Review Article

**Vata dynamics with special reference to cardiac disorders — A cross-disciplinary approach**

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**A B S T R A C T**

Vata is one of the fundamental patho-physiological entities with unique and dynamic properties. All actions inside the body, whether voluntary or involuntary, are governed by Vayu. Actions involved during natural physiological calls or urges, are involuntary, but partially under voluntary control. Classical texts from Ayurveda state that such natural urges (NU) should be strictly attended without disturbing their natural flow. Some urges can be intentionally or inadvertently initiated (Udeeran) or suppressed (Dhaaran), redirecting the normal flow of Vayu, leaving scopes for severe morbidities in the heart causing cardiovascular disorders (CVD). Since Vata has unique attribute of Vega (locomotion) that moves in a specific direction, its intensities can be quantified with the help of modern techniques. Few studies have objectively evaluated the intensities of NU like belching, sneezing, expulsion of flatus, etc. during normalcy, which may help us to determine their altered activity during morbidity. In spite of such studies, their relevance to CVD is inadequately explored. Hence, this article addresses details of such NU that lead to CVD alone, from classical texts of Ayurveda, conventional medicines and technology that quantify their intensities. Citing research articles from various journals using keywords were done to understand their mechanism along with their intensities. It was found that objective estimation of few NU was performed extensively whereas some had limitations. Theories from the classical texts confirm that physiological NU, if allowed to flow freely without any impedance, assures good health. It would certainly benefit the mankind if their pathologic state is timely detected so as to prevent disease progression in CVD.

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1. Introduction

All actions inside the body, whether voluntary or involuntary, are governed by Vayu. Some actions such as digestion, blood circulation, pumping and beating of the heart, etc. are performed uninterruptedly and are not under voluntary control. They come completely within the scope of the autonomous nervous system and work independently to govern all involuntary actions of the body. In spite of recent advancements in neurosciences, integration of voluntary and involuntary motor commands still needs to be better understood [1]; on the contrary, Ayurvedic classical texts present extensive evidences on similar integration. Actions involved during natural physiological calls or natural urges (NU), are involuntary; however, few are partially under voluntary control i.e. heavy breathing during exercise, yawning, coughing, sneezing, belching, vomiting, hunger, sleep, flow of tears, expulsions of flatus, urine, faeces and secretions discharged during orgasm are some of the involuntary actions that are partially under voluntary control.

Performing one’s actions, especially natural physiological calls or holding them back voluntarily, has always been a key feature in human beings [2]. Since majority of individuals are striving hard on upgrading their status of living than improving quality of life, the above-mentioned key feature is conveniently manipulated to meet their demands of mundane life. Ayurveda refers to such actions as Vega Udeeran (forceful initiations) or Vega Dhaaran (suppression), and if with-held repeatedly may lead to severe conditions which are root cause of all diseases [3], collectively termed as Udaavarta Rogas [4].

It is extremely challenging to detect morbidities caused due to manipulations of such involuntary actions, as some of them are
intermittent in nature like belching, sneezing, coughing, etc. and some are performed uninterruptedly like breathing. Since these actions are predominantly governed by Vata, they possess unique attributes of Vega (locomotion) [5]. They move in a specific direction and their intensities can be quantified using latest technology. Whether naturally expressed (physiologic) or manifested as Roga Lakshana (pathologic), this unique attribute of Vata is relatively expressed in different speed and frequencies which needs to be determined. Hence, such urges when intermittently or inadvertently manipulated, redirect the normal flow, leaving scope for severe morbidities in the heart leading to cardiovascular disorder (CVD).

CVDs are a leading cause of death in the world and can potentially impede one’s development [6]. CVDs have always been a major concern for health globally. United Nations (UN) has initiated well-set plans to prevent such diseases [7]. Moreover, there have been well-established and exhaustive evidences that feature various antecedent factors for CVDs such as inheritance or environmental factors that induce stress, improper diet or lifestyle [8]. In spite of well-established multi-factorial determinants and well set plans by UN, there has been no decline in CVD cases. There are more than 13 urges mentioned by authors from classical texts of Ayurveda leading to CVDs [9–12,16] (Table 1). Some of these urges have been quantified and technically elucidated during normalcy.

