RESPIRATORY MUSCLE STRENGTH WITH AGNISARA DHOUTI ON BEGINNERS AND ADVANCE YOGA PRACTITIONERS

Abstract

Background: Agnisara Kriya is one of the shat kriya of yoga practices. The technique is, isotonic contraction and relaxation of abdominal muscles creating passive stretch for diaphragm during breath holding. The understanding and performance of such multi-tasking is difficult for the beginners' and may lead to muscle catch or early fatigue or anaerobic injury if not practiced properly. Immediate changes like muscle catch, pain or intense tiredness can be recorded to make out the practitioner is beginner or advance. So, the minimum information like, physiological changes soon after the practice such as rise in heart rate (HR), respiratory rate (RR), temperature, etc help to understand the internal health. Any physical practice by an advance yoga practitioners will be able to perform better than beginners. But, because of intense mitochondrial workload and circulation imbalances created, the physical, physiological and immune changes may lead to drastic damage. Hence, there is need to grade the performance for beginners and advance students separately. There is inadequate information on the methodology of Agnisara dhouti kriya practice. Present study focused on the division of teaching technique for beginners and advance practitioners to avoid over usage of organs and their progressive injury.

Aim: To prove the immediate effects of Agnisara Dhouti and categorize the practitioner as beginner and advance.

Objectives: (1) Comparison of repetition maximum (RM) on pre and post phase.
(2) Comparison of rate of perceived exertion (RPE) on pre and post phase.

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Type of Research: Observational and experimental research.

Methodology

Sampling method: Sample size- 30, University yoga students, Study Design- Pre or Post, Sample collection- University students of Yoga department were invited for the testing.

Null Hypothesis (H_0): Respiratory muscle strength and exertion may or may not change with Agnisara Dhouti kriya.
Method of Agnisara Kriya: Explained the procedure of Agnisara kriya and trained for 3 days with expert.

Parameters

General Parameters: Body weight, Body height, BMI, Temperature, Blood Pressure, SpO_2, Pulse Rate, Respiratory Rate, PEFR, Inhale Breathing Hold Time (IBHT), Exhale Breathing Hold Time (EBHT).

Specific Parameters: Repetition maximum (RM), Rate of Perceived Exertion (RPE).

Data Collection: Parameters will be checked on first day prior to the practice and 4^{th} day of practice. During the practice if the muscle catch, tiredness, pain or any tingling sensation will be asked as points of beginner level during training period. Later these symptoms will be monitored on daily basis as routine feedback.

Results: The data will be entered into MS-Excel sheet and calculated Mean, Standard deviation and percentage change as part of dissertation-1. Comparison of pre and post data of specific and general parameters will be done with t-test as part of dissertation-2.

Conclusion: Agnisara dhouti kriya as the yogic intense practice to clean the intestine

with abdominal muscles and passive stretch of diaphragm, improves strength and reduce rate of perceived exertion with 3 days of guided training. There is possibility to differentiate the beginners and advance levels just by observing the repetition maximum and rate of perceived exertion for 3 days.

Keywords: Agnisara Dhouti, respiratory muscle strength, rate of perceived exertion, repetition maximum, yoga practitioner, Shart Kriya.

STANDARD INTERNATIONAL TRANSLITERATION CODE USED TO TRANSLITERATE *SAṀSKṚTA* AND BENGALI WORDS

অ	আ	ই	ঈ	উ	ঊ	ঋ
a	ā	i	ī	u	ū	ṛ
অ	আ	ই	ঈ	উ	ঊ	ঋ
ৠ	এ	ঐ	ও	ঔ	ং	ঃ
ī	e	ai	o	au	aṁ	aḥ
ৠ	এ	ঐ	ও	ঔ	ং	ঃ
	ক	খ	গ	ঘ	ঙ	
	ka	kha	ga	gha	ṅa	
	ক	খ	গ	ঘ	ঙ	
	চ	ছ	জ	ঝ	ঞ	
	ca	cha	ja	jha	ña	
	চ	ছ	জ	ঝ	ঞ	
	ঠ	থ	ড	ঢ	ণ	
	ṭa	ṭha	ḍa	ḍha	ṇa	
	ট	ঠ	ড	ঢ	ণ	
	ত	থ	দ	ঘ	ন	
	ta	tha	da	dha	na	
	ত	থ	দ	ধ	ন	
	প	ফ	ব	ভ	ম	
	pa	pha	ba	bha	ma	
	প	ফ	ব	ভ	ম	
য	র	ল	শ	ষ	স	হ
ya	ra	la	śa	ṣa	sa	h
য	র	ল	শ	ষ	স	হ
		ক্ষ	ত্র	জ্ঞ		
		kṣa	tra	jña		
		ক্ষ	ত্ত	জ্ঞ		

I. INTRODUCATION

1. **Background:** Agnisara Kriya will be a problem for beginners' practitioners at first and can't process practice properly. There may be physical problems a little in the after practice such as rising temperature, Heart rate etc. Advance yoga practitioners will be able to do better than beginners, because they practice regularly and everything will be perfect for them, and they will not have any physical problems and their immune system will be improved. PubMed search with keyword is shown below. ScienceDirect (1 result), PubMed (1 result).

- **Review keyword search on PubMed, Google Scholar and ScienceDirect**

No.	Journal	Keywords	Result
A.	**PubMed**	Effects of Agnisara Dhouti on beginners	0
		Agnisara Dhouti	2
		Repetition maximum of respiratory muscle	111
		Repetition maximum abdominal muscle	95
		Repetition maximum of diaphragm muscle	3
		Repetition maximum of respiratory muscle with yoga	0
		Repetition maximum of respiratory muscle with pranayama	0
		Repetition maximum of respiratory muscle with Agnisara	0
B.	**Google Scholar**	Agnisara	1
C.	**Science Direct**	Agnisara	1

Legend: Key words searched on different search engines.

The assessment tool per Agnisara Dhouti study in 1983 by E Roldan, C Dostalek is EEG. In This EEG pattern would be considered as the expression of the central excitation, produced by the exercise's long-lasting and repeated stimulation of visceral, and somatic receptors.[1]

2. Anatomy of Agnisara Dhouti

- **Muscles of Respiration- Annamaya Kosha:** The anterior portion of this sheath extends the entire length of the muscle and fuses with periosteum and ligaments at sites of the muscle's attachments. The posterior part of the sheath is complete behind the upper two-thirds of the muscle but absent below this level, which corresponds to approximately one-third of the distance between the umbilicus and the pubis. The termination of the posterior rectus sheath is usually gradual but may be abrupt and marked by a clearly visible curved horizontal line known as the arcuate line. Below this level, rectus abdominis lies on the transversalis fascia and extraperitoneal connective tissue as shown in the Figure-1.[25]

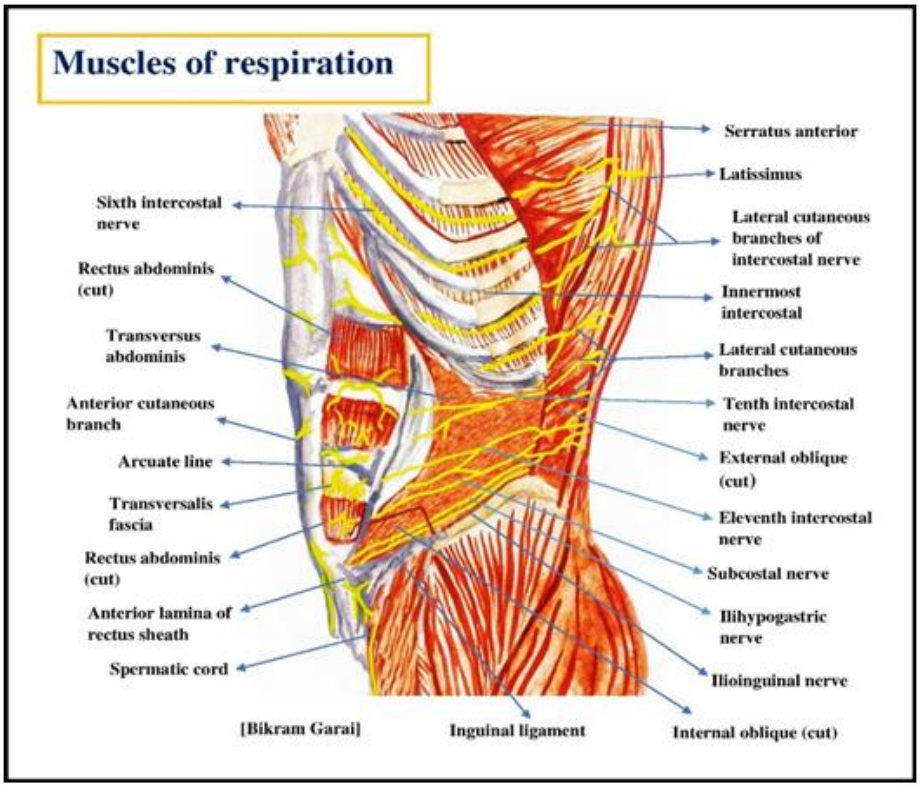


Figure 1: Muscles of Respiration under *samäna vāyu* control

- **Inhalation and Exhalation:** One of the most important roles of the abdominal wall is to assist in breathing. It relaxes during Inhalation to accommodate expansion of the thoracic cavity and the inferior displacement of abdominal viscera during contraction of the diaphragm.

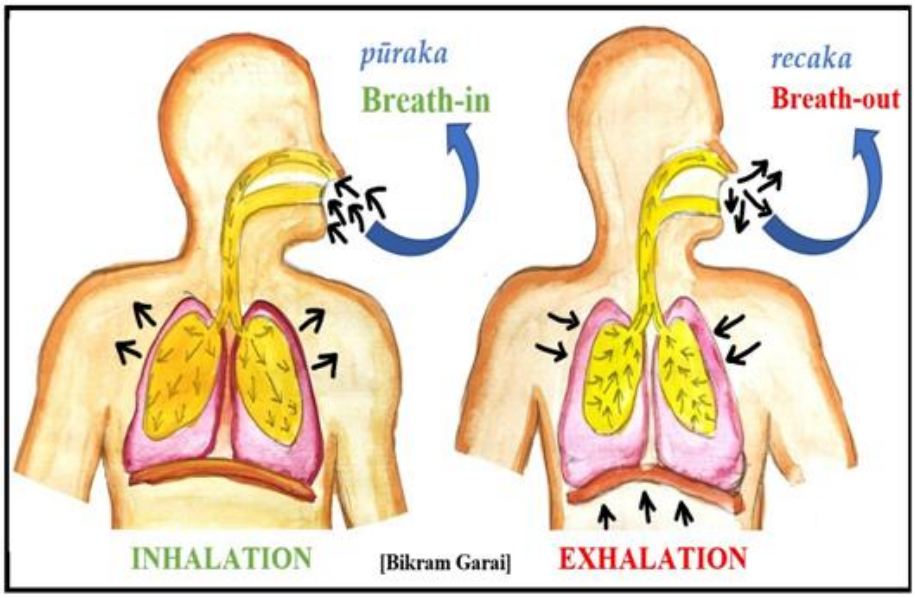


Figure 2: Inhalation and Exhalation as *püraka* and *recaka* of *prāna vāyu*

During Exhalation, it contracts to assist in elevating the domes of the diaphragm, thus reducing thoracic volume as shown in the Figure-2.[26]

