



Review Article

Health and therapeutic benefits of *Shatkarma*: A narrative review of scientific studiesP.S. Swathi^{*}, B.R. Raghavendra, Apar Avinash Saoji

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ABSTRACT

Shatkarma, also known as *Shatkriya* are a set of six yogic cleansing techniques described in the *Hatha Yoga* texts. Several health benefits of these procedures are indicated in the traditional texts of *Yoga*. However, there is no comprehensive literature about the scientific evidence on *Shatkriya*. Hence, we searched in PubMed, PubMed Central and Google Scholar databases to review relevant articles in English. The search yielded a total 723 references, published from 1976 to April 2020. Based on the inclusion and exclusion criteria, 37 articles were included in this review. We found scientific studies on four out of six cleansing techniques. The limited evidence on *Shatkriya* suggests positive effects on various physiological and clinical domains. The practice of *dhauti* was found to enhance respiratory functions and was useful in digestive disorders. Nasal cleansing, *neti* was particularly found beneficial in managing the rhinosinusitis in age groups ranging from children to adults. Although *trataka* practice was found to enhance cognition and bring a state of relaxation, but there was no evidence supporting its role in eye disorders. *Kapalabhati* practice appears to have a beneficial role in the activation of sympathetic nervous system, enhance cognition, and improve overall metabolism. Further large-scale clinical trials with robust designs are warranted to evaluate the effects of *Shatkriya* in health and disease.

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1. Introduction

Cleansing practices are part of most indigenous health systems, be it *Yoga*, Naturopathy, Ayurveda, or Chinese Medicine. In *Yoga*, six cleansing practices are described in the *Hatha Yoga* tradition, which are known to balance the constitution of an individual. These six cleansing practices in *Yoga* are known as *Shatkarma* or *Shatkriya*, which are said to promote health and well-being by purifying the whole body. *Hatha Yoga Pradipika* (ch: 2, v. 21 and 22) of Swatmarama recommends the practice *Shatkriya* prior to practice of *pranayama* (yogic breath regulation). The *Shatkriya* techniques include *dhauti* (internal cleansing), *basti* (yogic enema), *neti* (nasal cleansing), *trataka* (concentrated gazing), *nauli* (abdominal massaging) and *kapalabhati* (frontal sinus cleansing) [1]. Although several health benefits of *Shatkriya* are narrated in *HathaYoga* texts, there is a lack of comprehensive

literature on scientific studies in the subject matter. Thus, the current review was undertaken to summarize the scientific evidence on the physiological and therapeutic effects of the *Shatkriya*.

1.1. Traditional references for *Shatkriya*

There are four major texts of *Hatha Yoga* tradition viz. *Hatha Yoga Pradipika*, *Gheranda Samhita*, *Shiva Samhita* and *Hatharatnavali*. Among them *Gheranda samhita* and *Hatha Yoga Pradipika* describe the purification of the body, with reference to six variants of the cleansing procedures [1,2]. *Gheranda Samhita* has an elaborate description of the sub-types and benefits of the *Shatkriya*. *Hatharatnavali*, which is the latest among the *Hatha Yoga* texts, narrates eight variants of cleansing techniques [3]. However, the six cleansing techniques described in the *Hatha Yoga Pradipika* of Swami Swatmarama are most popular among the *Yoga* practitioners. The main objective of *Shatkriya* is to balance the three humours (*tridosha*) in the body, mucus (*kapha*), bile (*pitta*) and wind (*vata*) [1].

Though there are a few similarities in the cleansing procedures described in *Yoga* and *Ayurveda* (such as *basti* and *vamana dhauti*),

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the yogic cleansing methods are unique for multiple reasons. The yogic cleansing is done by the practitioner himself under the guidance of Yoga teacher and without administration of any medicine.