3. Elucidation of manipulated urges with special reference to CVDs

There are more than 13 urges mentioned by authors from classical texts out of which only nine have direct impact on Hṛdaya (Heart) leading to CVDs [9–12,16] (Table 1). Some of these urges have been quantified and technically elucidated during normalcy.

3.1. Belching

Belching is a physiological release of accumulated gastric air from the stomach. This phenomenon is a result of a coordinated response by the receptors in the gastric wall, which initiates the relaxation of the lower esophageal sphincter, and this excess air from the distended stomach is vented out towards the upper esophageal sphincter and finally releasing it through the mouth. This comes out as an audible sound as a belch. They are of two types of belching: gastric belch and supra-gastric belch [17].

Susrutta explains Udgar (belch) as a lakṣhana (symptom) where Vayu is expelled out through mouth making a varied sound. Shuddha Udgar (pure belches) are considered to be normal when arises without any foul smell, or food regurgite especially having sweet, sour or pungent tastes [18]. It is in fact an indication of the normal digestion process [19].

There are studies that have evaluated the frequency of belches to be considered normal and becomes pathological and bother-some if occurred more than 20–30 times per day [17].

Esophageal electrical impedance monitoring is a useful tool that objectively quantifies the intensity of a gastric belch. It measures the resistance/impedance on the movement of air in the esophagus. According to a study conducted by Bredenoord, an increase in impedance of air by ≥1000 Ω that moves in the oral direction is a characteristic of a gastric belch. Conversely, supra-gastric belching, moves in an abnormal direction, followed by a return to baseline moving in the opposite direction with a similar impedance value [20].

A high-resolution manometer is another instrument, widely used to access the pressure from pharynx to stomach. Sun et al. studied esophageal and gastric functions through this method and found that a normal value of lower esophageal sphincter was 9–27 mmHg [21]. It is also an important diagnostic tool for achalasia and dysphagia too.

A phenomenal belch with increased intensity can also arise as a result of habitual use of lozenges, chewing of tobacco/gum, swallowing of air along with saliva or a random gulping of food/liquid in large volumes. It becomes very difficult to measure their intensities if they are already being treated for the same by antacids, carbonated drinks or beer to release an excessive amount of accumulated air, as they give a false measurement on impedance [22].

Belching is predominantly seen in inferior wall myocardial ischemia [23]. It has been established as an enhanced autonomic response to ischemic heart disease [24]. Bulimia nervosa can influence belching to turn pathologic leading to CVDs [25]. Lack of taste, tremors, feeling of obstruction in the heart and other regions of chest, flatulence, cough, and hiccup are some of the consequences caused by forceful initiation or suppression of belching [5].

Natural human exhalation flows such as sneezing, coughing and...
breathing are actually produced from a single exhalation effort and can be considered as ‘jet-like’ airflows [26].

3.2. Sneezing

Sneezing is an explosive exit of air, washing out mucosal debris and irritants through mouth and nose. A phenomenal sneeze is a biphasic, coordinated and protective respiratory reflex that involves nasal as well as respiratory passages [27].

Susrutha says Kshavathu (sneeze) is an audible sound of Vayu being released through nasal passage. These are aggravated Praana and Udaana Vayus situated in the pathways of head regions [28].

Sneezing is difficult to investigate due to the dearth of available studies on estimating sneeze flow velocity. Tang et al. [26] objectively evaluated the intensity of sneezing using a shadowgraph imaging technique. It was found that within 0.5–2.5s, the maximum visible distance over which the sneeze plumes (or puffs) travelled, was 0.6 m, with a maximum derived velocity from this measured distance of 4.5 m/s. However, sneeze velocities vary depending on the velocities of the airflows or droplets expelled with them. Xie et al. cited a velocity of up to 100 m/s based on earlier estimates by Wells assuming the droplet size to be 10 μm in diameter [29].

Studies have confirmed that chronic sneezing, exceeding normal intensity may lead to aortic dissection [30]. Consequences of manipulation of sneezing include headache, debility of sense organs, stiffness of the neck, facial paralysis and obstruction during inhalation [9].