- **Solar Plexus:** The solar plexus is the centre chiefly concerned with the vital process of digestion and food metabolism. It governs the functioning of the gastric glands, the pancreas, gall bladder and so on, which produce and secrete enzymes, acids and juices necessary for the digestion and absorption of nutrients. Manipura chakra is the psychic centre which controls these activities and the instinctive drive to find food and nurture oneself as shown in the Figure 3 and 4.[25]

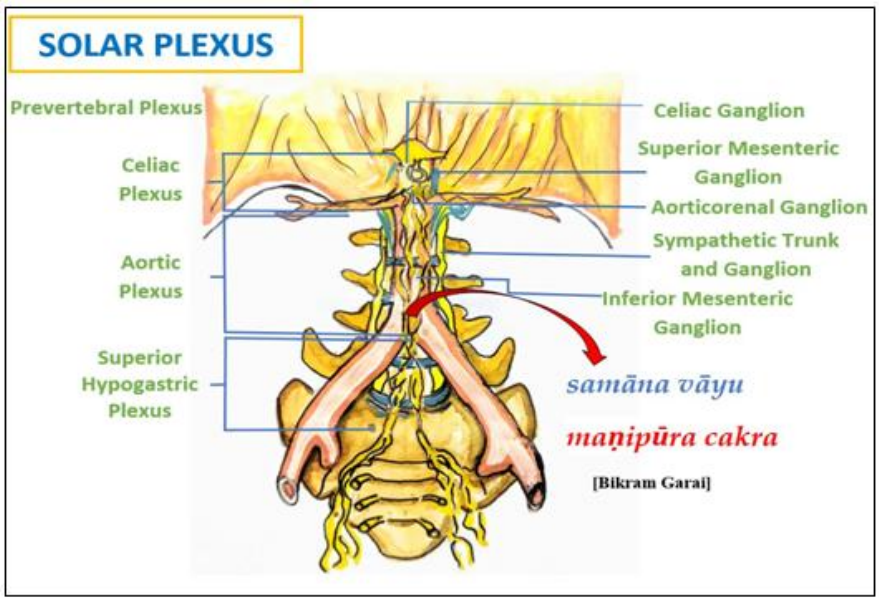


Figure 3: Solar Plexus as *samäna väyu*

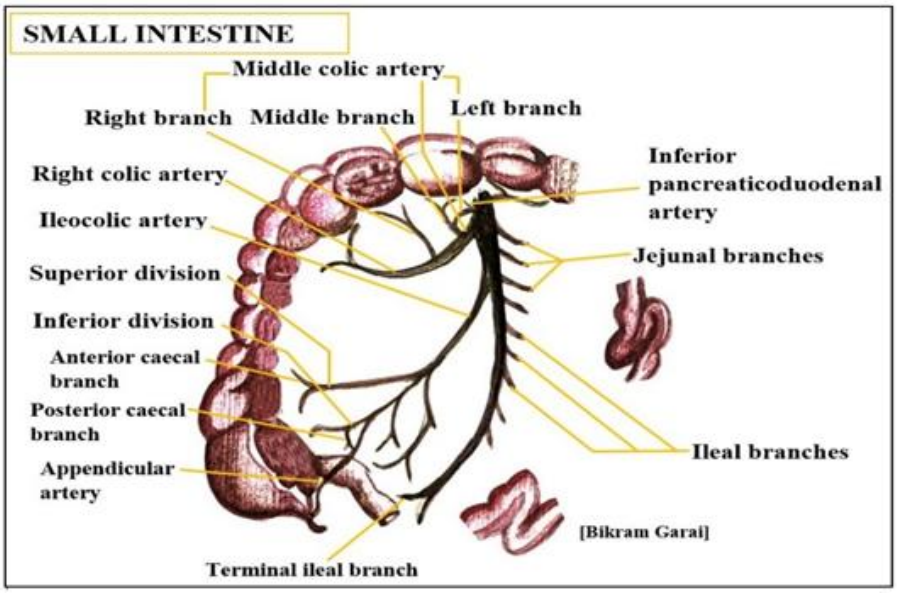


Figure 4: Small intestine as *samäna väyu*

3. Physiology of Agnisara Dhouti

- **Oxygen and carbon di-Oxide exchange:** The exchange of gases between the body and the environment. the means by which the body transports gases over long distances. along with the flow of air and blood. Both flows are driven by a pressure difference. Diffusion is used to transport gases over short distances of a few, through cell membranes and other physiological barriers. The exchange of gas between the atmosphere and alveoli is called ventilation. Oxygen (O2) in the inspired air is convicted to the alveoli before diffusing across the alveolar membrane into the bloodstream. It is then transported via the bloodstream to the tissues, where it diffuses from the blood into the cells and, ultimately, to the intracellular mitochondria. Carbon dioxide (CO2) produced in the mitochondria returns to the lung by the same route as shown in the Figure-5.[27]

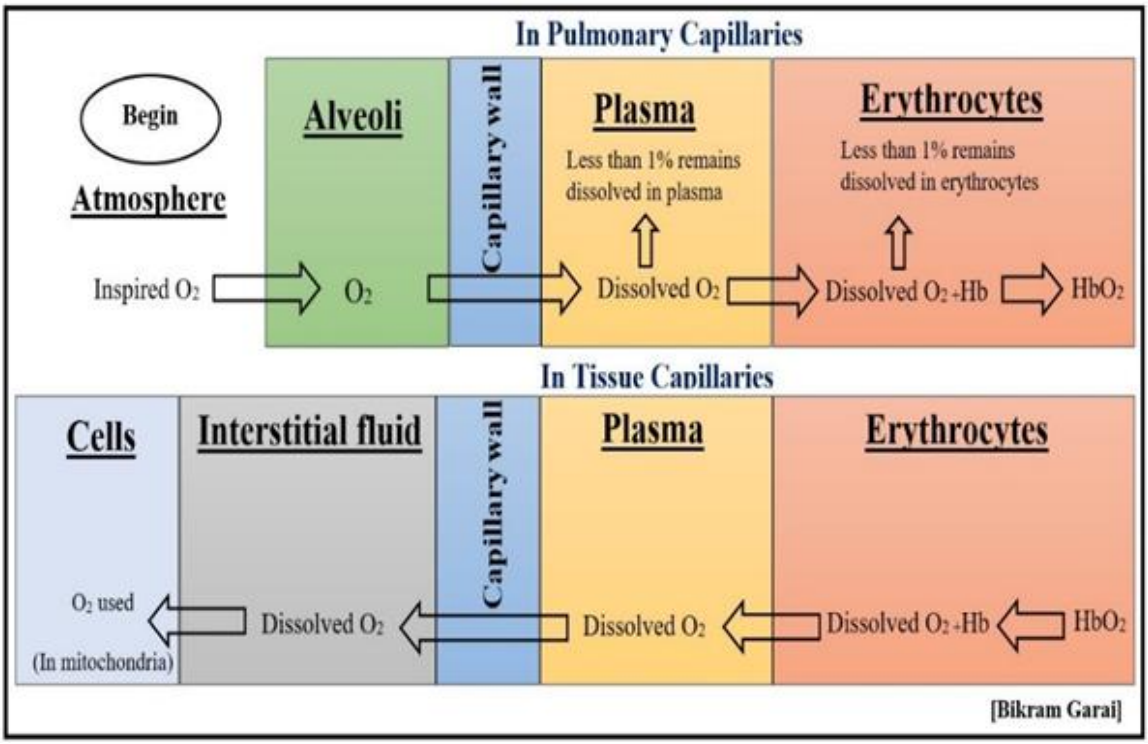


Figure 5: Oxygen and Carbon-Di-Oxide Exchange as *prāna vāyu*

- **Respiratory Centre in Brain Stem:** The brainstem is a stalk like structure within the posterior cranial fossa of the skull connecting the forebrain and spinal cord. From rostral to caudal, the brainstem consists of the midbrain, pons, and medulla oblongata. Broadly speaking, the brainstem has three main functions (1) it is a conduit for tracts ascending and descending through the CNS, (2) it houses cranial nerve nuclei III to XII and (3) it is the location for reflex centres related to respiration, cardio-vascular function, and regulation of consciousness. Externally, each portion of the brainstem has a distinct appearance and structural features that define its many functional roles as shown in the Figure-6.[26]

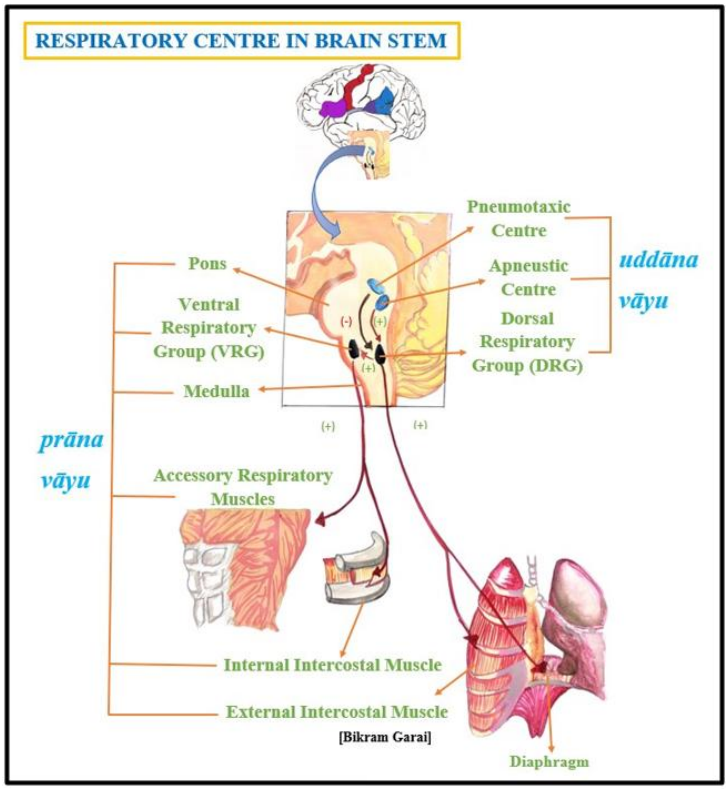


Figure 6: Respiratory Centre in Brain Stem as *prāna, uddāna and vyāna vāyu*

- **Thermal Balance and Thermoregulation**

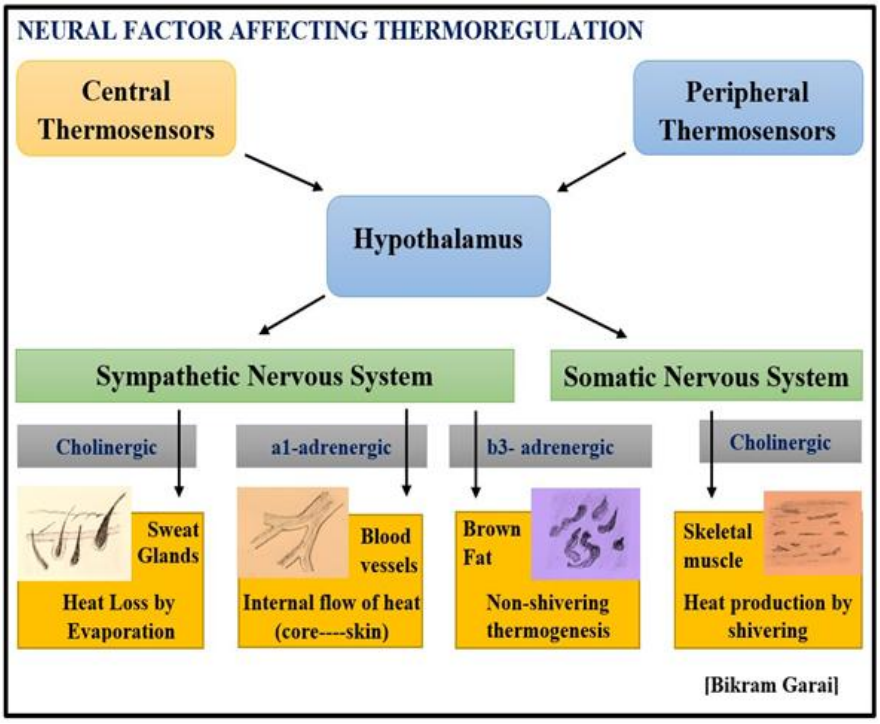


Figure 7: Neural Factor affecting Thermoregulation

The control centre for body temperature and central thermosensors are located in the hypothalamus. Additional thermosensors are located in the spinal cord and skin. The control centre compares the actual core temperature with the set-point value and initiates measures to counteract any deviations as shown in the image-7.[27]