2. Methodology

A comprehensive literature search in PubMed, PubMed Central, and Google Scholar databases was carried out for the keywords “*shatkriya*, *shatkarma*, *dhauti*. yogic stomach wash, *basti*, yogic enema, *neti*, yogic nasal cleansing, nasal irrigation, *tratata*, yogic visual concentration, *navli*, yogic abdominal massage, *kapalabhati*, yogic frontal sinus cleansing, high frequency Yoga breathing”. The search yielded a total number of 665 references from the year 1976 till April 2020 for the above-mentioned keywords. Experimental and quasi-experimental studies and case reports in English, with yogic cleansing techniques as an intervention were included in the review. The studies that had combination of Yoga practices were excluded. After applying the inclusion and exclusion criteria and removing the duplicates, a total of 37 studies were selected for the final review. The studies are presented based on the cleansing techniques.

3. Summary of scientific evidence on yogic cleansing techniques

3.1. Dhauti

A literal meaning of *dhauti* is internal cleansing. Four major forms of *dhauti kriya* as described in the *Gheranda Samhita* viz. *antar* (internal), *danta* (teeth), *hrid* (cardiac) and *moola shodhana* (purification of the anus) [1,2]. The most popular forms of *dhauti* include *vamana dhauti*, also known as *kunjala kriya*, *vastra dhauti* and *shankha prakshalana*. *Kunjala kriya* includes drinking warm saline water and voluntarily inducing vomiting to clear the contents of stomach. In *vastra dhauti*, the practitioner swallows a soft cotton cloth of about 2 m length and 4 cm width and removes the same. The practice of *shankha prakshalana* includes drinking warm saline water and passing it in the bowels by inducing peristalsis through certain postures [1]. It aids in reducing ailments of the digestive system like constipation, biliousness, indigestion, chronic gastritis, reflux acts. It even helps to reduce accessory organ ailments of digestive systems like torpid liver, sluggish pancreas, urinary elimination, renal complaints, and dyspeptic condition. Indirectly it strengthens the heart and respiratory systems like cough, asthma, tonsillitis and teeth problems. It even benefits in arthritis, diabetes, and loosening of weight [4].

3.1.1. Effects of dhauti on respiratory system

A study was conducted to assess the effect of *kunjala kriya* on the pulmonary functions in healthy volunteers. The authors found the practice to play a role in enhancing pulmonary functions along with increased vagal tone. These findings were based on the increase in slow vital capacity, forced inspiratory volume along with a reduction in expiratory reserve volume and respiratory rate. The findings also indicate a possible increase in endurance of the respiratory muscles, decreased airway resistance, better emptying of lungs, which may play a role in restrictive lung disorders [5].

3.1.2. Effect of dhauti on bowel health

A recent randomized controlled study done on 60 healthy individuals, demonstrated beneficial effects of *laghu shankha prakshalana* in bowel health. Thirty volunteers who received the intervention once in a week for 4 weeks demonstrated better scores

in the Cleveland clinic constipation scale. The control group showed no significant change during the follow-up period [6].

3.1.3. Effect of dhauti in chronic low back pain

A self as controlled study was conducted in 40 in-patients, randomly assigned to receive *laghu shankha prakshalana* and back pain yogic special technique on specific days. Assessments were performed before and immediately after the sessions. Pain and disability were assessed using Oswestry disability index, state anxiety using the state subscale of Spielberger’s state and trait anxiety inventory, spinal flexibility, and straight leg raising tests using Leighton type goniometer and caliper type goniometer respectively. Both Yoga sessions were found to be beneficial to the patients, but the magnitude of change was higher following the *laghu shankha prakshalana* session. Thus, *laghu shankha prakshalana* practice was found to reduce pain, disability, anxiety, and help to increase in flexibility [7].

3.1.4. A complication of dhauti

Practice of *dhauti* is generally considered safe when it is done under the guidance of a teacher. One case study was found to report the adverse effect of *dhauti* during the literature review. A case of dental erosion diagnosed using the Tooth Wear Index was reported by Meshramkar and Patil (2007) which they had attributed to the regular practice of *kunjala kriya* for 12 years [8].

Thus, from the limited evidence available on *dhauti kriya*, it was found useful as a therapeutic modality in the management of respiratory and digestive disorders. The practice should be done under the guidance of a trained teacher, which may help to avoid possible complications. Further large-scale clinical trials are required to establish the usefulness of *dhauti* as therapeutic modality. We have summarized the studies on *dhauti* in Table 1.