3.3. Cough

Normally, cough consists of inspiratory, compressive and expiratory phases [31]. It begins with a deep breath with a fully opened glottis [32] followed by a compressive phase of the closure of glottis and contraction of expiratory muscles. This suddenly opens the glottis causing an explosive release of trapped extra thoracic air as an expiratory phase. The term laryngeal competence is often used to imply a well-coordinated upper airway and an adequate cough response [33].

Doshas in pathologic state release Praana Vayu along with Udaana Vayu causing a peculiar sound as that of a sound generated from an empty brass vessel [28].

Tussometry is a new non-invasive technique for objectively assessing laryngeal function by analysis of the airflow waveform produced by a maximum effort voluntary cough maneuver [34]. This allows measurement of the peak airflow generated, cough peak flow rate (CPF) and the time taken to achieve this, peak velocity time (PVT).

The first publication that considered cough peak flow (CPF) in normal volunteers was published by Leiner et al. They observed that the average CPF was higher than 300 L/min in healthy Caucasian European individuals. Additionally, the researchers stated that the CPF must be higher than 160 L/min for an effective cough [35]. An effective cough must be preceded by the inhalation of a sufficient air volume, and strong expiratory muscles for generating high thoraco-abdominal pressures [36]. A cough is an essential protective reflex that keeps debris out of airways and clears excessive secretions during respiratory tract infections thereby, preventing airway or pulmonary diseases such as pneumonia, atelectasis and acute respiratory failure [37].

A chronic cough persisting for months or years can eventually lead to myocardial infarction through pulmonary infection or inflammation. But usually, an acute cough lasts for less than three weeks and is caused by upper respiratory tract infection [38]. Several previous studies have examined various aspects of the airflow dynamics of coughing with human volunteers using particle image velocimetry, but had some limitations since it was designed to evaluate in a closed environment [39].

Environmental pollution, disease conditions such as pulmonary edema can retain cough in chronic state, leading to increase in pulmonary artery pressure. Suppressing the natural act of cough increases its intensity, brings difficulty in breathing, loss of taste, heart diseases, emaciation, and hiccups [9]. It is seen that chronic cough increases pulmonary artery pressure causing pulmonary hypertension leading to dyspnea on exertion (DOE) bringing morbidity in the heart [40].
3.4. Breathing

Breathing, or ventilation, consists of two phases, inspiration and expiration. During inspiration, the air travels in, through the body’s conducting airway - nostrils, throat, larynx and trachea into the alveoli of the lungs. The diaphragm moves downwards and the external intercostal muscles contract. There is an increase in chest volume with lowering of air pressure as compared to atmospheric air. During a resting expiration, the diaphragm and external intercostal muscles relax, restoring the thoracic cavity to its original (smaller) volume, and forcing air out of the lungs into the atmosphere [41].

Heavy breathing, shortness of breath and exertional dyspnea are the terms commonly used for altered breathing during exercise i.e. Shrama Shwas. There is no mention of the suppression of breathing at rest in the literature since it is an uninterrupted activity occurring throughout one’s life, but its frequency is certainly altered during exercise.

Even though spirometry and echocardiography are widely used to quantify exertional dyspnea, they are performed in a resting state during exercise. During a resting expiration, the diaphragm and external intercostal muscles relax, restoring the thoracic cavity to its original (smaller) volume, and forcing air out of the lungs into the atmosphere [41].

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Even though spirometry and echocardiography are widely used to quantify exertional dyspnea, they are performed in a resting state and may correlate poorly during exercise. Hence, cardiopulmonary exercise testing provides a comprehensive assessment of the exercise response and reflects the influences (including interactions) of the cardiac, respiratory, musculoskeletal and hematological systems [42]. This testing provides data on respiratory gas exchange, including oxygen uptake (V̇O₂), and carbon dioxide output (V̇CO₂), tidal volume (Vt), minute ventilation (VE), and other variables such as electro and echocardiography, blood pressure and oxygen saturation. Testing can be done incrementally or at a constant work rate. Silverman et al., Kaufman et al. provided established baseline ventilation data under varying conditions of work [43].

Tang et al. used shadowgraph imaging system for breathing modalities and found the maximum visible propagation distance and derived exhalation velocities to be 0.6 m and 1.4 m/s respectively for nasal breathing, and that for mouth breathing, were 0.8 m and 1.3 m/s, respectively [26].

