa* (additive) properties and other related factors. The rectal route of administration of drugs shows greater effectiveness than when they are given orally. Research conducted using MgSO₄ revealed that when given orally, MgSO₄ acts as a laxative; when administered intramuscularly, MgSO₄ acts as an antidepressant; and when administered through the rectal route, it reduces intracranial pressure. Within the practice of *Vasti karma*, various medications are employed to serve diverse objectives.

For the absorption of peptide and protein medicines, the colon is thought to be an ideal location. The amount of retrograde spreading, the retention duration, and formulation parameters all affect the concentration of medications that reach the colon. On the other hand, Inflammatory markers are substances in the blood that increase in response to inflammation, a natural bodily response to injury, infection, or other stimuli. Common inflammatory markers include C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and procalcitonin (PCT). These markers help to identify and assess inflammation, but they are not specific to any one disease.

Cytokines like IL-17 and IL-22 play pivotal roles in host defense against microbes and in the development of chronic inflammatory diseases. These cytokines are produced by cells that are often located in epithelial barriers, including subsets of T cells and innate lymphoid cells.

The low grade chronic inflammation is characterized by accumulation of macrophages and other activated immune cells (T cells, B cells, eosinophils, neutrophils, mast cells and natural killer cells) in the adipose tissue.

M1 macrophages are characterized by enhanced pro-inflammatory cytokine production (TNF- α , IL-6, IL-1). On the other hand, M2 macrophages are characterized by the production of anti-inflammatory cytokines such as IL-10. Enhanced activity of TNF and IL-6 are involved in the development of inflammation. Macrophages and dendritic cells infiltrate into expanding adipose tissue, where they produce IFN- γ . Basti therapy downregulated levels of IL-6 and IFN- γ at S-2.

These biomarkers are valuable biological indicators that can be used to assess the severity, presence, disease progression of inflammation within the body. Inflammation is a complex physiological response that occurs in response to various stimuli such as tissue damage, infections and autoimmune responses. The inflammatory response in the body causes cellular changes and immune responses that result in repair of the damaged tissue and cellular proliferation at the site of injured tissue. Inflammatory reactions involve a series of cellular and Biochemical changes.

Keywords: *Basti*, *Basti Karma*, Inflammatory Markers

MODE OF ACTION *BASTI*:

- **Systemic Absorption:** The *Basti dravya* (medicated material) is absorbed directly into the systemic circulation from the colon, allowing the drug's properties to reach the entire body and act on specific pathologies.
- **Site-Specific Absorption:** *Basti* is primarily administered in the *Pakwashaya* (large intestine), which is the abode of *Vata*. Balancing *Vata* here helps manage systemic, nervous, and muscular disorders.
- **Neural And Reflex Mechanism:** Administration triggers the enterogastric and colonoileal reflexes, which help retain the *Basti* material for a longer duration to maximize absorption, rather than causing immediate evacuation.
- **Pathophysiological Impact:** It reverses the *Samprapti* (pathogenesis) of diseases by acting on the *Srotas* (channels) and restoring the normal function of *Agni* (digestive fire).
- **Stimulation of Enteric Nervous System**
- The enteric nervous system (ENS) is the greatest division of the autonomic nervous system. It is found to be a complex network of neurons and glial cells embedded in the gut wall. These cells perform independent of sympathetic and parasympathetic nervous system but can be influenced by them. It facilitates the activities of immune response, nutrient absorption, bowel motility etc. Administration of *Basti* directly into the gut may cause stimulation of ENS which in turn activates the above-mentioned functioning of the ENS. The ENS works in synergy with the central nervous system (CNS). Activation of ENS may cause stimulation of the concerned part of the CNS as well.
- **Absorption of *Basti***
- The working site of *Basti*, that is the *Pakwashaya*, or the large intestine is responsible for the absorption of almost 90% of the ileal effluent. The cell membrane epithelial cells of the colon is made up of lipid and is a semi permeable membrane. It allows unionised compounds to pass through it. Presence of *Sneha* could facilitate the process of absorption. The active compounds of *Basti* then reaches the systemic circulation and reaches the site of pathology. Colon offered as second brain and is intricately linked to the nervous system through the gut-brain axis (HPO-axis). *Basti* acting on colon spreads to whole body via tissues, pores, channels.