3.2. Neti (yogic nasal cleansing)

The practice of *Neti* is advised in *Hatha Yoga* to clean the nasal passage. In classical reference of *Hatha Yoga Pradipka* only *sutra neti* is explained however in general four variations of *Neti* practiced, which includes *jala* (water), *sutra* (thread), *dugdha* (milk), and *ghritha* (ghee) [1,9]. The most popular forms of *Neti* practice are *jala* and *sutra neti*. In *Jala neti*, saline warm water is passed from one nostril to another using a specially designed pot. The classical practice of *sutra neti* involves inserting a thread in the nostril and removing it from the mouth. In modern times instead of thread, a sterile catheter is used. *Neti* removes mucus from nostrils, sinuses which helps to allow the air easily without obstruction. This help in reducing allergic rhinitis, tonsillitis and to prevent cough, cold and tension headache due to eye strain.

3.2.1. Use of Neti for rhino-sinusitis

A study done on 150 subjects with chronic sinusitis assigned them in 3 treatment groups: nasal irrigation with a bulb syringe or *jala neti*, or reflexology massage. The follow-up duration was for 2 weeks. All three groups demonstrated improvement in rhinosinusitis outcome measures [10]. More than 70 percent of the participants wanted to continue practicing nasal irrigation even after completion of the study. The study also depicted that the improvements in the symptoms were better in male population. Smokers in the study did not show improvement in the symptoms.

Sinusitis is a common problem among children. Shoseyov et al. (1998) conducted a double blind RCT to illustrate the efficacy of normal water verses *jala neti* in children with chronic sinusitis. The outcome measures used were cough, nasal secretion and radiological assessment tools. They found significant improvements in four-weeks in the group which used *jala neti*, when compared to

Table 1
Evidence summary on *Dhauti*.

Author	Sample size	Study type and Duration of Intervention	Variables studied	Findings
Kiran et al., 2019 [6]	60 (Experimental = 30, Control = 30)	RCT Once a week for 4 weeks for study group & control group did not receive intervention	Cleveland Clinic Constipation Score	Four sessions of <i>laghu shanka prakshalana</i> reduced constipation score
Balakrishnan et al., 2018 [5]	18 (Experienced = 9, naïve = 9)	Comparative Study between naïve and experienced practitioners. Single session	Slow & forced vital capacity, Inspiratory & expiratory reserve volume, Respiratory rate & tidal volume	Improved respiratory functions were observed after <i>Kunjal kriya</i> practice.
Haldavenkar et al., 2014 [7]	40	Self as control study Single sessions of <i>laghu shanka prakshalana</i> and back pain specific yoga techniques were compared after 3 days of training	Pain & disability, state anxiety, spine flexibility and straight leg raising	A single session of <i>Laghu shanka prakshalana</i> was found better than back pain specific yoga session in reducing disability, anxiety & improved spine flexibility in patients with chronic low back
Meshramkar et al., 2007 [8]	1	Single case report	Tooth wear index of Smith & Knight	The regular practice of <i>kunjal kriya</i> for a prolonged time led to dental erosion

normal saline. The effects were sustained for a follow-up period of one month after the conclusion of the trial [11].

A case series was conducted to report effects of *jala neti* in 10 cases of sinusitis among children (age range: 3–9 years). The authors found improvement in the disease-related Quality of life and in symptom management [12].

An early study assessed the inflammatory markers in thirty symptomatic patients with active perennial allergic rhinitis. The three interventions compared were nasal heated water particles at 43 degrees C for 20 min, heated molecular water vapor at 41°C for 20 min, and simple *jala neti* at 39°C solution for 15 min at weekly intervals. Nasal washes were done before and immediately after the treatments, at 30 min, 2 h, 4 h, 6 h. Inflammatory mediators such as histamine, prostaglandin D2, leukotriene C4 concentrations were assessed using a competitive radioimmunoassay. Inflammatory mediators in nasal secretions decreased substantially after *jala neti*. It reduced histamine for a period of 6 h, after a single 15 min treatment, illustrating the beneficial effect of *jala neti* in reducing allergic response and inflammation [13].

