Promote Health of Cardiovascular System (Heart +)

by Nirankar S. Agarwal, Ph.D.

Do

1. Absolutely the most beneficial yet simple routine for heart is a daily brisk walk of 4 kms (2.5 miles) or more; before breakfast, if feasible.
2. Make abdominal breathing normal to you [see treatise, *Self Care for Improving Lung Function & Breathing*]
3. Kapalbhati pranayama – gradually increase to 400 strokes. [see treatise, *Self Care for Improving Lung Function & Breathing*]
4. Meditation – 10 to 20 minutes
5. Diet - whole grains & legumes, vegetables, fruits. If you can: Eat Fresh, Eat Natural, Eat Seasonal, Eat Local [see treatise, *Obesity Implications Causes Solutions*]

Avoid or minimize

6. Smoking, medications, drugs, caffeine, alcohol, soft drinks.
7. Homogenized dairy

In moderation

8. Oils & fats
9. Sweets.
10. Salt

Details →

Heart & the Cardiovascular System

- According to World Health Organization (WHO), 17.9 million people died from CVD in 2016. This is 31% of all deaths globally. (*www..who.int/new-room*)
- CVD is now more prevalent in India and China than in all economically developed countries in the world combined. (www.americanheart.org)
- The emerging scenario: The risk of Coronary Artery Disease (CAD) in Indians is three to four times higher than in the White Americans and six times higher than in the Chinese and 20-times higher than in Japanese. Indians become prone as a community to CAD at a much younger age. Premature CAD is defined as heart attacks occurring below the age of 40 years. Indians also show a higher incidence of hospitalisation, morbidity and mortality than other ethnic groups. This global phenomenon of prematurity and severity suggests that the disease starts at an early age and has a malignant and progressive course.

– Dr. H.S. Rissam[1]

Uninterrupted flow of blood in the cardiovascular system delivers life-sustaining oxygen and the nutrients to the entire body tissues and removes wastes for eventual elimination. The unceasing pumping action of the heart in combination with an extensive network of vessels accomplishes this circulation of blood. Of all the body organs, therefore, the importance of heart is difficult to overstate.

It is therefore unfortunate that heart disease has assumed epidemic proportions around the globe. Cardiovascular disease, a term which covers a score of diseases include disease of the heart itself (coronary heart disease, CHD), coronary artery disease (CAD) and stroke (an impediment of blood flow to the brain due to blockage in an artery or rupture of an artery in the brain).

After a brief description of the anatomy and physiology of the cardiovascular system, this treatise looks at the causes of

disease, and narrates measures to reduce risk through lifestyle changes and easydo routines.

Components of the cardiovascular system

The cardiovascular system is comprised of three main components: blood, vessels, and the heart:

Blood – is the carrier fluid which circulates throughout the body distributing oxygen, nutrients, hormones (produced by endocrine or so-called ductless glands) etc., and carries away wastes and carbon dioxide for eventual disposal. Other vital functions performed by blood include pH (a measure of acidity and alkalinity discussed in the treatise *Useful Tips for Proper Digestion and Relief from Constipation*) balance and control of temperature. White blood corpuscles fight disease and overcome toxins. A self regulated mechanism induces clotting to prevent loss of body fluids should a break occur in any vessel carrying blood.

Blood vessels – A sixteen thousand kilometres long network of tubes from the very thin 0.01 millimetre to 2.5 centimetre thick is spread over the entire human body to circulate blood to all tissues. Two distinct types of vessels make up the cardiovascular system:

* Arteries : Arteries carry blood *away* from the heart towards the tissues and organs. The walls of the arteries are comparatively thick for they have to bear the brunt of pressure of the blood when it is pushed out by the powerful pumping action of the heart. The walls of arteries are elastic and constrict when the blood is not flowing.

Cardiovascular system does not directly interact with individual cells, for the cells need a very controlled environment to function properly. All body cells are, however, surrounded by a watery medium known as interstitial fluid (ISF). Exchange of nutrients & waste, oxygen & carbon dioxide, etc. takes

place between ISF and the extremely thin membrane like walls of the ultrafine arteries, called capillaries. After the exchange, the vessels containing waste and carbon dioxide-rich fluid take up the character of veins which carry blood back to the heart.

