Chapter - I

INTRODUCTION

Sports today have become completely performance oriented. Participation in the competition in the spirit of Olympic motto of the bygone era now. What matters is absolute success.

In this endeavour for successful performance in sports, scientists, policy makers and sponsors all have directed their efforts, resources, research, towards performance enhancement.

Modern scientists have undoubtedly contributed in this direction. Performance in sports have reached to a level which earlier was thought to be impossible. Yet sport scientists are in continuous pursuit to find out new approaches to training, developing new techniques, designing better equipment, sports diet, performance enhancing drugs, physical and physiological performance, factor identification and enhancement of their capabilities etc.

Scientists today don't want to leave anything that might in any way contribute to sports performances or understand human capabilities.

Indian yogic approach to understand human body functioning system does provide an interesting and thought provoking field in this relevance.
Ancient yogis have long back understood the act of breathing, the most basic survival body functioning that follows a typical breathing mechanism of air passage.

The most prominent organ in this system is nostril passes: Yogis have long back observed that airflow through two nostrils throughout a day is not of uniform pattern. It fluctuates between left nostril dominance or right nostril dominance or both nostril dominance. Indian yogis have also long back understood causes of this typical air passes mechanism and could manipulate it with yogic exercises.

Our ancient history narrates the source of almost all human potential belongs to active life style which is recently identified as "Physical Education". At the eve of freedom of India our education system has launched a tremendous thrust to popularize physical education in India. As a result of long practice and deep-rooted benefits, this subject has been included as a subject in Indian school education. Even, the subject of physical education has also been included for the graduate and post-graduate studies in territory level of Indian education system. Physical education encourages the activities of sports and games in an organized way for enjoyment and simultaneously discourages the unhealthy competitions. This essence of physical education not only restricts the human beings from unhealthy competitive life, but also prevents the society from the unhealthy sufferings.
However, in comparison with the other developed countries, in India, the subject physical education is thought to be at the child stage. In fact, sophisticated research is one of the means for proper growth of physical education in any country and on the basis of this, as we see, other countries get prestige on an international platform of competitive sports. Through research, physical education can be identified as a process for smoothly connecting the teachers, coaches and players in a coordinated way. This, of course, must facilitate the development of physical education in India.

As the relationships between physical activity and health are numerous and complex, United States of America, a leading country for the consciousness of health and fitness, has recently released "Healthy People 2000: National Health Promotion and Disease Objectives" (US -1990)\(^1\) The three broad national goals of "Healthy People 2000" are as follows:

1) increase the span of healthy life,

2) reduce health disparities, and

3) achieve access to preventive service.

To achieve the above mentioned goals, priority has been centered to physical education which covers the major aspects of

physical activity and fitness. Increasing evidence suggests light to moderate physical activity, below the level recommended for cardio respiratory fitness, can have significant health benefits, including a decreased risk of cardiovascular disease (Leon, Connett, Jacobs & Raurama, 1987)² (Sallis, Haskell, Fortmann, Wood & Vranizan 1986)³. These reports, in turn, reveal that physical education professionals can make substantial contribution for improvement of cardiovascular efficiency not only in general public but also in sportsmen.

Even though India is a densely populated country with tremendous resources simultaneously various Indian sports scientists are involved with different research projects related to enhancement of games and sports, the counting of gold medals is negligible for Indian athletes in different international competitions. Such unfortunate incidences are happening repeatedly even in the history of the Olympic games at Sydney in 2000. Our track and field athletes could not even get success at such level of competitions.

To locate the site of our faults and shortcomings is a subject of long debate. In fact, it is a challengeable issue and a subject of sincere research which is an essential part in the development of games and sports in India. For this, Physical Education cannot be held

responsible, because the aim of it is not to win gold medals, but to encourage mass participation in physical activities in acquiring a good level of health related fitness for peaceful living.

India is a nation of cultural heritage. There is unity even though diversity exists in our innate potentials. Therefore, sports training for our Indian athletes may need a holistic approach. The human being is a psychosomatic unit. There is no mind-body separation. The mind influences the body and vice versa. Athletes are no exception to this rule. A holistic approach is required for both when aiming at top competitive results as well as when seeking a greater sense of well-being and deeper unity of body, mind and spirit.

Although conceptually as well as logically we prove the concept that inclusion of holistic approach in sports training schedule is beneficial for athletes for exhibiting top performance, our literature of physical education and sports and allied sciences have are failed to provide the real experimental evidence. Therefore, it was thought desirable to undertake this research project to highlight the significance of holistic approach in the area of games and sports.