A study (SNIFS Trial) assessing the efficacy of self-management tools for recurrent sinusitis compared *jala neti* with steam inhalation. The investigators of the study followed 32 participants for a period of six months. They concluded both interventions were acceptable to the patients, but *jala neti* was found to be effective in symptom management [14]. A large scale RCT involving 871 participants indicated that *jala neti* being better in managing symptoms of rhino-sinusitis and being acceptable to participants than steam inhalation [15].

A randomized control trial with seventy-six subjects followed patients with sinusitis for a period of six months. The investigators found improved quality of life, reduced symptoms, and need for medications in patients who performed *jala neti* daily for six-months [16].

3.2.2. *Neti for post-irradiation rhinosinusitis in nasopharyngeal carcinoma*

Sinusitis and nasopharyngeal irritation are common following radiotherapy for nasopharyngeal carcinoma. A five-year follow-up study demonstrated that long term nasal irrigation helped in improving quality of life (QoL) of patients affected with nasopharyngeal carcinoma within a one year of intervention there was a relief in nasal symptoms [17]. Similar observation of improved quality of life and reduced symptoms were observed in a trial

involving 107 nasopharyngeal carcinoma patients after irradiation. The follow-up duration for the study was six months [18].

3.2.3. *Complication of Sutra neti*

There was a case of 67 year old man presenting with change of voice, loss of sensation of smell, nose blockage and mouth breathing after regular practice of *Sutra neti*. He had to undergo a controlled ablation for release of the nostrils. The investigators suggested to avoid vigorous practice of *sutra neti* [19].

Thus, *Neti*, being one of the easiest cleansing procedures in *Yoga*, plays advantageous role in management of rhino-sinusitis. A case study also indicates beneficial effect of *sutra neti* on obstructive sleep apnea and snoring. The results indicate that the traditional explanation from *Hatha Yoga Pradipika* stating *neti* can help to cure disease above the throat appear to be supported with scientific evidence. The evidence based effects of *neti kriya* are summarized in Table 2.

3.3. *Trataka (yogic visual concentration)*

The practice of *trataka* involves concentrated gazing on a small object (usually a candle flame). The classical explanation of the practice involves gazing at an object without blinking the eyes, till tears roll out. The technique is said to reduce the eye disorders and to reduce the laziness [1]. The scientific studies on *Trataka* used cognitive functions and vision as their outcome measures.

3.3.1. *Effect of trataka on attention and cognition*

A self as control study assessed effect of *trataka* on critical flicker fusion (CFF). CFF is defined as the frequency at which a flickering stimulus perceived to be continuous. Thirty subjects were recruited for the study who were conditioned for the practice through five sessions on different days before the commencement of assessments. Subjects were assessed individually for CFF immediately before and after the *trataka* or control sessions. The *trataka* session involved eye exercise followed by gazing at the candle flame whereas control session had only eye exercise. The CFF was assessed with increasing and decreasing frequencies. The *trataka* group shown a significant increase in CFF, and there was a nonsignificant reduction in CFF following the control session [21].

Another study with similar sample size (n = 30) and design evaluated the cognitive performance using the adult version of the Stroop-color-word test. The results indicated improvement in

Table 2
Evidence summary of *Neti*.