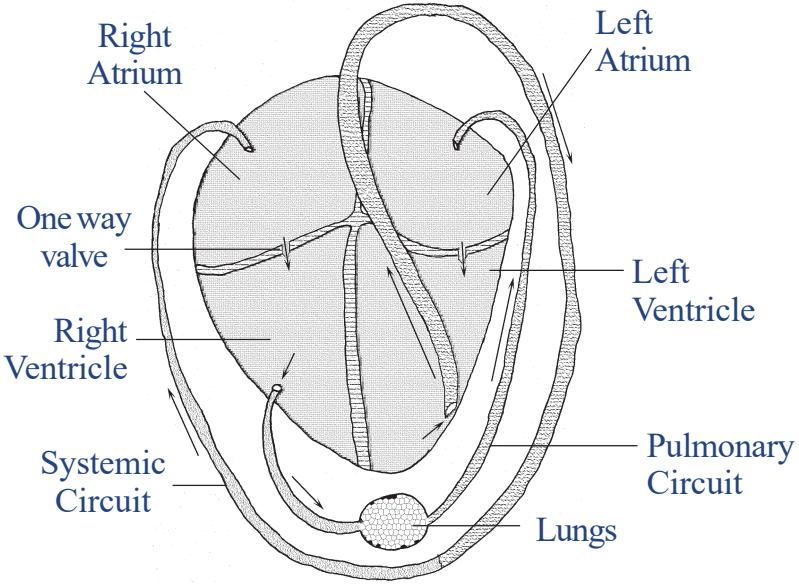
* VEINS : Veins generally run parallel to the nearby arteries and form that part of the loop which returns the blood from the tissues to the heart. By the time blood reaches the veins, the pressure within the vessels has decreased considerably. Against gravity, therefore, the flow of blood towards the heart becomes more difficult. For this reason, most veins are equipped with valves to facilitate one-way flow of blood. To diminish resistance to flow of blood, walls of the veins are thinner and wider.

Heart : The centre of the cardiovascular system is the heart. Typically beating 70-80 times a minute it circulates about 300 litres of blood every hour. Heart is made up of a special smooth muscle and is divided into four distinct chambers. The upper two are called atria (singular: atrium) and the lower two are known as ventricles. One way valves ensure flow of blood from atria to the ventricles. All four chambers of the heart are connected to other organs through sizable tubes equipped with unidirectional valves.

Blood movement to and from the heart

Cardiovascular system comprises of two distinct circuits. **PULMONARY CIRCUIT** refers to the flow of blood between heart and the lungs. Flow of blood between heart and other organs is referred to as the **SYSTEMIC CIRCUIT**. Not all chambers of the heart act at the same time. A full cycle of the pumping action of the heart comprises of the following:

1. Heart Relaxed – As a rubber bulb clamped on a tube, if squeezed and then relaxed, will suck up fluid, so does a relaxed heart muscle pull in blood from the veins. 'Purified' blood



from the pulmonary cycle (in which carbon dioxide of blood is replaced by oxygen in the lungs) is sucked into the left atrium. Impure blood from the rest of the body enters the right atrium. In this relaxed state, valves between atria and ventricles are open so that blood pours through, filling approximately 70% of each ventricle. This substantial filling in a passive phase has important implications for the long-term functioning and well-being of the heart.

2. Atria Contract – Muscles of the atria squeeze to force yet more blood into the respective ventricles.

3. Ventricles Contract – Squeezing of ventricles is the most forceful action of the cardiac muscle. Blood from the right ventricle is pushed into the PULMONARY CIRCUIT to be 'cleansed' by the lungs. 'Purified' blood in the left ventricle is forced into the SYSTEMIC CIRCUIT for distribution to the entire body.

4. Ventricles Relax – As soon as the ventricles start relaxing, they begin sucking the residual blood from the atria.

Then the entire heart relaxes, and the cycle begins again

with #1.

How can one keep the cardiovascular system otimally functional and healthy?

For an optimal performance, all three components of the cardiovascular system – heart, blood vessels particularly the arteries, and the blood – need to be in good shape.

Heart

1. **Stronger the heart, greater the pumping action**

The heart of a non-exercising but otherwise healthy adult weighs approximately 300 grams and beats about 80 times per minute. At 60 millilitre (mL) per beat, about 5 litres of blood are circulated through the system per minute.

With regular training the heart muscle can gain as much as 70%, that is the heart may now weigh 500 grams. This stronger heart is now capable of pumping something like 80+ mL per stroke. Since at rest, the same amount of blood, about 5 litres per minute, is to be circulated, the heart needs to beat only about 60 times to meet this target volume.