4. **Biomechanics of Respiration during Agnisara Dhouti:** Motion of Movement (*gamana*)

- **Biomechanics of Ribs**
  - Bucket Handle Movement
  - It is in antero-posterior view
  - Upwards (*utkñepana*) and Outwards (*prasäraëa*) during Inhalation or *püraka.*
  - Inwards (*äkuïcana*) and downwards (*avakñepana*) during exhalation or *recaka*. as shown in the Figure-8

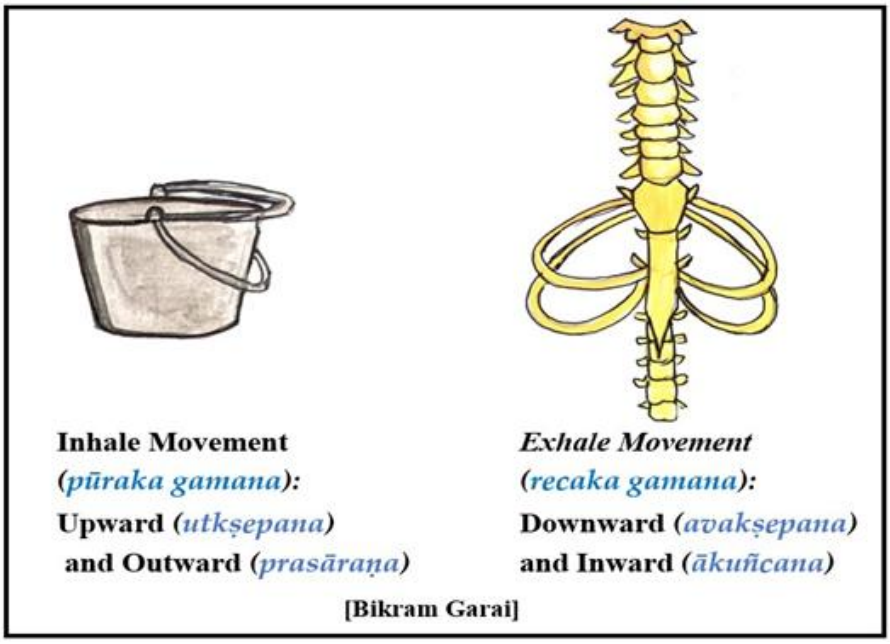


Figure 8: Movement of Biomechanics Ribs

- **Biomechanics of Sternum**
  - Pump Handle Movement
  - It is in lateral or side view
  - Upwards (*utkñepana*) and forwards during Inhalation or *püraka.*
  - Downwards (*äkuïcana*) and backwards during exhalation or *recaka.* as shown in the Figure-9.

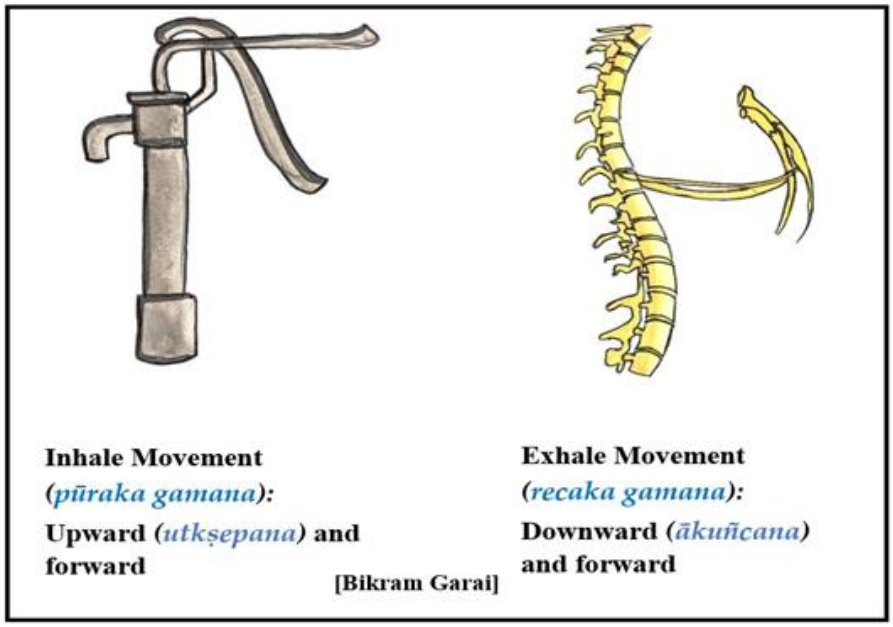


Figure 9: Movement of Biomechanics Sternum

- **Biomechanics of Abdomen in Agnisara Dhouti:**
  - External retention phase or *bähya kuàbaka*
  - It is in lateral or side view
    Upward (*utkñepana*) and backward movement of abdominal muscles to create negative pressure in the abdomen. as shown in the image-10.

5. **Effect of Negative pressure at Abdomen:** Holding of negative pressure at abdomen and passively pushing and pulling the Diaphragm. as shown in the Figure-11 and 12.

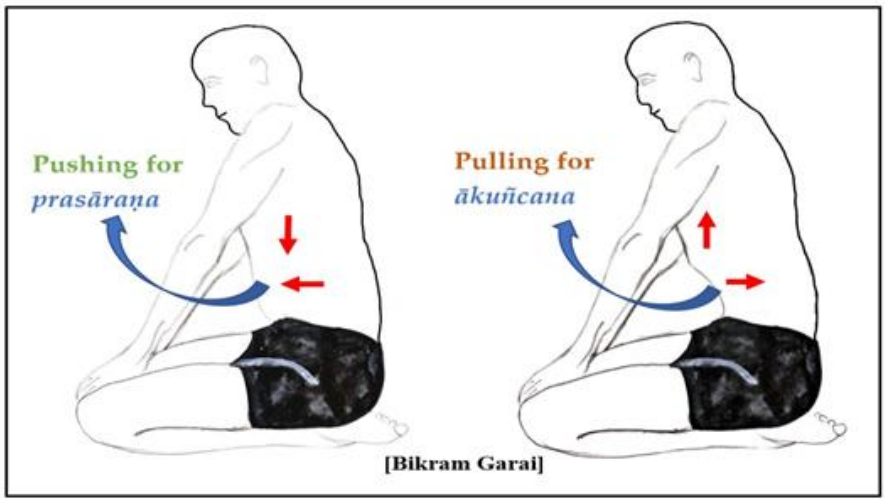


Figure 10: Abdominal muscle push and pull passively

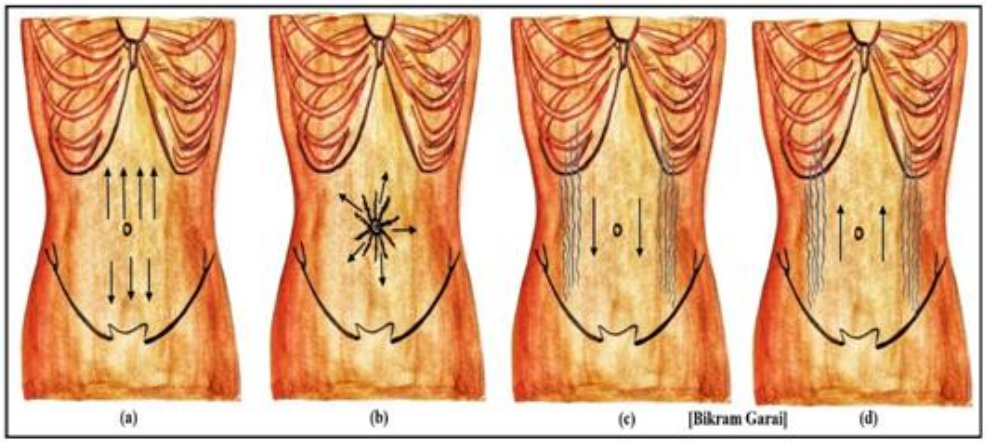


Figure 11: The subcutaneous venous circulation in (a) Normal subjects, (b) portal obstruction, (c) superior vena caval obstruction, and (d) inferior vena caval obstruction (arrows indicate the direction of blood flow)

- **Gastric Motility:** In simple terms, the proximal region of the stomach functions mostly as a temporary storage compartment, regulating intragastric pressure and the onward passage of chyme into the distal stomach. Proximal gastric tone decreases with swallowing and in response to gastric distension. Its activity is modulated by enterogastric reflexes, and gut hormones. The vagus nerve plays a key role in these reflexes. In contrast to this activity, the muscle of the distal region of the stomach exhibits strong phasic contractions that increase in amplitude towards the pylorus; these occur about three times per minute and act to grind the food mechanically and propel it towards the pylorus. Solid material lags behind liquids, and when the contents of the antrum reach the contracted pylorus, only the liquid and small particulate solids can be expelled into the duodenum; larger solid matter is retro pulsed back into the stomach for further breakdown.[25]

II. ANCIENT LITERATURE REVIEW

1. **Agnisara Dhouti and Activation of Manipura Chakra:** Agnisara is considered to improve all the signs of Manipura chakra also called solar plexus. From here the distribution to other parts is called as Vyana. Hence the central resistance slowly pervades as peripheral circulation. Hence any disturbances of Manipura chakra are going to be balanced this way with beginners and advance practitioners.

The information taken as it is in the ancient texts like Hatha Yoga Pradipika, Gheranda Samhita, Patanjali Yoga Sutras etc. The phrases of explanation are in Sanskrit. The literature was been translated from Sanskrit to Transliteration (form of English). Then written the meaning in English. Then translated into Bengali.

2. Hatha Yoga Pradipika

Author: Swami Muktibodhananda.