Life is absolutely depends upon the act of breathing. Breathing may be considered as the most important of all the functions of the body, for, indeed, all the other functions depend upon it. Man may exist some times without eating; a shorter time without drinking; but
without breathing his existence may be measured by a few minutes. Breathing is natural but correct habits of breathing provide a continued vitality and freedom from disease. An intelligent control of our breathing power helps to lengthen our days upon the earth by giving us increased vitality and powers of resistance.

We breathe day and night even during sleep. Breathing pattern changes generally after every hour (approx.) from right nostril to left nostril or vice-versa. When flow of breathing is more through right nostril, we call it right nostril dominated; whereas if the flow of breathing is more through left nostril, we call it left nostril dominated.

Our life activities are governed by the cyclic patterns in the natural breathing, even though we may not be aware of them. Some schools of Yoga seem to have given importance to cyclic breathing through the nostrils. In recent years there has been a growing interest among the scientists regarding the significance of two nostrils. They have also recognized the importance of uni-nostril breathing patterns for physiological functions.

Similarly, if the flow of breathing is equal (approx.) through both the nostrils, we call it both nostrils dominated.

As man has acquired contracted improper methods and attitudes of walking, standing and sitting, which have robbed him of his birthright of natural and correct breathing. He has paid a high price for
civilization. The savage, today, breathes naturally, unless he has been contaminated by the habits of civilized man. The percentage of civilized man who breathe correctly is quite small, and the result is shown in contracted chests and stooping shoulders, and the terrible increase in diseases of the respiratory organs, including that dread monster, consumption, "the white scourge" (Rama et. al., 1981)\(^4\).

The Occidental technique show that the physical health depends upon correct breathing. In addition to physical benefit derived from correct habits of breathing, man's mental power, happiness, self-control, clear-sightedness, morals, and even his spiritual growth may be increased by an understanding of the "Science of Breath".

The organs of respiration consist of the lungs and the air passages leading to them. The lungs are two in number and occupy the pleural chamber of the thorax, one on each side of the median line, being separated from each other by the heart, the greater blood vessels and the larger air tubes. Each lung is free in all direction, except at the root, which consists chiefly of the bronchi, arteries and veins connecting the lungs with the trachea and heart. The lungs are spongy and porous, and their tissues are very elastic. They are covered with a delicately constructed but strong sac, known as the pleural sac. One wall of pleural sac closely adheres to the lung, and

---

the other the inner wall of the chest, and that secretes a fluid which allows the inner surfaces of the walls to glide easily upon each other in the act of breathing.

The air passages consist of the interior of the nose, pharynx, windpipe or trachea, and the bronchial tubes. When we breathe, we draw in the air through the nose. The air is drawn into the lungs by the action of the diaphragm, a great, strong, flat, sheet-like muscle, stretched across the chest, separating the chest-box from the abdomen.

The blood starts on its arterial journey, bright red and rich with oxygen, laden with life-giving qualities and properties. It returns by the venous route with the waste matter of the circular system. The foul stream goes to the right auricle of the heart which in turn sends it on to the lungs. The foul stream of blood is now distributed among the millions of tiny air cells in the lungs. A breath of air is inhaled and the oxygen of the air comes in contact with the impure blood through the thin walls of the capillary bed, where the CO₂ is forced out. The blood thus purified oxygenated is carried to the left auricle, then to the left ventricle and to all parts of the body.

It is true that unless fresh air in sufficient quantities reaches to the lungs, the foul stream of venous blood cannot be purified. Consequently, not only is the body deprived from nourishment, but the
waste products that should have been destroyed are returned to the
circulation and ultimately poison the system and may cause death.
This, in fact, is an improper breathing which signifies domination of
deoxygenated blood in body, imperfect elimination may lead to ill
health. In perfect breathing shallows respiration shows that only a
portion of the lung cells are brought into play, and a great portion of the
lung capacity is lost. On the other hand, in proper breathing, the blood
is not properly exposed in the lungs and invigorates as well as does
not strengthen, replacing the worn-out cells and tissue by oxygenated
blood which nature converts to use it.