Author	Sample size	Study type and duration of Intervention	Variables studied	Findings
Tiwana et al., 2019 [19]	1	Single case report	Nasal endoscopy	Vigorous practice of <i>sutra neti</i> led to velopharyngeal stenosis requiring surgical intervention.
Leydon et al., 2017 [14]	32	Qualitative semi-structured interview study Six months	Medication score, symptom checklist	<i>Neti</i> was found better than steam inhalation in reducing symptoms of rhinosinusitis.
Little et al., 2016 [15]	871 (Usual care = 210, Nasal irrigation = 219, Steam inhalation = 232, Combined = 210)	RCT Six months	Rhinosinusitis Disability Index (RSDI)	<i>Neti</i> was found better than steam inhalation in reducing symptoms of rhinosinusitis.
Lin et al., 2015 [12]	10	Pre and Post study Daily for one month of nasal irrigation	Sinus & Nasal Quality of Life survey, Overall Nasal Quality of Life	<i>Neti</i> helped to reduce chronic nasal symptoms and improved quality of life
Luo et al., 2014 [17]	1134 (Group A = Nasal irrigator, Group B = homemade nasal irrigation connector combined with enenator, Group C used nasal sprayer)	Follow up study Five years	Sinus & Nasal Quality of Life survey	Long term use of <i>neti</i> helped in improvement of quality of life in nasal sinusitis patients
Liang et al., 2008 [18]	107 (Nasal irrigation = 44, Non irrigation = 63)	RCT Once daily upto six months of nasal irrigation	Questionnaire and radiological assessment of rhinosinusitis	The 6 months of follow up study of <i>neti</i> after radiotherapy, <i>neti</i> seems to improve the quality of life and symptoms.
Rabago et al., 2002 [16]	76 (Experimental = 52, Control = 24)	RCT Daily hypertonic saline nasal irrigation upto six months and control group didn't receive intervention	Medical outcome survey short form, Rhinosinusitis Disability Index, Single- Item- Sinus Symptom Severity assessment	<i>Neti</i> helped in reduction of symptoms and medication, even improved in quality of life in sinusitis patients.
Heatley et al., 2001 [10]	150 (Nasal irrigation with bulb syringe = 43, nasal irrigation with irrigation pot = 39, & reflexology massage = 46)	RCT Each group underwent 2 weeks of intervention	Rhinosinusitis outcome measures, Daily medication use	<i>Neti</i> was found equally effective for the management of rhinosinusitis, when compared with reflexology massage and nasal irrigation using bulb syringe.
Shoseyov et al., 1998 [11]	30 (Hypertonic saline = 15, Normal saline = 15)	Randomized double blind study Four weeks of hypertonic saline and nasal saline	Radiology score & nasal secretion, cough or postnasal drip for rhinosinusitis	There was significant reduction in nasal secretions, cough & postnasal drip in hypertonic solution group than <i>neti</i> group
Georgitis; 1994 [13]	30	Self as control study	Nasal secretions - histamine, prostaglandin D2, leukotriene C4	<i>Neti</i> and large particle water vapour reduced nasal histamines & leukotriene C4 indicative of reduced nasal inflammation.
Ramalingam and Smith; 1990 [20]	1	Single case report	Self-assessment of symptoms	Practice of <i>sutra neti</i> helped person to reduce snoring and obstructive sleep apnea

selective attention, response inhibition, cognitive flexibility following *trataka* session [22].

A randomized controlled trial done in elderly population evaluated the effect of *trataka* on cognitive function. There was improvement in the performance in the cognitive tasks such as digit span, six-letter cancellation test, and tail making test following a 26-day intervention compared to the baseline. This study indicates a possible role of *trataka* in preventing cognitive decline in elderly [23].

3.3.2. Effect of *trataka* in autonomic functions

A study assessed the immediate effect of *trataka* on heart rate variability (HRV) and breathing rate following two sessions on two different days. The investigators found an increased in vagal tone following *trataka* depicted by a decrease in heart rate and breath rate, low frequency component of HRV and increase in high frequency component. No changes were observed following the control session [24].

3.3.3. Clinical trials on *trataka* and eye disorders

A study assessing outcomes of ametropia and presbyopia compared the effects of two forms of eye exercises viz. Bates

method and *trataka*. The investigators reported subjective improvements in the vision without any change in objective assessment tools following both forms of eye exercises [25,26]. Table 3 illustrates the studies on *trataka*. Although, traditional texts quote *trataka* can be used to treat eye disorders, but not many studies have evaluated the role of *trataka* in eye disorders. The limited evidence does not support role of *trataka* in eye disorders, thus there is scope for further scientific evaluation in the subject area. The studies also demonstrated enhanced cognitive functions and autonomic relaxation immediately following the practice. Thus, there is a need to explore long term effects of *trataka* in physiological and clinical settings.