Breathlessness caused due to exertion, or DOE when left untreated or untended, leads to severe shortness of breath even without exertion. The presence of dyspnea predicts long-term mortality and characterizes high-prevalence of diseases like congestive heart failure, ischemic heart disease, chronic obstructive pulmonary disease (COPD), and asthma [44]. Shrama Shwas is one of the symptoms of vitiated Praanavaha Srotas caused due to irregular meals, injury to vital organ like the heart or Hrdaya Marma, leading to Hridroga [11,14]. Dust, smoke, wind, residing in cold places, intake of untimely and dry food, debility, severe dehydration, fever, vomiting, coryza, chest injury or any other internal hemorrhage, wasting, Udavaavarta Rogas, anemia and intoxication are some of the factors that lead to an altered breathing pattern [19].

3.5. Expulsion of flatus

Flatus is flatus or gas expelled through the anus and the scientific study of this area of medicine is flatology. Out of 95% of intestinal gas only two (nitrogen and oxygen), are present in the atmosphere in appreciable amounts whereas the other three (methane, hydrogen, and carbon dioxide) result from the metabolic processes of bacterial flora in the colon [45]. In humans, the production of methane is confined to the colon, where the partial pressure of this gas reaches as high as 200 mm Hg [22].

Flatus is brought to the rectum and pressurized by muscles in the intestines. It is normal to pass flatus, though volume and frequency vary greatly among individuals. The normal range of volumes of flatus in normal individuals varies hugely between 476 – 1491 ml/24 h [46].

Ayurveda refers to flatus as Adhovayu, where its obstruction causes bloating of gases in the abdomen as Adhmanaam [47]. Frequent impedance on its expulsion may lead severe cough, dyspnea on exertion, arrhythmia [48] and severe conditions like heart failure [14].

3.6. Expulsion of faeces

Human defecation is resultant of a synchronized activity that involves sensory-motor functions and is regulated by central, spinal, peripheral and enteric neural activities in a well-coordinated manner. Even though the systems involved in this mechanism initially are involuntary in nature, the concluding maneuver of an attempt to defecate is under voluntary control. Palit et al. unfolded this physiological response in four distinct phases, wherein the entire mechanism is well-coordinated, right from the basal phase to expulsive phase through pre-defecatory phase [49]. Inability to perform a coordinated movement till the phase of defecation leads to dissynergic defection.

A trained maneuver where an adult attempting to defecate with a frequency of minimum three per day and a maximum of three per week is considered normal [50].

Ayurveda refers to this inability as Anaha, which is a result of excess accumulation of undigested food or faecal matter disrupting its usual downward flow redirecting it upwards causing Hrullas (nausea), Hridvibandha (arrhythmia) and obstruction in belching [51]. Suppressing the urge of fecus gives rise to pinidikodweshatana (cramps in the leg muscles) and oppression in the heart [9].

3.7. Expulsion of secretions during orgasm (Retas)

A healthy and prolonged life expectancy lies in a secure sexual relationship whereas a chaotic sexual lifestyle, on the contrary, can lead to its adverse consequences [52].

As of date, the technology for calibrating the velocity of female orgasmic spurt/discharge has not been established. Moreover, there is an understanding that this velocity is negligible as compared to the velocity of male ejaculate. Sperm velocity and the fraction of sperm moving at that velocity can be measured objectively with a turbidimetric technique. The average sperm velocity in normal semen analysis is 96.5 µm/sec [53].

Contributors to flow impedance in the expulsion of sperm are atherogenic, high fat diet, stress factors resulting from insufficient rest or sleep. Consumption of drugs such as Sildenafil or Viagra that are popularly used for enhancing the sexual desire are found to have a serious impact on impairment of the penile vasculature or erectile failure consequently leading to severe arrhythmia. Stable, unstable angina and de-compensated heart failure are some of the consequences caused due to suppression in expulsion of spermatic fluid [54].

According to Bruhat Trayi, obstruction in micturation, cutting pain in the body, inguinal and scrotal hernia, urinary stones and impotence are the diseases caused due to suppression in expulsion of Retas [9,10,12].