The physiological phase, as described above, is considered as
exoteric (or external), whereas esoteric phase considers the internal,
both the principles are as found in our ancient teaching and
philosophy. In order to avoid misconceptions arising from the various
theories, bringing the concept of “Prana” (the Sanskrit term meaning
Absolute Energy, the universal principle) is justified. The Prana i.e.,
vital force, is evident in all living entity. It is found in all forms of life,
from most elementary form of plant life to the highest form of animal
life. It is the only aspect which can differentiates the lifeless things from
living beings. In fact, Prana is every where in every living thing.

Prana is the name by which we designate a universal principle
which is the essence of all motion, force or energy, whether manifested
in gravitation, electricity, the revolution of the planets, and all forms of life, from the highest to the lowest.

In ordinary breathing we absorb and extract a normal supply of Prana, but by controlled and regulated breathing (generally known as Yogic breathing) we are enabled to extract a greater supply which is stored away in the brain and nerve centers, to be used when necessary. We may store Prana, just as the storage battery. The many powers attributed to advanced occultists are due largely to their knowledge of this fact and their intelligent use of this stored-up energy. It is well known in Yoga that by certain forms of breathing the practitioners establish certain relations with the supply of Prana and may draw on the same for what they require. Not, only, do they strengthen all parts of their body in this way, but the brain itself may draw more increased energy from the same source and latent faculties be developed and psychic powers attained. One who has mastered the science of storing away Prana, either consciously or unconsciously, often radiates vitality and strength which is felt by those coming in contact with such individual and may also impart this strength to others, and give them increased vitality and health.

The importance of the breath can be better appreciated by observing some of the mind's properties, for the mind tends to assume that apparently constant, or slowly changing features of the environment, or body are constant, therefore, filters many of these
events out of conscious awareness in order to avoid a confusing barrier of sensations. This allows to focus on the more significant changes in life that may be required for survival or other basic needs. In other words, a new pattern of thought or a new activity initially attracts much conscious attention, but with frequent repetition it becomes unconscious and habitual (Ballentine, 1981). For example, walking is effortless for any adult, it occurs on an unconscious level and requires little effort or no conscious attention (although the conscious mind can easily intervene if necessary). However, the process of integrating the movements of walking into the mind take place only after years of trial and error throughout the childhood. Only then it becomes a habit and operate effectively on an unconscious level.

The internal organs (e.g. heart, kidney, liver) respond in a similar manner. Biofeedback research has shown that some of the physiological activities of these organs, previously labeled involuntary, can be consciously controlled with training. In most people, however, these activities are unconscious, and much practice is necessary in order to be efficient in its conscious control. This is in contrast to the voluntary muscles that are more easily controlled on a conscious level.

Breathing is unique as a physiological function, as it lies midway between the internal organs and the voluntary muscles with which it

---

can be consciously controlled. For example, depending upon one's proficiency in dealing with the breath, the rate and depth of breathing can be altered, but involuntary reflex activity limits the degree to which this can occur. These reflexes act as safeguard to prevent overextension of one's capacity. They are especially important in connection with breathing, since the flow of breath is essential to life, and the need to breathe is one of the most fundamental survival instincts. This in part reflects the key role played by oxygen in metabolism (for the process of supplying energy to the body), for without oxygen the body cannot convert food into usable energy.

Modern science has come to understand many of the principles involved in the physical aspect of breathing, from the muscles and organs, which transport oxygen into and throughout the body down to the molecular reactions of metabolism. However, the purely intellectual appeal of these complex physiological systems has limited the scientific community's concept of the breath to the physical level only, even though the most casual reflection indicates that the significance of breath extends beyond its purely metabolic functions. For example, experts suggest that there is a relationship between emotions and breath, for most emotional states especially if they are intense, appear to be associated with changes in breathing. The sob of grief and the trembling breath of anger are common examples that reflect this
interconnection. In addition, physical stimuli such as pain and exercise can act to change both the breath and the emotional state.

According to Yogic principles, respiration has been classified into the following methods:

I) High Breathing
II) Mid Breathing
III) Low Breathing
IV) Yogic Breathing
V) Pranayamic Breathing

1) **High Breathing**: This form of breathing is, physiologically, known as Clavicular Breathing or Collarbone Breathing. Breathing in this way elevates the ribs and raises the collar bone and shoulders, at the same time drawing in the abdomen and pushing its contents up against the diaphragm. Through this type of breathing a minimum amount of air enters in the lungs.

High breathing is probably the worst form of breathing known to man and requires the greatest expenditure of energy with the smallest amount of benefit. It is an energy-wasting, poor-returns plan.