It is, of course, obvious that the training required for strengthening the heart muscle has to be aerobic. Please look up the chapter on exercise for a detailed discussion. Aerobic exercises don't have to be inordinately strenuous. Even vigorously aerobic activities can be simple and moderate: brisk walking, stair climbing, jumping rope, to give a few examples. What is crucial is a continuous workout of the cardiovascular system for 30 minutes daily. It is entirely relevant to mention here that in general no recreational team sport provides a nonstop workout for the heart.

All tissues degenerate with age, but keeping a heart healthy and strong will surely decrease the rate of deterioration.

2. Give your heart extra rest

Since the heart has to function nonstop from birth to death, lowering the number of beats per minute results in fractionally more rest for the heart muscle. Additional rest between the beats also provides time for more blood to pour from atria in to the ventricles. This results in a higher supply of blood per beat, for, the Frank-Starling Principle postulates that if more blood is available in the ventricles, more will be pumped out: that is "more in, more out" is the general rule.[2] As mentioned above, through sustained training, it is not difficult to reduce the heart rate to 60 beats or even less per minute. In view of the incessant working of the heart (some 3,000 million heart-beats in 70 years), this supplementary relaxation can also add years to the robustness of the heart muscle. And since each cardiac cycle expends energy, fewer beats result in conservation of energy as well. As far back as 1940, Drs. Raymond Pearl and W. Eden Moffet had reported results of a remarkable study to the United States National Academy of Sciences. They found that individuals whose heart rate was merely four beats lower lived on an average 26 years longer![3]

Rate of heart-beats can be reduced further by making abdominal breathing, the deepest of breathings, suffusing the blood with a higer content of oxygen, natural to you. Yogic pranayamas – kapaalbhaati and anulom vilom – can lead to a further lowering of heart rate. Please see the chapter, 'Lungs and the Respiratory System' for details about breathing and pranayama.

Meditation has been shown to calm and rest the heart by not only decreasing the metabolic rate but also helps one deal less stressfully with every day hassles and tension even in such mundane things as traffic jams, disagreeements at work & home, and other frustrations inherent in a far from perfect society. Please see the chapter, 'Subtle anatomy and health' later in the book for more on meditation.

3. Greater networking of blood supply to the heart

A great deal of cardiovascular disease is due to an impediment to the supply of blood to the heart muscle itself – a condition termed as coronary heart disease (CHD). Vigorously aerobic exercises, such as fast walking, jogging, running, bike riding, etc. can increase the demand for oxygen by the heart muscle several fold. Because this high demand can not be fulfilled with the normal pathways, the coronary artery fashions branching of a wider network of arteries and capillaries. This extended network can provide alternate pathways to supply blood to the heart in case of blockage. As a real life example, a cardiologist showed the author an actual photograph of a blocked main coronary artery in an individual who survived a serious heart attack in all likelihood only due to alternate networking of blood supply to his heart muscle formed during his regular aerobic exercise regimen.

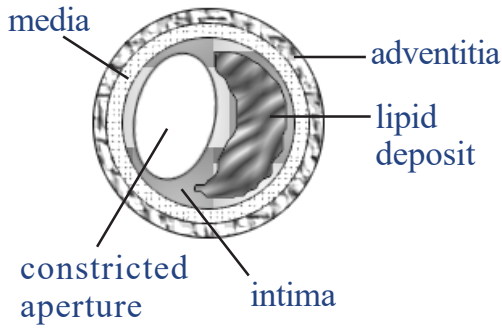
Blood Vessels

Blood vessels form a closed system for circulation of blood and are made up of three layers.

1. Adventitia, the outermost is formed of fibrous tissue.

2. Media, the middle, comprises of elastic muscle cells with ability to constrict and dilate.

3. Intima, the inner includes a lining of endothelial cells which are in direct contact with the circulating blood. These cells are of tremendous importance in the tasks of wound healing, fighting inflammation, blood clotting and immunity.



Walls of the arteries even though thicker are at greater risk of injury and damage as they

have to withstand the forceful pressure of blood pumped by the heart. Normal arteries are strong, elastic, and stretchy.

What kind of problems can develop witht the health of the arteries?

Hardening, arteriosclerosis, is the primary setback to the health of the arteries. Except for insignificant number of cases of calcification, the trouble most likely starts with injury or damage to the endothelial lining. This can happen due to relentless and forceful passing of blood over time. Or the damage may result from factors such as smoking, irritants from pollution, diabetes, excess alcohol or certain medications. Any irritant circulating in the blood can start the process of damage.