3.8. Vomiting

Vomiting or emesis is the actual oral expulsion of gastrointestinal contents and is the result of contractions of the gut and the thoraco-abdominal wall musculature. Retching is the term used to describe the muscular events of vomiting without expulsion of vomitus (dry heaves). Vomiting is triggered when motor pathways get activated in the vomiting centre i.e. medulla oblongata [55].
Angina caused due to coronary artery disease is associated with nausea and vomiting [56].

Contents released out through mouth and eyes are called Chhardi (emesis) and Ashru (tear) respectively. Suppression of emesis leads to morbidity in the heart through Shwas (breathlessness) and kaas (cough) [9,11]. Suppression of tears has a direct impact on heart causing CVDs [9,10]. Chhardi and Ashru are facilitated by Udaana Vayu with the help of Vyayaana Vayu. Suppression of tears [9,10] that are influenced by emotions due to anxiety, sorrow are causative factors for vitiation of Rasadhauti (nourishing metabolites) and thereby disrupting Vyayaana Vayu in heart [57].

3.9. Thirst

Thrushna (thirst) is caused by aggravated Pitta along with Vayu in the soft Taalu (palate). Vata, Pitta and the Rasavaha Dhamanis (arteries) in the tongue causes drying up of tongue, neck and buccal cavity leading to pathologic thirst.

Chronic thirst can cause hypovolemic condition which consequently leads to arterial stiffness, endothelial dysfunctions, impaired vascular functions, cardiovascular regulation and BP regulations [58].

4. Findings in brief

Diseases of the heart i.e. Hridrog, abnormalities in rates and rhythm i.e. Hridvipandha, and Hridyayoparidha, pain in the cardiac region i.e. Hriddipa, Hridshool and Hridvyathath, symptoms that consequently leads to CVD like Shwas (dyspnea) and obstruction in inhalation i.e. Usthwasavarodha were the terms mainly used by the authors from Bruhat Trayi, to describe morbidities caused due to suppression of NU [16].

Repeated forceful initiation or inhibition of heavy breathing during exercise, belching, thirst and expulsion of semen were mentioned by all the authors from Bruhat Trayi that cause morbidity in the Hrdaya (heart). Manipulation of urges like coughing, sneezing, and vomiting consequently lead to CVDs through Shwas (dyspnea). Some actions like yawning, hunger, sleep, expulsion of urine are not studied here since they are referred to have a direct impact on other diseases when manipulated.

It is seen that not only different techniques were used to objectively quantify natural physiologic urges, but their terms also differ (Table 2). Sneezing, breathing and ejaculation of semen were measured in terms of velocity but their techniques used were different. Even though two different techniques were used to evaluate the intensities of belching, they were studied in terms of pressure, using esophageal electrical impedance monitoring which measured their pressure through resistance. Similarly, expulsion of flatus was also studied in two different techniques, where intestinal was-out technique quantified the intensity in terms of volumetric flow rate and anorectal manometry quantified it in terms of pressure. Some findings were obtained in terms of frequency, as in belching and expulsion of faeces.

5. Dynamics of Vata influencing cardiac region

Vayu when normal (unvitiated), holds up the system and organs [59]. Generally, all locomotive activities inside the body are influenced by Vayu [60]. It has five forms — Praana, Udaana, Samana, Vyayaana and Apaana. Even though their subtypes are identified and characterized according to their location, all of them have the potential to influence, initiate and sustain functions related to flow and conductance [19].

5.1. Potential to influence [61]

Vayu possesses great speed and moves in all directions. It attends to functions like contraction and relaxation of voluntary or involuntary muscles and is associated with the circulation of essential nutrients or Rasasamvahana from the heart [62] influencing the flow of macro and micronutrients through vessels to different organs also called as Srotas [63]. This is facilitated by Vyayaana Vayu. Generally, all dynamic activities are governed by Vyayaana Vayu. It originates from the heart and performs its unique function of Prasaraana (expansion) and Akunchana (contraction). Vayu controls and regulates the flow of metabolites; however, when vitiated, causes altered kinesis in the heart muscles, termed as Hrd Stambhana, Hrdvibandha, Hrdvyatha and Hrdyayoparidha.