2) **Mid Breathing**: This method of respiration is known as rib breathing or inter costal breathing, and is found less objectionable than High Breathing. Here the diaphragm is pushed upward, and the
abdomen drawn in. The ribs are raised somewhat, and the chest is partially expanded.

3) **Low Breathing**: This form of respiration is far better than either of the two proceeding forms, and of recent years many scientists have explored its merits, and called it abdomen breathing, deep breathing, diaphragmic breathing etc.

4) **Yogic Breathing**: In Yogic terminology complete breath includes all the good points of high breathing, mid breathing and low breathing, which have been practiced by many rishis and munis. It brings into play the entire respiratory apparatus, every part of the lungs, every cell, and muscle of the respiratory organism. The entire respiratory organism responds to this method of breathing, and the maximum amount of benefit is derived from the minimum expenditure of energy, and the chest cavity is increased to its normal limits in all directions and every part of the machinery performs its natural work and functions. All the respiratory muscles are called into play. Intercostals muscles of the ribs help to increase the space in which the lungs may expand to the fullest. Certain muscles hold the lower ribs firmly in position, while other muscles bend them outward. The diaphragm is under perfect control and is able to perform its functions properly to the maximum degree of service. As a result, the diaphragm controls the function of the lower ribs and draws them slightly downward, while other muscles hold them in place and the inter-costal
muscles force them outward in which a combined action increases the mid-chest cavity to its maximum. In addition to this muscular action, the upper ribs are also lifted and forced outward by the intercostals muscles, which increases the capacity of the upper chest to its fullest extent. This method has reciprocal advantages and it is known as superior method of breathing.

5) Pranayamic Breathing: From the description of Puraka, Kumbhaka and Rechaka, one can clearly understand all the salient features of the techniques of basic pattern of pranayamic breathing. We can briefly summarize it as follows:-

The main important features of Pranayamic breathing includes:

1. Deep and excessively slow inhalation and more slow exhalation, intervened with the phase of inner retention of breath.

2. Full conscious control at every stage, and

3. Maintenance of increased internal pressure with the help of Bandhas, as well as,

4. Heightened awareness of all the internal sensations associated with this act of breathing.
The excessive prolongation of Puraka and Rechaka is brought about mainly by two 'maneuvers.' One involves the active control, exercised over the muscles of the chest, thoracic diaphragm, abdomen and pelvic diaphragm. The second one involves the creation of finally controlled, resistance, to the air-flow at three points of the air passage:

a) At the entry point—by closing one nostril as in the practice of Anuloma-Viloma or Suryabhedana Pranayama;

b) At the junction of nasopharynx and oropharynx by tightening the free border of the soft palate as in the practice of Bhramari Pranayama; and

c) At the level of vocal — by partial closure of the glottis as in Ujjayi Pranayama.

Many of the diseases to which civilized man is subject to are undoubtedly caused by this common habit of mouth breathing. Many persons who, for the sake of appearances, keep their mouth closed during the day, persist in mouth-breathing at night and are often prone to diseases in this way. Carefully conducted scientific experiments have shown that soldiers and sailors who sleep with their mouths open are much more liable to contract contagious diseases than those who breathe properly though the nostrils. As an instance is related in which small-pox became epidemic on a man-of-war in foreign parts, and every death which resulted with that of some sailor of marine who was
a mouth breather, not a single nostril-breather succumbing. In fact, no animal except human sleeps with the mouth open or breathes through the mouth.

The organs of respiration have their only protective apparatus, filter, or dust-catcher, in the nostrils. When the breath is taken through the mouth, there is nothing from mouth to lungs to strain the air, or to catch the dust and other foreign matter of germs in the air. From mouth to lungs the dirt or impure substance has a clear track, and the entire respiratory system is unprotected. And, moreover, such incorrect breathing admits cold air to the organs, thereby injuring them. Inflammation of the respiratory organs often results from the inhalation of cold air through the mouth. The person who breathes through the mouth at night, always awakens with a parched feeling in the mouth and a dryness in the throat. He is violating one of the nature’s laws, and is sowing the seeds of disease.

On the other hand, the nostrils and nasal passages show evidence of the careful design of nature in this respect. The nostrils are two narrow, tortuous channels, containing numerous bristly hairs which serve the purpose of a filter or sieve to strain the air of its impurities etc, which are expelled when the breath is exhaled. Not only do the nostrils serve this important purpose, but they also perform an important function in warming the air inhaled. The long narrow winding nostrils are filled with warm mucous membrane, which coming in
contact with the inhaled air warms it so that it can do no damage to the
delicate organs of the throat, or to the lungs.