It is hypothesized that the damage begins with the attack of free radicals generated within the body predominantly during energy generation in the cells, but extraneous pollutants including smoking vastly augment the number of free radicals thereby swamping the normal defence of the endothelium. Initially streaks appear on the inner surface of the vessels. In an attempt to repair damage, platelets cluster at the site of injury. Progressively, fatty plaques made of cholesterol and other cellular waste products accumulate. Artery hardens, loses suppleness and stretchability, and becomes brittle. The aperture narrows, passage of blood is obstructed, and the heart has to apply higher pressure to maintain flow. The heart mucle gets stressed. The arterial wall may crack, impeding supply of blood to tissues and organs. Interruption of blood supply to brain may lead to stroke.

Endothelium damage and dysfunction has now been accepted as one of the most important markers of atherosclerosis (cardiovascular disease due to hardening of arteries). Since the 1990s, benefits of antioxidants – Beta-carotene, Lutein, Lycopene, Selenium, vitamin A, Vitamin C, Vitamin E – are being fiercely debated through numerous studies. Antioxidants

are supposed to neutralize free radicals, but some are reported to be harmful rather than beneficial. Vitamin C, however, in multiple studies was found to be of significant benefit in cases of endothelial dysfunction caused by smoking.

Given that pollution in Delhi is said to be equivalent to smoking 40 cigarettes a day and in other metropolitan areas may not be too far behind, it might be prudent to take 500 mg of Vitamin C per day as a supplement to minimize risk of damage to the endothelium.

Results of a six week yoga and meditation workshop at Yale University School of Medicine clearly demonstrated improved endothelial function – 17% in healthy normal volunteers, but a remarkable 70% in participants with cardiovascular disease. It is well known that practice of yogasanas (yogic postures) leads to significant improvement in body flexibility. Adepts are occasionally referred to as being pretzels while practicing yogic postures! This suppleness is naturally imparted to all body systems – bones, muscles, organs, blood vessels and lymphatics – and may be a significant factor in perpetuating the health of blood vessels. Deliberate stretching and contraction may also help dislodge adhering particulate matter and tiny blood clots from the vessels. Thus regular practice of yogic postures (see chapter on Yogasanas) should also lead to healthy blood vessels even in to the old age.

What is cholesterol?

Cholesterol is a fatty compound of the family of steroids. It is a constituent of all cell membranes in the body, and also forms part of several hormones. Unlike vitamins, the body can synthesize all the cholesterol it needs. Any intake of dietary cholesterol reduces its manufacture inside the liver. A spirited debate is presently going on in the scientific community regarding the role of cholesterol levels circulating in the blood. Normally accepted conventional wisdom claims that high choles-

terol levels induce a high incidence of cardiovascular disease by promoting deposit of cholesterol on the inner surface of the arteries. But a significant and respected community of scientists contends that irritants of various kinds, known or unknown, are responsible for hardening of the arteries and the resultant threat to health. They further allege that far from being a detriment, high cholesterol actually retards the onset of infectious disease and reduces mortality in 60+ individuals most prone to arteriosclerosis[Please see www.westonaprice.org/moderndiseases/benefits.cholest for a detailed treatment of this lesser publisized scenario].

Even so, one ought to be prudent and consume fats in moderate amounts. There is certainly no harm in consuming natural unsaturated fats rather than the highly processed saturated variety.

What is blood pressure?

Blood pressure is force of the blood pushing against the arterial wall. The scale used for describing blood pressure is the same as for the atmospheric pressure – in terms of millimeters of mercury pushed up a column. One atmospheric pressure at sea level is 760 mm Hg (that is, mercury rises to a height of 760 millimetres). Blood pressure is denoted by two numbers. Normal reading for blood pressure of an adult is considered to be below 120/80. The upper number, systole, is the force exerted when the heart pumps blood in to the arteries. Lower number, diastole, represents the pressure in the arteries when the heart is at rest. It is now recognized that both numbers are important in diagnosis of the health of the cardiovascular system.

	Systolic pressure	Diastolic pressure
Normal	below 120	below 80
Prehypertension	120-139	80-89
Hypertension	140-159	90-99
Serious Hypertension	160 and above	100 and above

What are the implications of high blood pressure?

High blood pressure or hypertension is now referred to as the 'silent killer' because it usually has no symptoms. And yet it can lead to such grievous conditions as:

* An enlarged heart, causing heart failure. Half of new heart attack cases suffer from hypertension.