Urges such as heavy breathing [64], expulsion of Retas (Spermatic fluid), Ashru (flow of tears), Trashna (thirst) and Chhardi (emesis) if voluntarily withheld, alter the function of Vyaana with the help of Vyaana such as Praana, Udaana and Apaana (Table 3), causing severe morbidity conditions of the heart like stable and unstable angina [54], stress-induced CVDs [13], arterial stiffness, vascular dysfunctions [58] and de-compensated heart failure [14].

Another Vayu that plays a vital role in influencing and is chiefly responsible for the existence of life is Praana Vayu. The absence of

| Sr.No. | Altered Actions | Vitiated Vayus Involved |
|--------|-----------------|------------------------|
| 1.     | Belching [12,73]| Praana, Udaana, Apaana |
| 2.     | Sneezing [28]   | Udaana and Praana      |
| 3.     | Cough [74]      | Udaana and Praana      |
| 4.     | Heavy breathing [64] | Praana, Udaana and Vyayaana. |
| 5.     | Expulsion of Flatus [12] | Apaana, Praana        |
| 6.     | Expulsion of Feaca [12] | Apaana, Praana, Udaan |
| 7.     | Expulsion of Sperm [56] | Apaana, Vyayaana      |
| 8.     | Tear [12,75]    | Udaana, Vyayaana       |
| 9.     | Thirst [76]     | Vyayaana               |
| 10.    | Emesis [57]     | Udaana, Vyayaana       |

Table 3
Involvement of vitiated Vayus, responsible for causing pathologically significant actions.

| Sr. No. | IA Action | Technique | Intensity (Normal values) |
|---------|-----------|-----------|---------------------------|
| 1       | Belching  | Esophageal electrical impedance monitoring | ≥ 1000 Ω |
| 2       | Sneezing  | High resolution manometer | 9–27 mmHg |
| 3       | Cough     | Shadowgraph imaging technique | 1.4 m/s (nasal) |
| 4       | Expulsion of Flatus | Shadowgraph imaging technique | 1.3 m/s (mouth) |
| 5       | Expulsion of Flatus | Intestinal washout technique | 476–1491 ml/24 h |
| 6       | Ejaculation of Semen | Anorectal manometry | ≥ 40 mmHg |
| 7       | Ejaculation of Semen | Turbidimetric technique | 96.5 μm/sec |
**Praana in a living being or Karmapurusha denotes its death. The Hrdaya and Mahasrotas (lungs) are the seats of Praana Vayu. When normal, it attends to inspiration, swallowing and belching, but certainly gets altered if frequently suppressed. Initially the system tries to restore the mechanism, but, in case of failure, gets aggrava-
dated and vitiated. Suppressing urges like belching, heavy breathing,
expulsion of flatus and faeces aggravates the Praana Vayu and
combines with Vayus such as Apaan and Udaan. These aggravated Vayus gets vitiated leading to various morbidities of the heart such as Hrdpida (pain in the chest), Shramashwas (dyspnea on exertion)
[65], ischemic heart disease [23], arrhythmia [66] and heart failure [14] [Table 3].

5.2. Potential to initiate

Any effort taken to initiate the smallest act or Prayatna is done by Udaana Vayu [67]. Movement of this Vayu is usually upwards,
within the region of nasal passage and umbilicus. When normal, it
is released out through nose and mouth. It attends to expectoration,
sneezing and expiration, but gets altered consequently if manipu-
lated. Urges such as sneezing and coughing aggravates Udaana Vayu leading to obstruction in the throat region vitiating Praana Vayus, and consequently leading to obstruction in the throat region vitiating Praana Vayus and Udaana Vayus leading to disorders of the heart through pulmonary hypertension [39], aortic dissection [20] and many more [Table 3].

5.3. Potential to sustain [61]

Vayu that flows downwards is Apaana Vayu. It pushes the Adhovata (abdominal gas), Mutra (urine), Shakruti (faeces) [69] and Retas (semen) downwards for expulsion. Vayu when normal per-
forms the above functions without any impedance and sustains health [67]; however, it gets altered and aggravated when sup-
pressed leading to vitiation of Apaana Vayu, redirecting the flow in the opposite direction, exerting upward pressure on the dia-
aphragm. This increases intra-thoracic pressure bringing a negative impact on the heart by disrupting the normal flow of Vayus and Praana Vayus, and consequently leading to Hrdvyatha (stable, un-
stable angina), Hrdyaparak (arrhythmia), de-compensated heart failure, and many more conditions related to CVDs [11] [Table 3].