- **Agnisara Dhouti:** Vahnisara Dhouti, also known as Agnisara kriya, involves moving the 'fire' in the body. Vahni and Agni mean 'fire.' Sar is 'essence.' 'The essence of fire' is located in the navel region. On a physical level, the practice involves conscious movement of the abdominal muscles and organs and this creates internal heat. The practice is very useful as a preparation for kapalbhati and bhastrika pranayama.[28]

कर्मषट्कमिदं गोप्यं घटशोधनकारकम् ।
विचित्रगुणसंधायि पूज्यते योगिपुंगवैः ॥ २.२३ ॥

Meaning in English: Agnisara Dhouti (Kriya) Shatkarma which effect purification of the body. They have manifold, wondrous results and are held in high esteem by eminent yogis.[28]

Meaning in Bengali: অগ্নিসার ধৌতি (ক্রিয়া) শতকর্ম যা শরীরের শুদ্ধিকরণকে প্রভাবিত করে। তাদের বহুগুণ, আশ্চর্যজনক ফলাফল রয়েছে এবং বিশিষ্ট যোগীদের দ্বারা উচ্চ মর্যাদায় অনুষ্ঠিত হয়।

- **Manipura Chakra Activation:** The next chakra is behind the navel, within the spinal column. It is a ten-petalled yellow lotus called Manipura and it is associated with the solar plexus. Manipura influences the digestive process and the assimilation of food and prana. It is also connected to the eyes and sight. At the level of Manipura, the consciousness is still bound by the grosser levels of existence and sensualities, ambition and greed.[28]

3. Gheranda Samhita

Author: Swami Niranjanananda Saraswati

- **Agnisara or Fire Process**

नाभिप्रन्थिं मेरुपृष्ठे शतबारम्ब कारयेत् ।
अग्निसारमेचा धौतियोगिनां योगसिद्धिदा ॥ १.२० ॥

Meaning in English: Press in the naval knot or intestines towards the spine for one hundred times. This is Agnisara or fire process. This gives success in the practice of Yoga it cures all the diseases of the stomach (gastric juice) and increases the internal fire.[29]

Meaning in Bengali: মেরুদণ্ডের দিকে নৌ গিঁটে একশ বার টিপুন। এটি অগ্নিসার বা অগ্নি প্রক্রিয়া। এটি যোগ অনুশীলনে সাফল্য দেয় এটি পেটের সমস্ত রোগ (গ্যাস্ট্রিক জুস) নিরাময় করে এবং অভ্যন্তরীণ আগুন বাড়ায়।

4. Patanjali Yoga Sutras

Author: Swami Satyananda Saraswati

- **Kriya Yoga: Agnisara Dhouti**

"तपः स्वाध्याय येश्वरप्रनिधानि क्रिया योगः" ॥ २.१ ॥

Meaning in English: *Austerity/purification, self-study and surrender to God are practical action of Yoga.*[30]

Meaning in Bengali: তপস্যা/শুদ্ধিকরণ, স্ব-অধ্যয়ন এবং ঈশ্বরের কাছে আত্মসমর্পণ হল যোগের ব্যবহারিক ক্রিয়া।

- **Manipura Chakra Activation**

नाभिचक्रे कायव्यूहज्ञानम् ॥ ३.३० ॥

Meaning: By performing samyama on the navel centre, knowledge of the arrangement in the body is gained.[30]

It should be noted that nabhi chakra here does not mean Manipura chakra but the centre of the navel from where different nadis emerge and go to different parts of the body.[30]

5. Hatha Ratnavali Text

Author: Srinivasayogi

- **Union of Apana and Prana**

अपान प्राणयोश्चापि जीवात्मपरमात्मनोः ॥
योगश्चायं हि योगार्थ केचिदाचक्षते बुधाः ॥ १.६ ॥

Meaning in English: Yoga is the union of apana and prana, while others say that it is the union of jivatma and paramatma. Yet according to some, yoga is for the sake of yoga itself.[31]

Meaning in Bengali: এই যোগ হল আপন ও প্রাণের মিলন, আবার অন্যরা বলে যে এটি জীবাত্মা ও পরমাত্মার মিলন। তবু কারো কারো মতে, যোগ হলো যোগের জন্যই।

- **The Eight Karmas**

चक्रि नौलिर्धौतिनेतिबस्तिश्च गजकरिणी ||
त्राटक मस्तकभ्रान्तिः कर्माण्यष्टौ प्रचक्षते ॥ १.२६ ॥

Meaning in English: Now we will narrate the eight karmas, (purificatory processes) The eight karmas are cakri, nauli, Dhauti, neti, basti, gajakarini, trataka and mastakabhranti.[31]

Meaning in Bengali: এখন আমরা আটটি কর্মের বর্ণনা করব, (শুদ্ধিকরণ প্রক্রিয়া) আটটি কর্ম হল চাকরী, নৌলি, ধৌতি, নেতি, বস্তি, গজকারিণী, ত্রাতক এবং মস্তকভ্রান্তি।

- **Purificatory Processes Gastric Fire**

ततः प्रत्याहरेच्चैतदभ्यासाद ध्दौतिरुच्यते ॥
दिने दिने ततः कुर्याज्जिठराग्निः प्रवर्द्धते ॥ १.३८ ॥

Meaning in English: Dhauti is purificatory processes, which has to be mastered over day by day. This enhances gastric fire.[31]

Meaning in Bengali: ধৌতি হল শুদ্ধিকরণ প্রক্রিয়া, যা দিনে দিনে আয়ত্ত করা দরকার। এটি গ্যাস্ট্রিকে আগুন বাড়াতে সাহায্য করে।

- **Undoubtedly Removes the Diseases**

कासश्वासप्लीहकुष्ठं कफरोगाश्च विंशतिः ॥
धौतिकर्मप्रभावेन धावन्त्येव न संशयः ॥ १.३९ ॥

Meaning in English: Practice of dhauti undoubtedly removes the diseases like cough, asthma, spleen (disorders), skin diseases and all the varieties of phlegmatic disorders.[31]

Meaning in Bengali: ধৌতি অভ্যাস নিঃসন্দেহে কাশি, হাঁপানি, প্লীহা (ব্যাধি), চর্মরোগ এবং সব ধরনের কফের রোগ দূর করতে সাহায্য করে।

6. The Serpent Power

Author: Kalicharana and Sir John Woodroffe.

Meaning in English: The navel lotus is called Mani-Pura. The Gautamiya Tantra Says' "This Lotus is called Manipura because it is lustrous like a gem." as shown in the image-13.[32]

Meaning in Bengali: নাভি পদ্মকে মণি-পুরা বলা হয়। গৌতমীয় তন্ত্র বলে ' "এই পদ্মটিকে মণি-পুরা বলা হয় কারণ এটি রত্নটির মতো উজ্জ্বল।"

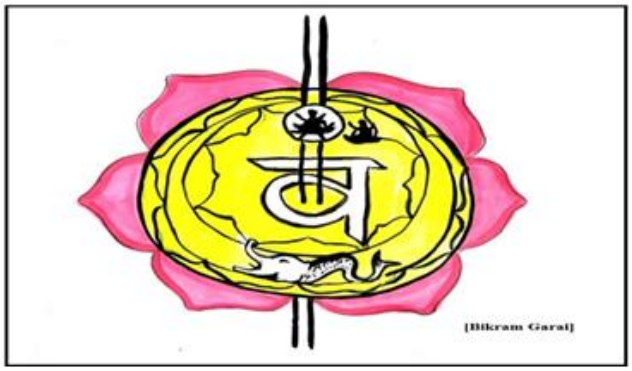


Figure 12: Lotus is called Manipura

7. Asana Pranayama Mudra Bandha (APMB)

Author: Swami Satyananda Saraswati

- **Agnisara Dhouti:** Swami Satyananda SaraswatiSituated in the spine behind the navel is Manipura chakra. The word mani means 'gem' and Pura means 'city'. Therefore, Manipura means 'city of jewels'. It is so called because, being the fire centre, it is lustrous like a jewel and radiant with vitality and energy. This chakra is depicted as a bright yellow lotus with ten petals. Within the lotus is a fiery red triangle, the yantra of Agni tattva, the fire element, and the bija mantra ram. The animal which serves as the vehicle for Manipura is the ram, the symbol of assertiveness and energy as shown in the Figure-14.[33]

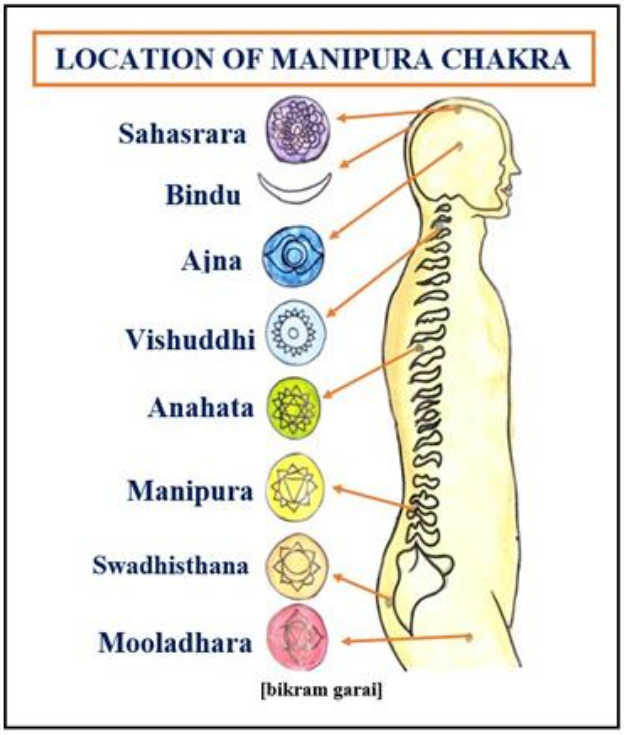


Figure 13: Location of Manipura Chakara

8. Vaisheshika Philosophy

Author: Major B. D, Basu.

According to vaisheshika philosophy are 5 type motion all motion name:

1. उत्क्षेपन (throwing upward)
2. अवक्षेपन (downward movement)
3. आकुञ्चन (contraction)
4. प्रसारण (expansion)
5. गमन (locomotion)

1. ***गुरुत्वप्रयत्न संयोगाना मुत्वेपणम् ॥ १ । १ । २ ९ ॥:*** The meaning is that Throwing upwards is their single effect. Here Weight residing in the hand, stone, etc., is the conditional cause and Conjunction of the Soul exercising Volition is the non-combinative cause, of the Throwing upwards seated in the hand, whereas the non-combinative cause of the Throwing upwards seated in the stone is the internal movement or vibration of the hand.[34]

2. ***संयोगविभागाश्च कर्म्मणाम् ॥ १ । १ । ३० ॥:*** Conjunctions and Disjunctions also (are individually the products) of Actions.
'Products' is the complement. The plural number is for the purpose of individual reference Impression' also should be taken an indicated.[31]
Vivriti: The word cha' implies Impetus and Elasticity in addition (to Conjunctions and Disjunctions).[34]

III. SCIENTIFIC OR MODERN LITERATURE REVIEW

There are 10 studies on PubMed used RM as the tool with yoga intervention.

1. According to Meng Ni, Kiersten Mooney, 2016, there is improvement in both upper and lower limbs bradykinesia and muscle strength of Parkinson's disease after 3 months of power yoga. It also improved the daily activities of life (ADL) on quality-of-life questionnaire (PDQ-39).[4] But this study has not given the information about ability of respiratory muscle strength and ability of Parkinson disease patient where there may be chance of imbalance in metabolic changes of brain. As the repetition maximum shown strength of skeletal muscles with different gym equipment like biceps curl, chest press, leg press, etc. but not focused on respiratory muscles which are mandatory for performance. In the present study we focused on the specific technique called *Agnisara Dhouti* where the respiratory muscles will be checked for strength and tiredness. As the strength with 1 RM and tiredness with RPE were done for 3 days of training in university students. This is the basic needed knowledge before implementing power yoga as an intense asana practice.