3.4. *Kapalabhati* (yogic frontal brain cleansing)

Kapalabhati is a combination of two syllables, *kapala* means forehead and *bhati* means shining. The practice of *kapalabhati* involves breathing out at a rapid pace (~1–2 Hz) by flapping the abdomen. Classical texts indicate beneficial role of *Kapalabhati* in respiratory disorders [1]. It is also known as high frequency *Yoga* breathing due to the nature of practice. Generally the practice of

Table 3
Evidence summary of *Trataka*.

Author & Year	Sample size	Study type and duration of Intervention	Variables studied	Findings
Tiwari et al., 2018 [26]	48 (Trataka yoga kriya = 24, Eye exercise = 24)	Comparative study Eight weeks of either <i>trataka</i> or eye exercise group	Snellen's Chart	<i>Trataka</i> and eye exercise did not show any significant changes in refractive errors
Raghavendra and Singh; 2016 [22]	30	Self as control study After 15 days of orientation programme in <i>trataka</i> , immediate effect of 25 min assessed for <i>trataka</i> & control session	Stroop colour-word test	Improvement in selective attention, cognitive flexibility, and response inhibition was found following <i>trataka</i> session
Talwadkar et al., 2014 [23]	60 (Trataka group = 36, control group = 24)	RCT One month (26 days) of <i>trataka</i> or control group	Digit span test, six letter cancellation test, trail making test	<i>Trataka</i> session in elderly population shown significant increase in cognitive levels compare to control group
Raghavendra and Ramamurthy; 2014 [24]	30	Self as control study After 15 days of orientation programme in <i>trataka</i> , immediate effect of 25 min assessed for <i>trataka</i> & control session	Heart rate variability (HRV) & respiration rate	<i>Trataka</i> group shown decrease in heart rate, breath rate, low frequency component of HRV and increase in high frequency component of HRV
Gopinathan et al., 2012 [25]	66 (Eye exercise = 32, <i>trataka yoga kriya</i> = 34)	RCT Once daily for three weeks of eye exercise or <i>trataka</i>	Signs and symptoms of presbyopia, retinoscopy, autorefractometer, keratometer	Both <i>Trataka</i> and eye exercise improve subjective signs and symptoms, but no change in both groups on objective assessments
Mallick and Kulkarni; 2010 [21]	30	Self as control study Five practice session of <i>trataka</i> (30 min) introduced before the immediate assessment.	Critical Flicker fusion	After the practice of <i>trataka</i> there was a significant increase in critical flicker fusion compare to eye exercise group

Kapalabhati is done prior to practice of *pranayama* (yogic breathing practices). Some masters categorize the practice of *kapalabhati* as one of the *pranayama* itself. However, the practice is classified as one of the *Shatkriya* as per the traditional Yoga texts [27].

3.4.1. Effect of *kapalabhati* on metabolism

One of the earliest studies on *kapalabhati* showed a decrease in blood urea with an increase in creatinine and tyrosine following one minute of practice in twelve healthy subjects. These changes were attributed to a possible promotion of decarboxylation and oxidation [28].

3.4.2. Effect of *kapalabhati* on respiratory and cardiovascular changes

Stancak and colleagues conducted a group of experiments to determine physiological changes associated with *kapalabhati* as early as in 1991. Their experiments demonstrated reduction in baroreflex sensitivity and vagal tone, associated with increase in blood pressure and heart rate following *kapalabhati*. They could also demonstrate slower brain waves in the EEG topography which were attributed to the subjective relaxation in the participants [29–31].

Series of studies were conducted by Telles et al. on the effects of *kapalabhati*. They found *kapalabhati* improves cognitive performance and attention assessed through event related potentials [32], associated with decreased anxiety [33]. Similar positive outcomes were found with motor performance [34] and finger dexterity [35] and spatial and working memory tasks [36] following *Kapalabhati*. They also observed sympathetic arousal [37,38], and metabolic activation [39], during *kapalabhati* however, the practice does not cause increase in the prefrontal cerebral circulation [40].