- **Actions on Gut Microbiota**
- The colon hosts nearly 5000 species of bacteria, viruses, archaea and fungi that improve the normal functioning of the colon. They are rather considered as essential for the health because disturbance in the gut microbiota has been associated with various systemic disorders. These tiny guests play an important role in synthesis of the essential metabolites that are easily absorbed by the colon. For example, the complex carbohydrates are fermented to short-chain fatty acids which in turns acts as lipid regulating factor. The ingredients of *Basti Dravya* are basically lipids, carbohydrates, and minerals that basically have nutritive effect on the gut microbiota which in turn may help in improving their colonisation.
- **Increases Bioavailability**
- There are studies showing that bioactive compounds of certain drugs may get degraded while digestion thus are not available for absorption. Hepatic pass metabolism or the first pass effect of liver is another challenge for the oral drug to get into the systemic circulation. Inferior rectal veins drain into the inferior vena cava and bypass liver thus avoiding the hepatic first pass effect which in turns increases the bioavailability of the active compound of the medicine.
- **Cleansing Effect**
- Gut microbiota is an essential factor in the metabolism but studies have shown that dysbiosis of gut flora can cause serious health issues. The administration of *Basti Dravya* causes distention of the colon which in turn initiates a defecation reflex. *Basti* reaching to ileocecal junction, thus evacuates the whole colon content and may result in the expulsion of the harmful colonies of microorganisms.
- *Basti Karma* is believed to exert a harmonizing effect to the mind, making it a valuable therapeutic tool for conditions such as anxiety, stress and even certain cognitive disorders.
- It has been seen that *Basti* has helped in reducing the inflammatory markers. It is basically depend on the ingredients used in the *basti*. As a fact being noticed in certain cases, that given *basti* with some ingredients rich in estrogen helps in reducing inflammatory markers such as CPR, ESR, etc.

• **OVERVIEW OF ACTION OF ESTROGEN:**

• **Musculoskeletal**

- **Anabolic:** Increases muscle mass and strength, speed of muscle regeneration, and bone density, increased sensitivity to exercise, protection against muscle damage, stronger collagen synthesis, increases the collagen content of connective tissues, tendons, and ligaments, but also decreases stiffness of tendons and ligaments (especially during menstruation). Decreased stiffness of tendons gives women much lower predisposition to muscle strains but soft ligaments are much more prone to injuries (ACL tears are 2-8x more common among women than men).
 - Reduce bone resorption, increase bone formation

• **Metabolic**

- Anti-inflammatory properties
- Accelerate metabolism
- Gynoid fat distribution: increased fat storage or estrogenic fat in some body parts such as breasts, buttocks, and legs but decreased abdominal and visceral fat (androgenic obesity).
- Estradiol also regulates energy expenditure, body weight homeostasis, and seems to have much stronger anti-obesity effects than testosterone in general.
- Inhibition of ferroptosis by hydroxyoestradiol derivatives.

• **Other structural**

- Maintenance of vessels and skin.

• **Protein synthesis**

- Increase hepatic production of binding proteins
- Increase production of the hepatokine adropin.
- Suppress the transcription of ether-lipid pathway proteins.

TYPES OF ESTROGEN: 4Types of estrogen

E1: during menopause is the predominant circulating estrogen.

E2: the most potent form of estrogen found circulating in the non-pregnant females between menarche and menopause phase.

E3: during pregnancy role of E2 shifts to E3.

E4: produced only during pregnancy.

Estrogen exerts potent anti-inflammatory activity, particularly through estradiol(E2) binding to estrogen receptors, which inhibits pro-inflammatory pathways like NK-κB and interferon signalling. It acts by

reducing pro-inflammatory cytokines (IL-6, IL-1beta, TNF-alpha), suppressing macrophage and microglia activation, promoting regular T-cells, and inhibiting leukocyte migration into tissues.

While generally anti-inflammatory in neuroprotection and vascular health, estrogen's effects can be tissue-dependent and time-dependent. It has been shown to reduce inflammatory damage in brain ischemia and neurodegenerative diseases, but it can also have immune-enhancing properties in certain contexts.

Estrogen may also influence CD8⁺ T cells and multiple signaling cascades through cytosolic Ca²⁺ influx. Although estrogen has multiple roles in inflammatory diseases, other ER agonists also exert their anti-inflammatory and neuroprotective roles to prevent inflammation and autoimmunity in the CNS.

Antigen presenting cells (APCs) such as dendritic cells (DCs) and macrophages may play important roles in connecting the innate immune system with the adaptive immune system. A recent study indicated that endogenous estrogen level can modulate the number of APC. ER agonists can regulate activities of T cells through direct involvement of APC functions. Studies have shown that splenic DCs isolated from estrogen-treated animals produce lower levels of TNF- α , IFN- γ , and IL-12 upon LPS exposure, while macrophages produce decreased levels of TNF- α . One of the major roles for ER α signaling in T lymphocytes is the induction of anti-inflammatory effects of estrogen and protection against CNS inflammation.