2. According to SoJung Kim and Michael G. Bemben, 2012, proven no change in arterial compliance in pre-menopause women with 8-months of Ashtanga Yoga style session. There is no improvement in other skeletal muscle strength. However, there is no

information about the respiratory and cardiac muscle performance to show the relation between the blood flow and its peripheral changes. The possible changes with intense performance of ashtanga vinyasa yoga is stimulation of solar plexus and improve digestive fire. The present study focused on solar plexus in-terms of rate of perceived exertion (RPE) and the performance (1RM) from diaphragm and abdominal muscle.[5] Hence the present study may help the method of training of Ashtanga Vinyasa practitioner to asses and follow changes at solar plexus within limits. *Agnisara Dhouti* as a shat kriya can improve solar plexus as the warm up prior to ashtanga vinyasa practices. This way there may be definitive changes in arterial compliance of the large and small arteries and cardiovascular variables.

3. According to Milind V Bhutkar and Pratima M Bhutkar, 2011, study was 8th week practice of Surya Namaskar improves muscle strength, endurance and body composition. Surya namaskar in a yoga session contributes to significantly intense physical activity to improve muscle strength, oxygen uptake, cardio-respiratory fitness in unfit or sedentary. Males shown increased Muscle strength and females shown decrease in body fat.[6] The present study focused on respiratory muscle strength in-terms of rate of perceived exertion (RPE) and the performance (1RM) from diaphragm and abdominal muscle. *Agnisara Dhouti* as a shat kriya focused on solar plexus and vital parameters for safety practice. Respiratory tract muscles are smooth or involuntary muscles can show changes on RPE levels. Hence the present study may help as a prior test or testing tool to confirm the practitioner is eligible for Surya namaskar that is dynamic asana practice or any flow yoga.

4. According to Ashley L Artese, Rachael L Hunt, 2021, this study purpose 24 week of functional impact training (FIT) that consisted of resistance and high-impact exercises in comparison with yin yoga. The body composition, bone mineral density (BMD), blood biomarkers for bone metabolism, breast cancer survivors (BCS) were assessed. Main improvement was observed for left femoral neck and left forearm bone mineral density (BMD). The functional impact training (FIT) group improved upper body strength, whereas the yin yoga group did not. It was observed that peak isokinetic knee extension and flexion improved at all speeds.[7] Cancer as an auto-immune disease needs to be treated by removal of dead or old infected cells and create space for new immune cells as part of bone mineral density (BMD) from bone marrow. Hence *Agnisara Dhouti* as a shat kriya can remove such impurities or waste from body and create space for new cells. All these possible easily with increased warmth or high metabolism of *Agnisara Dhouti*. The intense tiredness and immediate provision of intense Oxygen also helps in refreshment of cells. Hence there may be no chance for dysmorphism.

5. According to Savannah V Wooten, Nicholas Cherup in 2020, yoga breathing techniques have no impact on isokinetic and isoinertial power. the pneumatic leg press machine using 3 different yoga breathing techniques Ujjayi, Bhastrika, and Kapalabhati and normal breathing across all repetitions. Here men consistently demonstrated greater isoinertial power, isokinetic power, isokinetic torque, and isokinetic work than women. The differences between this study which have concluded that adopting specific breathing techniques can enhance core stability and force production during lifting. Nonetheless, the current outcome does not support the use of yoga breathing techniques as a method to enhance power output, whether used before or during power performance.[8] In the present

study we focused on the specific technique called *Agnisara Dhouti* where the respiratory muscles strength will be checked with the performance of 1RM by stretched position of diaphragm and flapping of abdominal muscles. The tiredness or fatigue will be rated by rate of perceived exertion (RPE). That is also the reflect of trachea-bronchial-tract (TBT) muscle strength which are involuntary and necessary for force production during weight lifting. Hence the present study may help in determining the person's ability to continue the power practice by using TBT muscles or not. This study will provide information about the beginner or advance level practice based on the strength of TBT muscles for skeletal muscle performance.

IV. METHODOLOGY

1. **Aim:** To prove the effects of Agnisara Dhouti on respiratory muscle performance and level of exertion in beginners and advance yoga practitioners.

2. **Objectives**
   - Comparing the repetition maximum (RM) on pre and post training phases.
   - Comparing the rate of perceived exertion (RPE) on pre and post phases of training.

3. **Hypothesis**

   - **Positive Hypothesis (H_p):** Respiratory muscle strength and exertion may change with Agnisara Dhouti kriya.
   - **Null Hypothesis (H_0):** Respiratory muscle strength and exertion may or may not change with Agnisara Dhouti kriya.
   - **Negative Hypothesis (H_n):** Respiratory muscle strength and exertion may not change with Agnisara Dhouti kriya.

4. **Study Design:** Pre-Post Experimental.

5. **Sampling Methods:** Convenient Sampling. Total number of students 30. Place is offline testing and online training of B.Sc. yoga students in Visva Bharati. It was announced in each semester of B.Sc. course and explained the research process in few lines. Students were willing and given consent randomly from 1st semester to 6th semester. Criteria were checked before obtaining the parameters as observational study. After 3 days of successful training, the matched student's data alone was considered for further analysis.

6. **Inclusion Criteria**
   - **Gender:** 44% male and 56 % female
   - **Age:** 20 to 22 years.

7. **Exclusion Criteria**
   - **Experience:** More than graduate level
   - **General Health:** Menstruation, ulcers

8. Parameter

- **General Parameters**
  - Body weight
  - Body height
  - Pulse Rate
  - Respiratory Rate
  - Temperature
  - Blood Pressure.
  - PEFR
  - SpO_2
  - Inhale Breathing Hold Time (IBHT)
  - Exhale Breathing Hold Time (EBHT)

- **Specific Parameters**
  - Repetition maximum (RM)
  - Rate of Perceived Exertion (RPE)

9. Repetition maximum (RM): Repetition maximum (RM) is a method of quantifying exercise intensity, developed by Delorme. The "one Repetition maximum" (1RM) is the most defined number of exercises movements. [2] In the present study with Agnisara Dhouti kriya, the RM use for Abdominal Flapping count. The practice of abdominal front or back is count as one round or 1RM. Breath hold in Agnisara Dhouti kriya will fix the diaphragm and allow the flapping of abdominal muscles. By counting total number of flapping for 1 breath hold will be measured on prior day with demonstration and describing the technique. Later 3 days will be trained with 80% of 1RM (checked on base line and on 3rd day practice.

10. Rate of Perceived Exertion (RPE) Scale : The Rate of Perceived Exertion (RPE) scale measures the perceived breathlessness soon after activity (Agnisara Dhouti). It is used to estimate how a task is and what effort that task requires, from very, very light to very, very hard. RPE tool is the 'Borg scale'. The Borg scale is a 15-point scale ranging from a rating of 6, representing no endeavour at all, to a rating of 20 representing maximum endeavour. Author name is Gunnar Borg (1998).[3]

11. Time of data collection: Pre data was taken for four days. Every morning at 7.30am. A sample data collection was given in Annexure-14.4.

12. Lesson Plan of Agnisara Kriya

- **Define:** Agnisara' is evolved from two Sanskrit words The term "Agni" implies to "fire" and "Sara" expands "essence". The "Agni" stands for the inward material fire which synchronize exclusion, digestion and mutation. "Sara" represent the crucial act that the fire modulate.[25]

- **Instructions:** Sit in padmasana and breathe in deeply. Exhale, emptying the lungs as much as possible. Lean forward slightly, straightening the elbows. Push down on the

knees with the hands and perform jalandhara bandha. Contract and expand the abdominal muscles rapidly for as long as it is possible to hold the breath outside comfortably. Do not strain. Release jalandhara bandha. When the head is upright taking a slow, deep breath in. This is one round.[25]

- **Benefits:** Agnisara kriya stimulates the appetite and removes digestive disorders such as indigestion, hyperacidity, hypo-acidity, flatulence, constipation and sluggishness of the liver and kidney. It massages the abdomen, stimulating the associated nerves, strengthening the muscles and encouraging optimum health of the abdominal organs as shown in the Figure-15.[25]

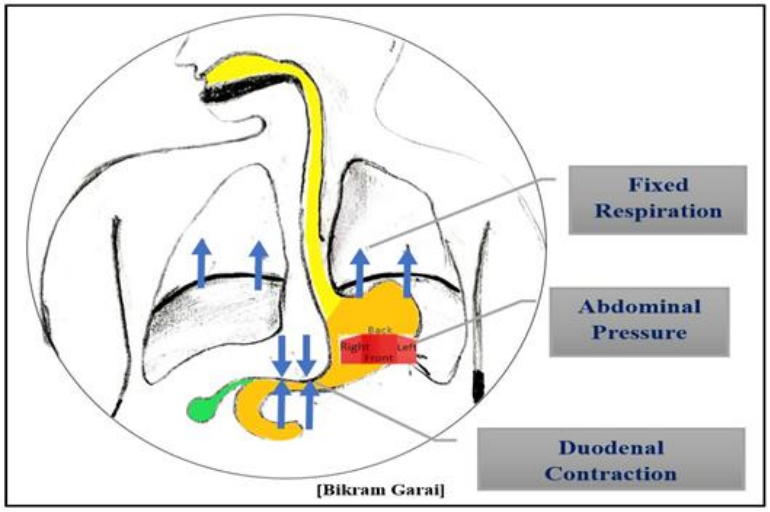


Figure 14: Abdominal Pressure Movement

- **Contra-Indications:** People suffering from high blood pressure, pre-menstrual syndrome (PMS), menstruation phase, anxiety, low immune power or recent flu attack (in past 2 months), heart disease, acute duodenal or peptic ulcers, overactive thyroid gland or chronic diarrhoea should not perform this kriya. Women who are more than three months pregnant should refrain from this practice. However, Agnisara kriya may be practised in the postnatal period to tighten up the abdominal and pelvic muscles, and to recondition the reproductive organs.[25]

V. RESULTS

The data of 64 students was entered into excel sheet. After matching the availability of pre & post data, the total of 30 student's data was considered for analysis. The data is tabulated and made into graphs for better understanding by using mean values. Percentage change also given in tables for more understanding. Tables are shown in three major divisions. Table 1: Demographic data, Table 2: General parameters, Table 5: Specific parameters. General parameters are sub-divided into three-parts. Table 2: Physical body, Table 3: Respiratory, Table 4: Cardio-Vascular. Specific parameters are shown in two separate divisions. Table 5: Repetition Maximum (RM) and Table 6: Rate of Perceived Exertion (RPE). Graphs shown after every table. Abbreviations are given below every table

and graph. The p-values were drawn from online SPSS software using t-test like, independent & paired t-test.

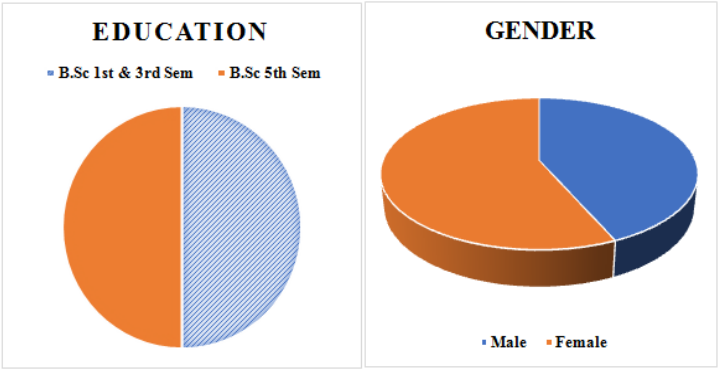
After noticing the results, the positive hypothesis was proved and failed in null hypothesis (Ho) and negative hypothesis (Hn). So, the alternative hypothesis (H_A) is "is there difference between beginners and advance practitioners".