A study conducted on effect of *kapalabhati* on cognitive functions demonstrated improvements in the cognitive tasks [41].

Transcranial doppler was used to assess the cerebral blood flow changes during practice of *kapalabhati*. There was a reduction noted in the end diastolic velocity and mean flow velocity indicating a decrease in cerebral blood flow. Such change could be due to reduction of partial pressure of CO₂ during the practice which involves breathing at a high frequency [42].

An RCT performed on 60 mild to moderate asthma patients demonstrated 10 min of practice of *kapalabhati* can enhance the forced vital capacity, forced expiratory volume in one second and their ratio. These finding indicate a possible role of *kapalabhati* in management of bronchial asthma [43].

3.4.3. The complication of *kapalabhati*

A case report presented a 29-year-old healthy woman, who developed the spontaneous pneumothorax caused due to extreme practice of *kapalabhati*. The investigators attributed such complication to pushing the practice to physiological extreme limits [44].

Thus, the studies on *kapalabhati* illustrate the beneficial effects of the technique in enhancing cognitive and respiratory functions and leading to a state of physiological arousal. Such changes can be used in clinical situations such as bronchial asthma. However, one should be careful not to strain while performing the practice of *kapalabhati*, which may also lead to complications. The evidence summary on *kapalabhati* is summarized in Table S1.

3.5. *Basti* (yogic enema)

There are two forms of *Basti* described in *Hatha Yoga*, *jala* (water) and *sthala* (dry). Both *basti* practices involve the cleansing of the colon. Swami Swatmarama considers the practice of *basti* beneficial for balancing *tridosha* and *dhatu*s and to purify mind and senses [1]. According to sage *Gheranda*, *basti* reduces the disorders of *vata* and is beneficial in urinary and digestive problems. It is also known to improve digestion [2].

3.6. Nauli (yogic abdominal massaging)

Nauli is a practice of contracting and isolating the rectus abdominis muscle and churning the abdominal muscles. There are three variations based on the position of isolation of the muscles, namely *dakshina nauli* (right), *vama nauli* (left), *madhyama* (center). This practice is said to strengthen the secretion of gastric juice including endocrine and exocrine functions of the pancreas [1,9]. Since the practices of *basti* and *nauli* are considered to be an advance practice, we could not find any scientific study on the practice of *nauli* during our literature review.

4. Conclusion

The practice of *shatkriya* or *shatkarma* is recommended in the *Hathayoga* tradition. Studies exploring the effects of four out of six cleansing procedures were found in physiological as well as clinical settings. No studies were available on *basti* and *nauli* which could be due to the difficult nature of the practice. The practice of *dhauti* was found to enhance respiratory functions and was useful in digestive disorders. Nasal cleansing, *neti* was particularly found beneficial in managing the rhinosinusitis in age groups ranging from children to adults. Although *trataka* practice was found to enhance cognition and bring a state of relaxation, but there was no evidence supporting its role in eye disorders. *Kapalabhati* was the most studies among the *Shatkriya* practices. The ranges of studies on *kapalabhati* included assessing the neurocognitive assessments, autonomic, and metabolic activity. The practice appears to have a beneficial role in the activation of sympathetic nervous system, enhances cognition, and improves overall metabolism. It was also found to enhance the respiratory functions in patients with asthma. Single case reports (one each) were also found for practices of *dhauti*, *neti* and *kapalabhati* and it was attributed to pushing the body to the physiological extreme.

This literature review was limited to online free databases only and due to the keywords chosen. Although we tried, including a variety of key-words related to *shatkriya*, there may have been studies that were missed in the current review because of exclusion through the keywords and databases.

The beneficial role of *shatkriya* narrated in both traditional texts and evident from the small body of empirical work warrants further rigorous scientific exploration. From the available literature, we found the practice of yogic cleansing technique safe, when practiced under the guidance of a trained teacher and has a potential role in health and disease.

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None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jaim.2020.11.008>.

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