If there is chronic impedence in flow of Praana and Vyaana Vayus, actions motivated by these Vayus becomes pathologic and have a direct impact on the heart leading CVDs. Udaana Vayu and Apaana Vayu first gets redirected to the opposite path, disrupting the Praana and Vyaana Vayus functions finally leading to disorders of Hrdaya (CVDs).

Heavy breathing after exercise is seen to be the most affected action leading to CVDs since it involves both the main Vayus that originate from the heart (Praana and Vyaana Vayu) [64]. Every human being is uniquely designed with varied endurance capacity. This in turn depends upon the energy store and its release. The energy required for exercise is derived from Adenosine Tri-
Phosphate (ATP) which is generated in the cells by 3 processes - aerobic oxidation of glycogen and fatty acids, anaerobic hydrolysis of phosphocreatine and anaerobic metabolism of glycogen. Aerobic glycogen and fatty acid metabolism provide the major source of ATP and constitute the only source during moderate intensity exercise. During heavy or sustained exercise, aerobic metabolism is unable to meet the demand; consequently, anaerobic generation of ATP oc-
curs. During exercise, heart rate, respiratory rate, VT and VE increase. VO₂ and VCO₂ rise steadily till the anaerobic threshold is reached [70]. Guidelines from Ayurveda on exercise or Vyayayaam clearly correlate with this concept and indicate that one should exercise until half of his energy is consumed [71]. This altered metabolism during exercise is automatically restored after rest. Thus, the scope of voluntary altered breathing is very less after stress or exercise. But when outperformed beyond one’s capacity repeatedly by forcefully switching to an anaerobic mode of respi-
ration may induce shortness of breath even during rest leading to serious consequences of cardio-pulmonary disorders like COPD, heart failure, etc.

Initially some Vega lakshanas (pathologic urges) such as Udgar Bahulya (excessive belching), Apaana Vayu (release of abdominal gas) etc. occurs as a primary homeostatic mechanism in the body, restoring the disrupted Vata physiology; it re-expresses itself as a normal Vega, but may become pathologic if fail to restore. Thus, the intensity or frequency of such physiological or pathologic Vagas if quantified, may serve as candidate markers to screen primary disrup-
tion in specific type of Vata physiology at an earlier phase. This may give us an approximate idea to approach strategically where a forthcoming morbidity in the heart due to disrupted Vata may be prevented.

There are few subtle urges like Lobha (greed), Moha (delusion), Irshya (jealousy), Dwesha (hatred), Krodha (anger), Mada (ego) etc. which are advisedly to be helped. Even though it is impossible to quantify these subtle urges as they are seated in mind, they certainly bring an impact in the Hrdaya through altered vascular resistance, reflected as hypertension due to stress [72].

6. Conclusion

The dynamic nature of Vata when encouraged to perform without any impedance, becomes a resource to inspire, influence and sustain life. Every natural urge is uniquely expressed in different intensities due to a unique locomotive property of Vata. The same property is also expressed during pathologic state but in altered intensities. The advancement in technology has enabled these intensities to be quantified. Studies with intensities found during normalcy can be taken as baseline to detect their altered functions. These altered functions need to be timely detected as they are influenced by many factors. As a result, they either appear as one of the symptoms or independently. Transgression of their intensity or frequency can lead to serious morbidities in the heart causing CVDs.

Attending to them on priority basis or maintaining their values within an acceptable range without manipulation and preventing them from influencing factors, would certainly enable Vata to sustain its function, thereby preventing the heart from possible disorders.