1. Demographic Data

Table 1: Demographic Data

No.	Demographic Data		Details
1.	Age Group		20-22
2.	Sample size (n)		30
3.	Male & Female		13 & 17
4.	Education		Yoga Graduation Course
	1.	B.Sc. 1st & 3rd SEM	15
	2.	B.Sc. 5th SEM	15

Abbreviations: Beginner, Advance, Male, Female, Age Group.



Graph1: Demographic Data of Groups

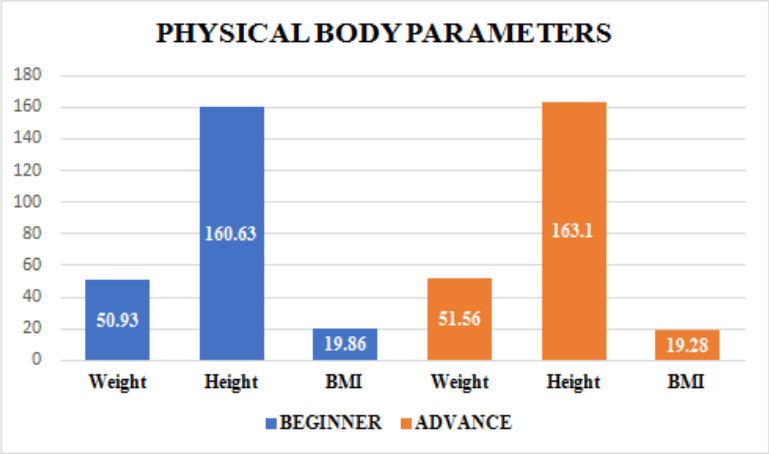
2. General Parameters: Physical body, Respiratory, Cardio-Vascular

Table 2: Physical body Parameters

Beginner and Advance Group pre-post comparison

S. No	Parameter	Beginner (Mean ± SD)	Advance (Mean ± SD)
1.	Weight	50.93±8.31	51.56±8.85
2.	Height	160.33±10.05	163.1±6.40
3.	BMI	19.86±3.76	19.28±2.42

Abbreviations: Weight, Height**,** BMI- Body Mass Index, SD- Standard Deviation.



Graph 2: Physical Body Parameters

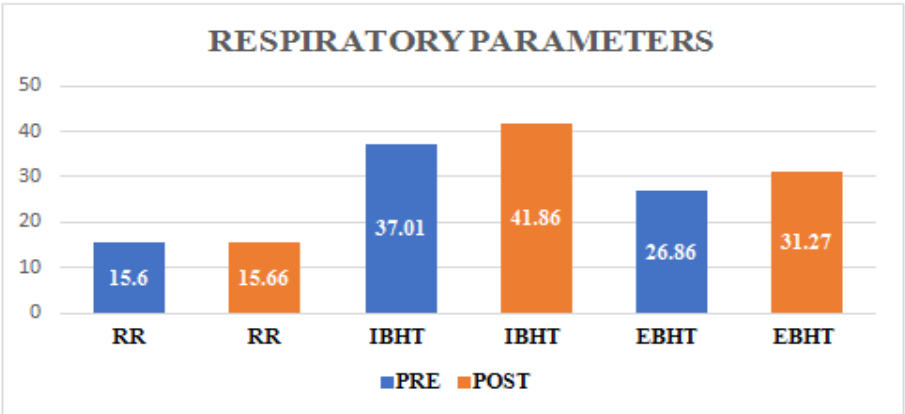
Abbreviations: Weight, Height, BMI- Body Mass Index.

Table 3: Respiratory Parameters
Beginner and Advance Group pre-post comparison

Table 3a: Beginner Group

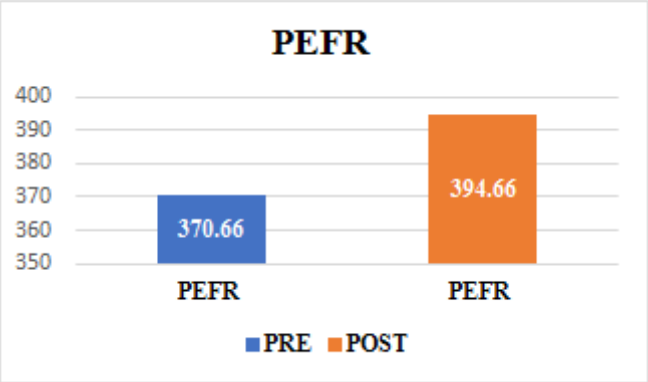
S. No	Parameter	Beginner-Pre (Mean ± SD)	Beginner-Post (Mean ± SD)	% Change
1.	RR	15.6 ± 3.94	15.66 ± 3.26	0.42
2.	IBHT	37.01 ± 10.37	41.86 ± 10.71	13.10
3.	EBHT	26.86 ± 7.37	31.27 ± 5.63	16.40
4.	PEFR	370.66±104.29	394.66±120.64	6.47

Abbreviations: RR-Respiratory Rate, IBHT- Inhale Breath Holding Time, EBHT-Exhale Breath Holding Time, PEFR-Peak Expiratory Flow Rate, SD- Standard Deviation.



Graph 3a: Beginner Group

Abbreviations: RR-Respiratory Rate, IBHT- Inhale Breath Holding Time, EBHT-Exhale Breath Holding Time.

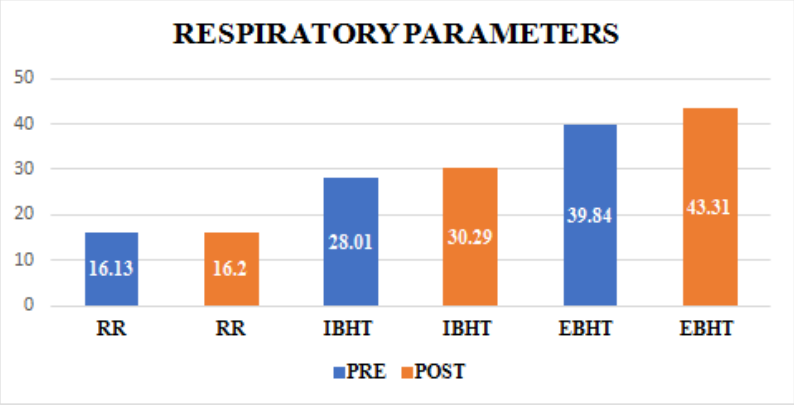


Abbreviations: PEFR-Peak Expiratory Flow Rate.

Table 3b: Advance Group

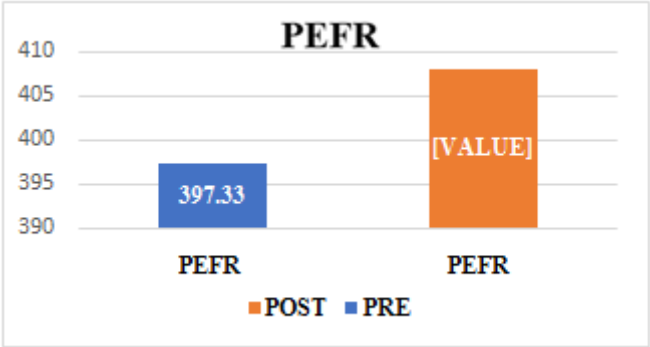
S. No	Parameter	Advanced-Pre (Mean± SD)	Advanced-Post (Mean ± SD)	% Change
1.	RR	16.13±2.32	16.2±3.48	0.41
2.	IBHT	39.84±9.99	43.31±11.25	8.71
3.	EBHT	28.01±7.78	30.29±6.15	8.14
4.	PEFR	397.33±152.29	408±156.85	2.68

Abbreviations: RR-Respiratory Rate, IBHT- Inhale Breath Holding Time, EBHT-Exhale Breath Holding Time, PEFR-Peak Expiratory Flow Rate, SD- Standard Deviation.



Graph 3b: Advance Group

Abbreviations: RR-Respiratory Rate, IBHT- Inhale Breath Holding Time, EBHT-Exhale Breath Holding Time.



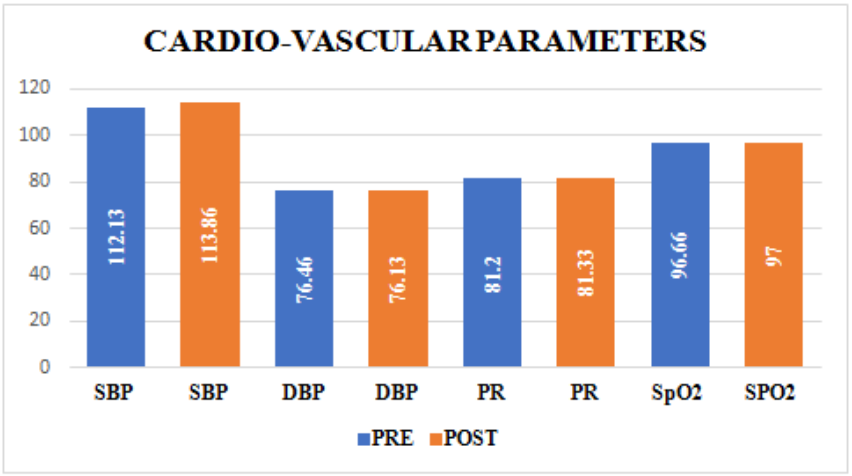
Abbreviations: PEFR-Peak Expiratory Flow Rate.

Table 4 Cardio-Vascular Parameters
Beginner and Advance Group pre-post comparison

Table 4a: Beginner Group

S. No	Parameter	Beginner Pre (Mean ± SD)	Beginner Post (Mean ± SD)	% Change
1.	SBP	112.13±12.31	113.86±7.59	1.54
2.	DBP	76.46±8.39	76.13±5.74	-0.43
3.	PR	81.2±5.40	81.33±6.65	0.16
4.	SpO_2	96.66±1.29	97±1.36	0.34

Abbreviations: SBP – Systolic Blood Pressure, DBP- Diastolic Blood Pressure, PR- Pulse Rate, SpO_2- Saturation of Peripheral Oxygen, SD- Standard Deviation.



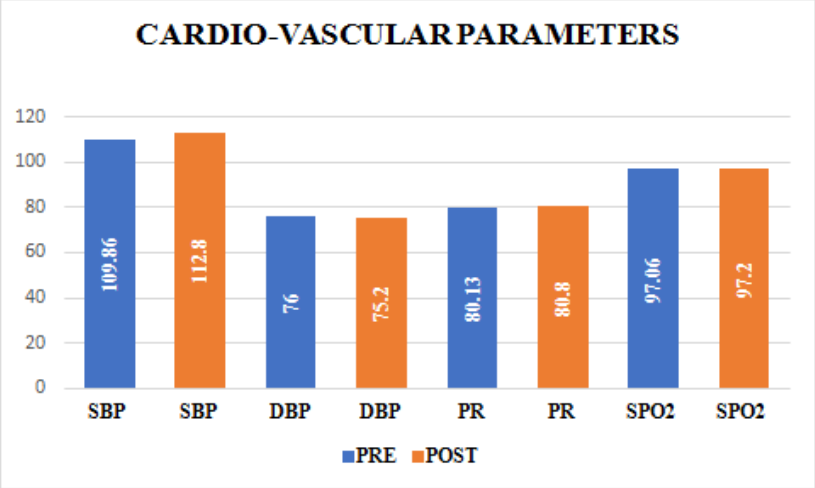
Graph 4a: Beginner Group

Abbreviations: SBP – Systolic Blood Pressure, DBP- Diastolic Blood Pressure, PR- Pulse Rate, SpO2- Saturation of Peripheral Oxygen.