PLANTS CONTAINING ESTROGEN AS THEIR ACTIVE COMPOUNDS

- **Shatavari** (*Asparagus racemosus*): Acts primarily through its rich content of steroidal saponins (Shatavarins I-IV), flavonoids, and phytoestrogens, providing estrogenic, antioxidant, and anti-inflammatory effects. Key compounds include steroidal saponins, isoflavones, mucilage, polysaccharides, and alkaloids (asparagamine) which offer immune-boosting, antioxidant, and estrogenic benefits.
- Steroidal Saponins (Shatavarins)
- Phytoestrogens/Isoflavones
- Alkaloids: Asparagamine A
- Sterols: Sitosterols and sarsapogenin
- Nutrients & Others: It contains essential fatty acids (gamma-linolenic acid), Vitamins A, B1, B2, C, E, and minerals like calcium, magnesium, and zinc.

These components together contribute to the plant's presentation as a powerful adaptogenic, galactagogue (milk-inducing), and anti-inflammatory agent.

- **Ashwagandha**: Primary active compounds are withanolides, a group of steroidal lactones like withaferin A, withanone, and sitoindosides, responsible for its adaptogenic, anti-inflammatory, and antioxidant effects.
- Acts as an adaptogenic herb that helps balance hormones, potentially increasing estradiol (a form of estrogen) while reducing FSH and LH levels in women, particularly during perimenopause.
- Estrogen Regulation: Studies indicate that ashwagandha can increase serum estradiol levels in women experiencing perimenopause.
- **Methi (Fenugreek)**: Active ingredients are primarily concentrated in the seeds and include **4-hydroxyisoleucine** (an amino acid that helps manage blood sugar), **steroidal saponins** (such as diosgenin), and **alkaloids** (mainly **trigonelline**). These compounds provide anti-diabetic, anti-inflammatory, and galactagogue (milk-boosting) properties.
- **Gokshura**: Primary active ingredients including steroidal saponins (specifically Protodioscin and Protogracillin), flavonoids, alkaloids (nor harmans and harmans) and terrestrosins. These bioactive compounds are highly concentrated in the fruits and the roots providing diuretic, aphrodisiac and anti-inflammatory properties.
- **Flavonoids & Glycosides**: These provide powerful antioxidant and anti-inflammatory properties, protecting kidney and heart tissues.
- **Alkaloids (Norharman/Harman)**: Contribute to muscle-relaxant and neurological effects.
- **Ashoka** (*Saraca Asoca* Or *Saraca Indica*): Particularly its bark, is known in Ayurveda as a premier "female tonic" for its ability to regulate hormones and treat gynecological disorders. The primary active ingredients responsible for its medicinal properties include Tannins, Flavanoids, Glycosides and Sterols (specifically Ketosterol).
- **Ketosterol**: Found primarily in the bark, acting as a natural estrogenic compound.

- **Flavonoids(e.g., Quercetin, Catechin, Epicatechin):** Contribute to anti-inflammatory, antioxidant, and anti-cancer properties.
- **Anti-inflammatory:** Effective in reducing joint pain and inflammation.
- **Guduchi (*Tinospora cordifolia*):** contains a complex mixture of active compounds that provide its immune-boosting, anti-inflammatory, and antioxidant effects.
- The primary active ingredients are alkaloids (berberine, palmatine, choline), terpenoids (tinosporin, tinosporic acid), and glycosides (tinocordiside, syringin).
- **Diterpenoid Lactones/Terpenoids:** These compounds including tinosporin, tinosporic acid, and clerodane derivatives are considered as a key to its anti-inflammatory and hepatoprotective(liver-protective) properties.
- **Glycosides:** Critical compounds such as **tinocordiside**, **syringin**, and **cordifoliosides A-E** are responsible for significant immune-modulating and antidiabetic effects.
- **TIL:** Antioxidants Sesamol and sesaminol (formed from sesamolin) are phenolic compounds that provide strong anti-inflammatory, antibacterial, and antifungal properties.

CONCLUSION:

Basti prepared from such estrogen rich ingredient has been seen in reducing inflammation. Shatavari, Guduchi, Ashwagandha, Methi, Gokshura, Ashoka are rich in such chemical constituents which are directly or indirectly acting on reducing inflammatory markers. Therefore, the reports showing improved inflammatory markers can be considered here as a result of Basti.

The ingredients of *Basti* will reach up to the small intestine and get absorbed through the gut wall, are distributed in the body and thus exert systemic effects. However, one cannot comment on its mechanism of action at this point of time. Perhaps as an indicator towards the mechanism of action, was the observation that the elevated serum levels of IL-6 and IFN- γ of the patients reduced significantly after *Basti*. (With the evidence from scientific research papers on reduction of inflammatory markers..... with gut flushing in the form of enema)... our medicated enemas will have similar or superior results. Hence, with the need of further studies supported by our biochemical markers, we can assertively put forth a promising and effective anti-inflammatory effect of Basti.

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