Another feature of mouth-breathing is that the nasal passage,
being thus comparatively unused, consequently fail to keep
themselves clean and clear, and become clogged up and unclean and
are apt to contract local diseases. One, who habitually breathes
through the nostrils, is not likely to be troubled with clogged or stuffy
nostrils. But for the benefit of those who have been more or less
addicted to the unnatural mouth-breathing and those who acquire the
natural and rational method, it may perhaps be well to add a few words
regarding the way to keep their nostrils clean and free from impurities.

Neuro-physiologists have found that inhalation not only
stimulates the olfactory nerve when the air contains substances that
can be sensed with the sense of smell, it also triggers neuronal
messages in the olfactory nerve even when the air is clean (Wallance
& Benson, 1972)\(^6\); (Wenger & Bagchi; 1961)\(^7\). Why this occurs is not
known. It is known, however, that the olfactory nerve and the part of
the brain that it reaches it is integrally connected to the limbic system,
that part of the central nervous system which subserves emotional
states. We all know that order are closely connected to emotions, a

\(^6\) R.K. Wallance, & H. Benson, (1972), The Physiology of Mediation, Scientific
American, 226, 2, 12-34.
\(^7\) M.A. Wenger, & B.K. Bagchi, (1961), Studies of Autonomic Functions in Practitioners
of Yoga in India, Behavioural Science, 6, 312-323
fact which is put into practice every time a bit of perfume is dabbed behind the ears. To discover, however, that the same brain structures may be brought into play simply through the movement of air is intriguing.

The breath has, then, a profound effect on man's physical and psychological functioning, since it is the link between the body and mind. The nose, therefore, as the major portal of breath into the body, interacting with both the external and internal environment, changing its activity to meet the body's energy demands from moment to moment, and an awareness of the functioning of the nose lends an added dimension to both psychological and physiological self-awareness.

Modern scientists give importance to breathing exercises only from the viewpoint of oxygen intake and their concern with the absorption of oxygen in large amount of quantities to vitalize the nervous system (Wallance & Benson, 1972)\(^6\), (Wenger & Bagchi, 1961)\(^9\). But experimental evidences indicates the opposite view i.e., breathing related to pranayama accumulates more oxygen in the body. The ancient manuals of Yoga anatomy, for instance, describe a network of several thousand nadis or channels, through which the

\(^{6}\) Wallance et. al., Ibid, p. 33.  
\(^{9}\) Wenger, et. al., Ibid, p. 322.
currents of Prana flow, energizing and sustaining all parts to the body as well as the several thousand Nadis.

The words Nadis, channels and vehicles are meant to explain one and the same force which is called pranic force. According to some manuals the number of nadis 72,000 (other manuals talk about 350,000 nadiṣ). Fourteen are more important than the others, but the most important among these are six: ida, pingala, sushumna, brahmani, chitrani, and vijnana. Among these six, three are the most important: pingala (surya) which flows through the right nostril, ida (chandra) which flows through the left nostril; sushumna which is a moment when both nostrils flow freely without any obstruction. Expansion of that moment is called sandiya, and for meditation the application of sushumna nadiṣ is of prime importance.

All three of the major nadiṣ originate at the base of the spine and travel upwards. The sushumna nadiṣ centrally located and travels along the spinal canal. At the level of the larynx it divides into an anterior portion and a posterior portion, both of which terminate in the brahma mudra, or Cavity of Brahma, which corresponds to the ventricular cavity in the physical body. The ida and pingala nadiṣ also travel upwards along the spinal column, but they crisscross each other and the sushumna before terminating in the left and right nostrils, respectively.
The junction of ida, pingala and sushumna along the spinal column is called Chakras (viz., muladhara: at the base of the spine at the level of the pelvic plexus in the physical body; swadhisthana: at the level of the hypogastricplexus; vishuddha: at the level of the pharangeal plexus; ajna: at the level of the nasociliary plexus: and sahasrara: at the top of the head.

Scientists have made many attempts to identify the nadis with what we know of modern anatomy, but they have not been able to do so. Yoga anatomy and physiology, however, is very clear and accurate to those who systematically practice and study the science of yoga, and they find that it reveals more about internal functioning of human body than any modern scientific experiment or explanation. Some scientists have tried to establish a correspondence between the two systems. But the assumption behind such an attempt is that the nerves and plexuses belong to what is known as yoga science as the subtle body. The currents of Prana flowing through these nadis are the subtle counterparts of the nerve impulses.