Table 4b: Advance Group

S. No	Parameter	Advanced Pre (Mean± SD)	Advanced Post (Mean ± SD)	% Change
1.	SBP	109.86±11.88	112.8±5.68	2.66
2.	DBP	76±7.67	75.2±6.43	-1.05
3.	PR	80.13±3.29	80.8±4.60	0.83
4.	SPO2	97.06±1.48	97.2±1.42	0.13

Abbreviations: SBP – Systolic Blood Pressure, DBP- Diastolic Blood Pressure, PR- Pulse Rate, SpO_2- Saturation of Peripheral Oxygen, SD- Standard Deviation.



Graph 4b: Advance Group

Abbreviations: SBP – Systolic Blood Pressure, DBP- Diastolic Blood Pressure, PR- Pulse Rate, SpO2- Saturation of Peripheral Oxygen.

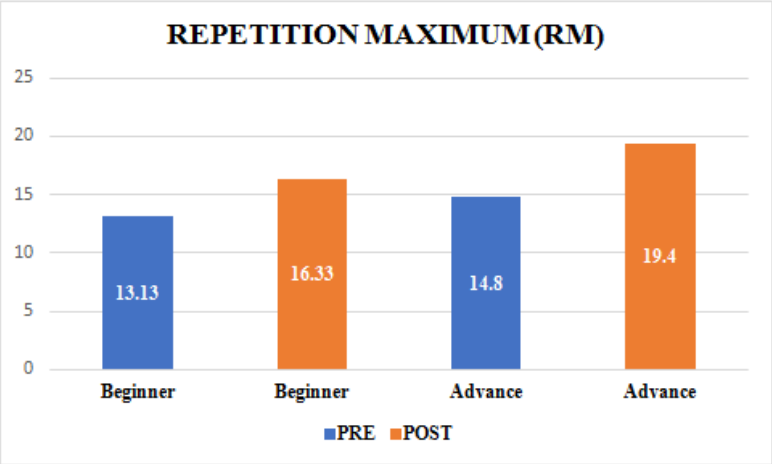
3. Specific Parameter- Repetition Maximum (RM) and Rate of Perceived Exertion (RPE)

Table 5: Repetition maximum (RM)

Beginner and Advance Group pre-post comparison

Specific Parameter	Beginner-Pre (Mean ± SD)	Beginner-Post (Mean ± SD)	% Change	Advance-Pre (Mean± SD)	Advance-Post (Mean ± SD)	% Change
RM	13.13±3.70	16.33±3.06	24.36**	14.8±2.95	19.4±7.90	31.08**

Abbreviations: RM- Repetition Maximum, SD- Standard Deviation, **- p-value is highly significant.



Graph 5: Repetition Maximum (RM) as Specific Parameter

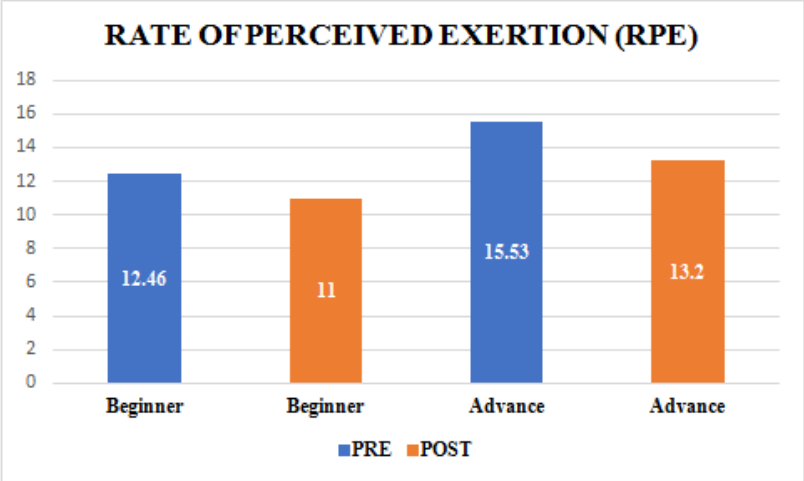
Abbreviations: RM- Repetition Maximum, SD- Standard Deviation.

Table 6: Rate of Perceived Exertion (RPE)

Beginner and Advance Group pre-post comparison

Specific Parameter	Beginner-Pre (Mean ± SD)	Beginner -Post (Mean ± SD)	% Change	Advance -Pre (Mean± SD)	Advance-Post (Mean± SD)	% Change
RPE	12.46±4.10	11±3.38	-11.76**	15.53±1.59	13.2±2.21	-15.02**

Abbreviations: RPE- Rate of Perceived Exertion, SD- Standard Deviation, **- p-value is highly significant.



Graph 5: Rate of Perceived Exertion (RPE) as Specific Parameter

Abbreviations: RPE- Rate of Perceived Exertion, SD- Standard Deviation.

VI. DISCUSSION

Four-day practice of Agnisara Dhouti of all participants on pre and post phases improved in.

After dividing the sample as equal and above 2 years of experienced, the below changes are documented. Specifically, the repetition maximum improved by 3.2 in beginners and 4.6 in advance practitioners. Rate of perceived exertion reduced by 1.4 in beginners and 2.33 in advanced yoga practitioners. Supporting general parameters shown the positive changes within these 72 hours of training and testing. The details are discussed as all improvement, neutrals and adverse changes for better understandings of the readers.

1. Positive Effects with Agnisara Dhouti

- **Beginners Practitioners:** Workload on abdominal muscles pulls the blood flow and direct from peripheral to central circulation as proved with reduced RPE from 12.46 to 11.0. (-11.76%) (Table-6) (Graph-6). This also exactly matching the urgency of blood flow soon after releasing the negative pressure after Agnisara Dhouti kriya in the present study. There is activation of mitochondrial function that is how the performance improved from 13.13 to 16.33 (24.36%) (Table-5) (Graph-5), by 3rd day of training in beginners. Cesare Granata, et al, 2018 proved, mitochondrial respiration and the citrate synthase (CS) activation by 40 to 50 % with heavy intensity training (HIT) in vastus lateralis biopsy. There are contrasting findings on the effects of relative exercise intensity on training-induced changes in citrate synthase (CS) activity in human skeletal muscle.[9] According to Martin J. MacInns, et al, 2016, there is increased CS activity after high intensity interval training (HIIT) at 65% Wmax and no change after work-matched moderate intensity continuous training (MICT) at 50% Wmax.[10]

  According to Reitzschel in 2001, situations that counter blood pressure with vascular diseases can be a matching measure for any cardiovascular changes. Just as observed in the present study where systolic blood pressure (SBP) mean value improved from 112.13 to 113.86 (1.54%) (Table-4a) (Graph-4 a) and diastolic blood pressure (DBP) mean value reduced from 76.46 to 76.13 (-0.43%) (Table-5.2.3. a) (Graph-5.2.3. a).[11] Newer studies by Panagiotis Kougias, 2010, the ability of adjustment of blood pressure happens chronically through baroreceptors and kidney function.[12]

  Pulse Rate (PR) mean value improved from 81.2 to 81.33 (0.16%) (Table-4a) (Graph-4a) Baroreceptor activation means pulmonary vasculature, are sensitive to change in central volume. there activation during changes in central volume in central blood volume induce reflex changes in peripheral sympathetic nerve activity. These effects contribute to orthostatic adjustments while regulation of sodium/water reabsorption that plays a role in the regulation of blood volume as proven by Seravalle G, 2019. They found alteration in cardiac function, that activates afferent stimuli from

baroreceptors to the central cardio-regulatory areas. That leads to activation of sympathetic and renin angiotensin-aldosterone system. These physiological changes lead to produce vasoconstriction as immediate effect or reflex.[13] It was observed in the previous study by Masi S, 2009, that, there may be chance of damage to the organs inside if the sympathetic activation technique is performed for long time.[14]

Saturation of Peripheral Oxygen (SpO2) mean value improved from 96.66 to 97 (0.34%) (Table-4 a) (Graph-4 a). Previous study by Field, 2010, the oxygen saturation reduces by 19% with rest and stimulation way of meditation session. the present study proven 0.002%-0.003% reduction at seconds of time after Agnisara Dhouti kriya. This way, there is possibility to understand the aerobic capacity before starting any other yoga practice. Also, there is chance to understand hypoxic changes of brain in terms of dizziness. that must be addressed with Shavasana rather asana session. so present study helps for yoga prescription of yoga practices instantly.[15]

It was observed in the previous study by Sabine K Illi, 2012, that there is possible improvement in respiratory muscle endurance in less fit normal individual and long duration sports individuals. Present study shows increased respiratory rate 15.6 to 15.66 (0.42%) (Table-3a) (Graph-3a) soon after agnisara dhouti to provide enough oxygen as per the training time and intensity. It shown the stimulation of aerobic capacity that is important for the less fit individuals like beginner and also long duration practitioners like advance practitioners. Agnisara dhouti brought this basic vital balance in university yoga practitioners. As the practice of 3 days made clear about the dosage as matching the kriya practice than aerobic practice. Hence agnisara can be a good warm up for winter season, beginners' level and less fit people before general practices.[16].

Inhale Breath Holding Time (IBHT) mean value improved from 37.01 to 41.86 (13.10%) (Table-3a) (Graph-3a). According to Amaravathi E, et. al, the conventional lifestyle program (CLSP) resembles the conventional rehabilitation program which reduce the resting heart rate and increase duration of exercise performance with peak oxygen consumption. This has improved the overall QOL after coronary artery bypass graft (CABG). This might be the same reason behind the agnisara dhouti in beginners and advance practitioners with IBHT.[17]

Exhale Breath Holding Time (EBHT) mean value improved from 26.86 to 31.27 (16.40%) (Table-3a) (Graph-3 a). Resistance of blood vessels with Agnisara Dhouti kriya stimulates release of Nitrous oxide (NO) from epithelium of blood vessels as observed in previous studies by Masi S, 2009. That enhance the vasodilatation and modulates blood pressure soon after the practice. So Agnisara helps to bring balance between high or low BP. But it should be under the guidance of experts. Present study revealed significant positive changes in advance group than beginners.[14]

As per the study by Jenna B. Gillen, 2016, the peak oxygen uptake improved by 19% with 12 weeks of spring training. Sprints are with whole body by area, weight and gravitational force used the oxygen and shown improvement of PEFR. Agnisara dhouti as part of such intense training, the abdominal muscle (intense contraction) and

diaphragm (passively stretch) oxygen uptake or demand for oxygen increases immensely very soon and initiates rapid breathing. Here the amount of PEFR increased by 6.47% (Table-3a) (Graph-3a) within 3 days of training. So, the PEFR improvement is with small region of body, very less weight and less gravitational force for performance in beginners. 1.2% improvement of VO2max with sports can be assumed to be 2.68% with agnisara dhouti of advance practitioners as safe endurance with interval training of 3 days per week.[18]

- Advance Practitioners: Repetition Maximum (RM) mean value improved from 14.8 to 19.4 (31.08%) (Table-5) (Graph-5), shows the ability of abdominal muscle strength and passive stretching of diaphragm. Quick ability of abdominal muscles performance was matched with PEFR that was improved from 397.33 to 408 (2.68%) (Table-3b) (Graph-3b), in advance students. 1.09% of workload with interval training of intense sports by Jenna B. Gillen, 2016. [18] can be assumed with advance trainers in the present study.