7. Gaps in the knowledge

a. There is a need to explore an appropriate range of intensity or frequency to classify the urges as normal physiologic or patho-
logic through Ayurvedic concept.

b. It is necessary to conduct a cohort study to confirm the influence of manipulation of NU on heart such as chronic history of con-
stipation, untreated heavy breathing, chronic persistent cough or belching etc.

c. Ayurveda gives more importance on the impact of food and lifestyle modifications in metabolic disorders. Metabolomic studies on normal individuals against cardiac patients along with their details of above mentioned 14 natural urges would benefit the health care professionals to manage the issue more swiftly.

d. There is a need to provide severity scores for all the above-
mentioned actions as explained in DOE in terms of New York Heart Association (NYHA) functional class. Probably
asymptomatic cardiac patients may have a history of other altered actions other than DOE.

e. There is a need for studying the variations in electrocardiogram on established CVDs with special reference to the chronic history of manipulation of natural urges.

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Conflict of interest

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References

[1] Pruszynski JA, Kurtzer I, Scott SH. The long-latency reflex is composed of at least two functionally independent processes. J Neurophysiol 2011;106: 449–59. https://doi.org/10.1152/jn.00528.2010.

[2] Schel MA, Kühn S, Brass M, Haggard P, Richard Ridderinkhof K, Crone EA. Neural correlates of intentional and stimulus-driven inhibition: A comparison. Front Hum Neurosci 2014;8:1–10. https://doi.org/10.3389/fnhum.2014.00027.

[3] Pt. Bhishagacharya harishastri paradkar vaidya (reprint). Astangahrdayam composed by vagbhata and commentaries by arunadatta and hemadri; Yogatantra; sutasastra; pranashta shalya vidnyaniya, critical notes; chapter 26. Verse 11. Varanasi: Krishnadas Academi; 2000. p. 56–2.

[4] Vaidya Yadavji. Acharya Trikamji Sushrutasamhita of sri dalhanacharya; uttara tantra; udavarta prathisdhe; chapter 55, verse 4, 5, 8th ed. Varanasi: Choukhamba Orientalia; 1981. p. 776.

[5] Pt. Bhishagacharya harishastri paradkar vaidya (reprint). Astangahrdayam composed by vagbhata and commentaries by arunadatta and hemadri; Dos-hadvidnyaniya; chapter 11, verses 1. Varanasi: Krishnadas Academi; 2000. p. 182.

[6] Clark H. NCDs: A challenge to sustainable human development. The Lancet 2013;381:510–1.

[7] sacco RL, Roth GA, Reddy KS, Arnett DK, Bonita R, Gaziano TA, et al. The heart of 25 by 25: achieving the goal of reducing global and regional premature deaths from cardiovascular diseases and stroke: a modeling study from the American heart association and world heart federation. Circulation 2016;133: e674–90.

[8] Hernandez LM, Blazer DG. Genes, behavior, and the social environment: Relationships between air swallowing, intragastric air, belching and gastroesophageal reflux. Neuro Gastroenterol Motil 2005;17:341–7. https://doi.org/10.1111/j.1365-2924.2004.00625.x.

[9] Vaidya Yadavji Trikamji Acharya Sushrutasamhita of Sri Dalhanacharya; uttara tantra; swasthavrutta verses 64, verse 84. 8th ed. Varanasi: Choukhamba Orientalia; 1981. p. 814.

[10] Vaidya Gagdi Dilip Prabhakar Hetukosah (volume 1). Pune: Tilak Maharashtra Vidyapeeth; 2000. p. 1032.

[11] Bredenoord AJ, Aeropgastric, gasia, and supragastric belching: a study using intraluminal electrical impedance monitoring. Gut 2004;53:1561–5. https://doi.org/10.1136/gut.2004.029455.

[12] Sun X, Ke M, Wang Z. Clinical features and pathophysiology of belching disorders. Int J Clin Exp Med 2015;8:2196–14.

[13] Cormier RE. Abdominal Gas. Clinical Methods: The History, Physical, and Laboratory Examinations. 1990.

[14] Swain S, Gera L, Singh S, Goyal N, Singh R, Sperling LI. Clinical and pathophysiological characteristics of epigastric air swallowing in patients with and without gastro-oesophageal reflux disease. Eur Respir J 2003;21:619–25. https://doi.org/10.1183/09031936.03.000679.2001.

[15] Addington WR, Sharrock N, Cusack F, Mendes JAH, Smith CD, Davison S, et al. Life 1981 Oct;1(2):83–93.