* Aneurysms (bulges) in the blood vessels, which can burst. Bursting arteries cause damage in two ways - one, the spilled blood can damage tissues, paricularly in the brain; two, the supply of blood to the organ(s) and tissues is reduced. Hypertension is implicated in 2/3 of new stroke cases.

* Arteries harden faster throughout the body, especially those supplying blood to the heart, brain, kidney, and legs increasing risk of heart failure, stroke, kidney failure, or amputation of part of the leg.

* Blood vessels in the eye may rupture causing deterioration of vision or blindness.

Blood

For blood to carry out its function optimally, the efficacy of its constituent parts is naturally important. Blood consists of liquid plasma and 3 types of cells:

1. White blood cells (WBC) – Normal count of WBC is taken to be 4,500-10,000 cells per microlitre (1,000 microlitre equal one millilitre) of blood. Infections; medicines such as antibiotics, corticosteroids and antiseizure drugs, or medications used in chemotherapy; and severe physical or emotional stress are implicated in under or over- production of WBCs, naturally harmful for the health.

2. Platelets (thrombocytes) are colourless cells which clump together to form plugs (clots) at the site of injury to blood vessels. Their normal count is 150,000 to 450,000 cells per microlitre of blood. Significantly reduced count may result from

under production or increased breakdown of platelets. Chemotherapy drugs, certain medications like heparin, quinidine, quinine, sulfa-antibiotics, oral diabetic drugs, gold salts, rifampin, aspirin, viral infections, and heavy consumption of alcohol can lead to a significantly lower count of platelets which can be dangerous to health. Vitamin K is essential for coagulation of blood. It is partly synthesized in the intestines. Whole grains and vegetables are rich dietary sources of Vitamin K.

3. Red blood cells (RBC, erythrocytes) – transport oxygen from lungs to tissues and carbon dioxide from tissues to lungs. A steady supply of Iron, Vitamins B-12, B-9 (folate), and C from diet are essential for an adequate production of healthy RBCs. Deficiency of iron intake or insuffcient vitamin C necessary for absorption of iron, may give rise to anemia. Iron rich foods include beans, lentils, dry fruits, nuts, seeds, and leafy vegetables. For effective iron intake, cooking in cast iron pots *used to be* a standard feature in Indian homes. It is now recommended even by the StudentBMJ, an International Journal for medical students published by the prestigious British Medical Journal. B vitamins are readily available from whole grains, whole unprocessed foods, dairy, eggs, meat. Citrus fruits, leafy vegetables, and legumes. Vitamni C is abundant in amla and reasonably so in citrus fruits, potatos, guava, etc.

Smoking and alcohol can retard absorption of vitamins and contribute to vitamin deficiency anemia.

Are there other factors implicated in cardiovascular dysfuntion?

Oh yes, several others are important. **Heredity** is one. Certainly, people with a family history are at greater risk of heart disease. But genes have become a catchword over the past few decades. Many individuals make it an excuse for not willing to take trouble to change their lifestyle. But the fact of the matter is that genes only induce a somewhat higher sus-

ceptibility to a condition and do not necessarily express during one's lifetime. Actually, a family history of a hereditary disease could even be turned into a blessing in disguise, for one is forewarned and can take suitable measures to preclude its expression. "For example, hypertension may be prevented or reduced by controlling diet and fluid volume, and coronary artery disease may be prevented by lowering serum cholesterol concentrations [in genetically susceptible individuals]" affirms a respected medical text.[4] Regular exercise in conjunction with proper diet can certainly lead to a disease-free heart.

But there are indications of another menace that has so far escaped attention of the orthodox medical science: the process of homogenization of milk!

What is homogenization? How does it affect the heart?

Besides pasteurization, the milk in the USA and increasingly elsewhere is also homogenized. According to Encyclopedia Britannica, 'homogenization is a process of reducing a substance, such as the fat globule in milk, to extremely small particles, e.g. milk'. In homogenized milk the cream does not rise to the top as happens with raw milk. The process involves forcing the milk through tiny apertures under high pressure.[5]

Apparently there is an enzyme, xanthine oxidase (XO), in the globs of milk fat. Drs. Kurt A. Oster and Donald J. Ross pointed out that XO is normally present in liver only and its function is to destroy plasmalogen, a constituent of cells. Homogenization makes it possible for XO to enter blood stream, where it carries out its natural function of attacking plasmalogen in heart muscle cells and destroying inner lining of arteries. Homogenization was first introduced in 1932, and it is claimed that there is a good correlation between consumption of homogenized dairy and hardening of the arteries (atherosclerosis) in the USA.