Rate of Perceived Exertion (RPE) mean value reduced from 15.53 to 13.2 (-15.02%) (Table-6) (Graph-6), shows the ability of facing the breathlessness soon after activity. The ability shown at skeletal muscles level (Annamaya kosha) by breath holding times which are improved from 39.84 to 43.31 (8.71%) and 28.01 to 30.29 (8.14%) (Table-3b) (Graph-3b), for inhalation and exhalation respectively. This might have helped cells to live aerobically because of maintained SpO2 from 97.06 to 97.2 (0.13%) (Table-4b) (Graph-4b), at energy level (pranayama kosha). [9.10]

All the above-mentioned changes can be considered normal because of normal vital changes of systolic blood pressure (SBP) mean value improved from 109.86 to 112.8 (2.66%) (Table-4b) (Graph-4b), diastolic blood pressure (DBP) mean value reduced from 76 to 75.2 (1.05%) (Table-4b) (Graph-4b), pulse rate (PR) mean value improved from 80.13 to 80.8 (0.83%) (Table-4b) (Graph-4b), respiratory rate (RR) mean value improved from 16.13 to 16.2 (0.41%) (Table-3b) (Graph-3b). In the previous study Cowen, 2007, heart rate with ashtanga yoga compared to the other two styles. No significant difference was found between the hatha yoga and gentle styles. There was improvement in cardiorespiratory fitness. The increase in heart rate from beginning to relaxation was 1.00 and the effect size is 0.96 indicating a highly reliable test.[19]

2. **Neutral Effects of Agnisara Dhouti:** All the parameters shown changes in the present study. This counters the null hypothesis (Ho).

3. **Adverse Effects of Agnisara Dhouti:** There is no suffering or sickness or adverse effects noticed during and after 3 minutes of the study. So, it shows the natural metabolic changes within the normal limits with agnisara dhouti kriya. Hence it is safe yoga technique under the experts. This may help the Samana vayu to stimulate 72 thousand nadi as mentioned in 4th question of prashna upanishad.

4. **Possible Mechanisms of Agnisara Dhouti:** Respiratory muscles tiredness has reached normal levels within 3 minutes of times makes sure about the safe metabolic changes with

agnisara dhouti. The tiredness of respiratory muscles was less in advance practitioners than beginners. This actuality is what make a teacher clear about the abilities of vital organs to plan the intense or warmup session for an individual.

According to Amaravathi E. et al, 2018, there is improvement of muscle strength as physical health in post operative cardiac surgery patients with yoga-based lifestyle.[17] According to Eraballi A, et al, 2017, there is requirement of such yoga programs for the world at large as mentioned in constitution of world health organization (WHO).[20]

Mindfulness on physical practices is the other part happened in the present study that might also contribute to differentiate the beginners and advance level of respiratory tract performance. As reviewed by Rupesh Kumar et al, 2021, mindfulness part of yoga practices is the solution for gastroesophageal reflux disease (GERD).[21] There is possible strengthening of larynx during kumbaka state of agnisara dhouti kriya. That can further improve the strength and coordination with breath and swallowing in future. That is how the chanting also helps as experimented by Sudhir Ranjan Singh et al, 2022, chanting part of yoga practices like, Gayatri Mantra is an effective means in improving cognitive function. Incorporation of Gayatri Mantra may be helpful to improve the academic ability along with their all-round personality development.

According to Dharmesh Kaswala, (2013), yoga can be used to treat gastroesophageal reflux disease (GERD). In this case report, the regular practice of Kapalbhati and Agnisar kriya along with PPI, patients with hiatal hernia had improvement in severe symptoms of GERD, which were initially refractory to prescribed proton pump inhibitors (PPI) alone. [22]

Amit Chandra Deshmukh, (2021), this study found Chain Yogic Exercise (Yogasana), Yogic Therapy (Agnisar Kriya) both has a significant effect to control Diabetes Mellitus (T2D). [23]

According to Rinad S. Minvaleev (2022). The properly performed agnisara increases blood flow to the splanchnic region, registered by the superior mesenteric artery (SMA), which should contribute to adequate blood supply to the gastrointestinal tract for successful performance of digestive function.[24]

VII. CONCLUSION

Agnisara dhouti kriya as the yogic intense practice to clean the intestine with abdominal muscles and passive stretch of diaphragm, improves strength and reduce rate of perceived exertion with 3 days of guided training. There is possibility to differentiate the beginners and advance levels just by observing the repetition maximum and rate of perceived exertion for 3 days.

VIII. LIMITATIONS

1. Could not plan physical training during lockdown time.
2. Sampling is from known institution and could not access control group from other institutions during this lockdown time.

IX. STRENGTHS

1. This is the first attempt about the agnisara dhouti kriya in 20th century as the PubMed, Scopus, Science direct.
2. This study gives a clear information about the general health and reactions soon after Agnisara kriya practice.
3. This intense practice makes the demand on resting metabolism and activate sympathetic system without emotions.
4. This is the best way to have internal journey or inward practice.
5. This might give a direction for the teachers to understand the eligibility of students to do advance asana or not.
6. If the exertion level (RPE) is less with practice, they are advance students and they can have synchronized metabolism during advance asana. Otherwise, shivering or imbalance happens from muscle level.

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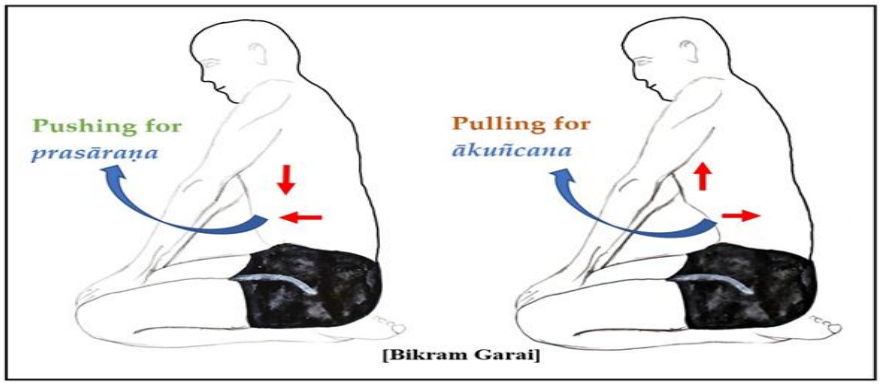
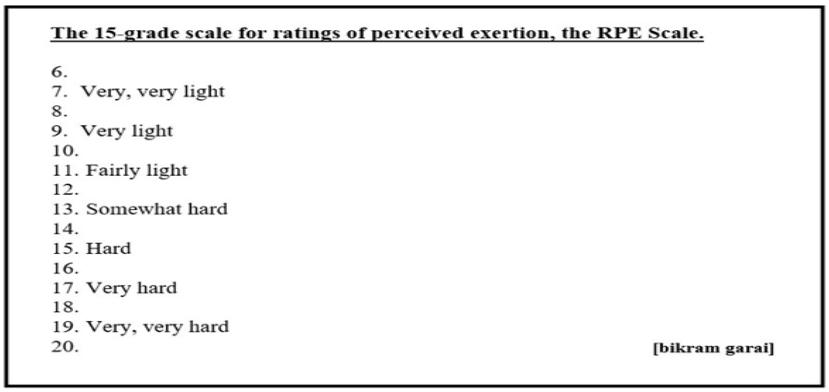
ANNEXURES

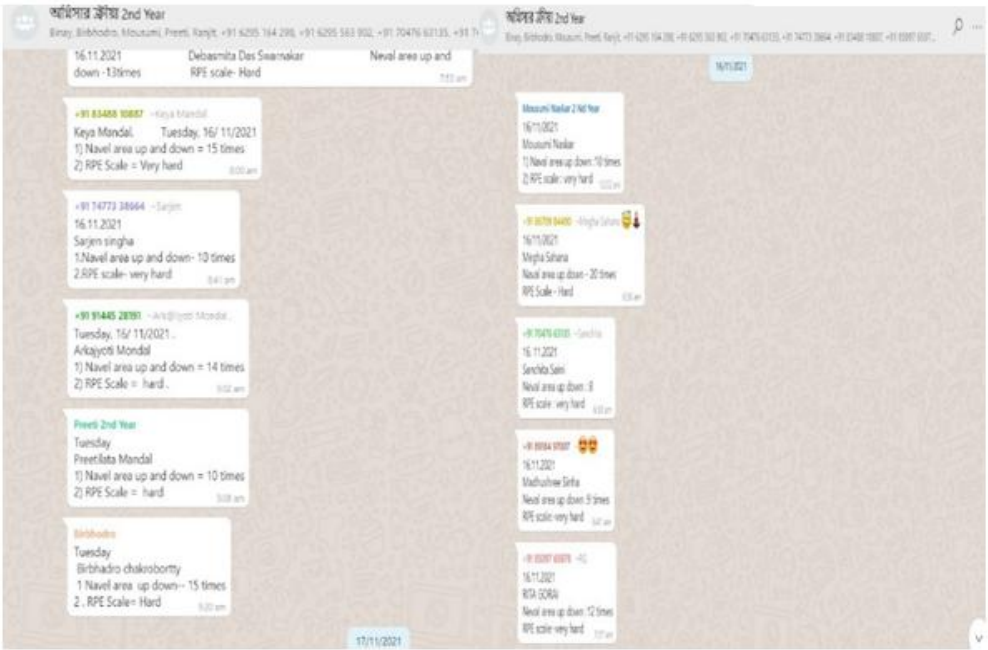
Annexure-13.1: Repetition maximum photo



Annexure-13.2: RPE scale



Annexure-13.3: Sample RM and RPE scale WhatsApp photo



Annexure-13.4: Sample Data collection form

Informed Consent

Title: Respiratory Muscle Strength with Agnisara Dhouti on Beginners and Advance Yoga Practitioners

Information to the participants:

We are conducting a study to find of Respiratory Muscle Strength with Agnisara Dhouti on Beginners and Advance Yoga Practitioners. This study is a part of the M.Sc. degree. Your consent will have very important role in this study.

If you consent to take part in this study, the investigator will assess your present status by measuring Repetition maximum (RM), Rated Perceived Exertion (RPE). The information collected from you would be helpful to find the effects of Respiratory Muscle strength with Agnisara Dhouti on beginners and advance yoga practitioners. The tests are expected not to cause any serious adverse effect on your physical or mental health. Please note that you have a right to refuse to take part in the study at any time.

Consent:

I have been informed about the procedures and the risks of the study. I have understood that I/We have the right to refuse my consent or withdraw it any time during the study without adversely affecting my treatment. I am aware that by subjecting to this investigation, I will have to give more time to assessments by the investigating team and that these assessments do not interfere with the benefits. I, Rohan Bera, the undersigned, give my consent to be a participant of this investigation/study program.

Signature of the Participant

Signature of the investigator