Many others refute this theory including the American Heart Association and the health agencies of the United States government. For the interested reader, a few websites are mentioned at the end of references under the title, 'The Homogenization Controversy'.

But very recently some scientists appear to be very enthused about a potential new class of drugs that may be efficacious for heart disease based on XO inhibitors, that is destroying xanthine oxidase in the body may reduce incidence or severity of heart disease.

In India, milk is generally boiled and then consumed. A good proportion of xanthine oxidase is likely to be destroyed by high temperatures. However, there is another danger from homogenized milk – enhanced absorption of fat. During homogenization, fat globules are pulverized in to extremely fine colloidal particles, as mentioned above, which get absorbed from the digestive system, but most fat from unpulverized globules does not get assimilated. This may mean that more fat from 1% homogenized milk gets absorbed than from whole raw milk containing 3.5% fat! That may be one of the reasons for the tremendous increase of obesity in the United States and other predominantly homogenized-milk-drinking countries.

In any case, since the only purpose of homogenization is to increase shelf life, why not be prudent and avoid homogenized dairy until it is proven to be safe for the heart?

Reversal of Decay

One of the first indications of the disease of heart mucle itself is an inability to pump adequate amounts of blood to the tissues and organs. The cause is a weak squeezing stroke of the left ventricle. Whereas deaths from heart attack and stroke are declining in USA, the incidence of congestive heart failure (CHF), as the weaker ventricle stroke is called, and fatalaties

from CHF are increasing. The symptom which generally leads to its detection is dispnea (shortness of breath) during exercise escalating to dispnea at rest. CHF may develop due to diseases of coronary artery and heart valve, or weakening of heart muscle, or hypertension. Severity of CHF may determine the need for heart transplant. CHF patients in earlier times were advised rest. Since the 1990s, a number of clinical studies have revealed the benefits of controlled exercise so much that *The Committee on Exercise, Rehabilitation, and Prevention of the American Heart Association Council on Clinical Cardiology* were led to advise the insurers and other third-party payers of medical costs to promote exercise training programs for CHF patients (*Circulation* 2003; 107:1210).

A major consequence of CHF has been uncovered as respiratory dysfunction due to weakening of respiratory muscles (F. Joachim Meyer, MD, *Circulation.* 2001;103:2153). Many clinical studies with CHF patients have been carried out in which inspirational muscle training (IMT) succeeded in improving functional performance and lessening dsypnea (Laoutaris I, et al, *Eur J Cardiovasc Prev Rehabil.* 2004 Dec;11(6):489-96; Jerome L. Fleg, MD, FACC, FAHA, *J Am Coll Cardiol*, 2008; 51:1672-1674). Deliberately slowing down respiratory rate to some 6 breaths from a normal average of 12-15 breaths per minute as a regimen for some weeks also was reported to alleviate shortness of breath, improved gas exchange in the lungs and increased exercise performance (Luciano Bernardi, MD, et al, *The Lancet*, 351 (9112) 1308 - 1311, 2 May 1998).

A few salient points emerge from the above clinical research. That, even after chronic heart disease has manifested, practice of a judicious regimen may not only halt the progress of disease but might even reverse the decay. Much can be accomplished by enhancing respiratory efficiency. An efficient respiratory system should lead to a decrease in number of breaths per minute. The heart rate also lessens as higher oxy-

gen saturation is achieved with enhanced contact for gas exchange. Both of these will entail a significant saving of energy and stress. And if higher amounts of oxygen can be made available without placing increased stress on the body, the system may respond by repairing the damaged tissues.

Yogic breathing exercises (as the Indian practices, *pranayama* are generally understood) selectively deal with clearing air passageways, respiratory muscle training, and eventually enhancing oxygen intake at rest. As detailed in the treatise, *Self Care for Improving Lung Function & Breathing*, yogic breathing can be made spontaneous by regular practice over some months. Some other *pranayamas* – forced anulom vilom, bhastrika, and kapaalbhaati – helpful for alleviating the condition of CHF are also described therein. Under expert supervision with gradual increase in the time and frequency, they should go a long way in halting and reversing the disease. As dyspnea decreases, leisurely walks can be undertaken gradually leading to brisk walking. With perseverance it is not inconceivable that milder forms of CHF may altogether disappear and more severe forms of CHF may become manageable.

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Aspiration

विश्वं पुष्टं ग्रामे अस्मिन्ननातुरम्।।

– *Yajurveda* 16:48

In this village [global village],
may all sentient beings be robust and healthy