In sports, breathing or respiration control is an important factor which insures optimum motor actions. The ability to maintain pace or tempo of an exercise during competition is impossible without the requisite level of controlled respiration. Moreover, as a result of controlled respiration a good level of endurance also enhances high quality of performance or skill of movement which finds excellent
expression and accuracy in rhythm, consistency etc. among athletes. It is generally observed that sportsmen tend to lose motor coordination, concentration and mental alertness etc. under the condition of fatigue. This clearly indicates the importance of controlled breathing or respiration for the athletes participating in various games and sports even in track and field.

Training in respiration, which involves aerobic, anaerobic or both, results in the improvement of functioning of various organs and systems of the human body. This training in turn improves the ability to recover quickly from the load of competition. Moreover, such training enables the sportsmen to resist the onset of fatigue/ or to delay the fatigue. The tenacity to withstand against fatigue and to recover faster from fatigue require higher training load, adaptation and appropriate training strategies.

It has, thus, become clear that overall fitness can be improved by sophisticated sports training along with the holistic approach of breathing control. Some related research reports have revealed that Yoga, an Indian traditional science, has better significance for improvement of physical fitness level (Bera & Rajapurkar, 1983)\textsuperscript{10}.

(Ganguly, 1981)\textsuperscript{11}; (Gharote, 1973)\textsuperscript{12}; (Gharote, 1976 a)\textsuperscript{13}, (Gharote 1976 b)\textsuperscript{14}. These studies have been conducted on various age groups and sex groups belonging to common people. Although, the efficacy of Yoga practices on health and fitness of common people is established, the relationship of nostril or nostril dominance on health and fitness for sportsmen is not known so far. No research publication, in fact is available to implicate the direct impact of Nostril dominance on performance enhancement of track and field athletes. More specifically, no attempt has been made in this direction till-to-date to see the relationship between nostril dominance and physical performance in track field athletes.

The above concepts clarify that nostril breathing training (nostril dominance) may prove as a very important factor, even for a track and field athlete to exhibit top performance with greater success.

Psychological preparation can be divided into two types: general and specific. The tasks of general psychological preparation are to develop basic mental skills such as goal setting, relaxation techniques, concentration, and visualization (also useful for non-athletes seeking general well-being and a deeper mind-body-spirit union). Specific

\textsuperscript{13} M.L. Gharote, (1976 a), Effect of Short Term Yogic Training Programme on the Physical Fitness of School Boys, \textit{Avagahan}, 1, 1, 9-15.
\textsuperscript{14} M.S. Gharote, (1976 b), Physical Fitness in Relation to the Practice of Selected Yogic Exercises, \textit{Yoga-Mimansa}, 18, 1, 14-23.
psychological preparation keeps the athlete ready for the upcoming competition. The ultimate goal of psychological preparation is self-mastery: control of emotions and control of the mind. This goal is achieved through several steps contributed by the discipline of Yoga. In order to control body and mind, an athlete must first understand them. Self-Knowledge is gained through self-study and self-observation. An athlete must learn to listen to his/her body, learn own body language, and understand his/own mind and how it works. The necessary basic steps towards self-mastery are: body awareness (body control) breath, attention focus (self-discipline), and concentration. Through these an athlete can experience the remarkable benefits of Yoga that enhances the autonomic or unconscious body functions (Kogler, 1999). Yoga postures consider the following :-

- Supplemental Exercises for Supplemental Training;
- Compensation Exercises for correcting Muscle Imbalance;
- Regeneration Exercises for speeding up Recovery;
- Activating Exercises for increasing Body Activation;
- Exercises for Warming up and Concentration; and
- Exercises for Cool-down and Relaxation.

---

Supplemental exercise, in general, means practicing sports and activities other than the sport in which an athlete participates in order to build overall fitness. Such overall fitness cannot be achieved with the practice of just a single sport. The reasons for practicing supplemental training includes the following:

- Some sports develop only a limited range of muscles (for example fencing alone develops a certain group of muscles more than others).

- Beginning competition at an early age can negatively influence the harmonious development of the young child. Supplemental training is necessary to ensure harmonious development and supplemental exercises are a good habit to develop in a young athlete for they help develop a strong base on which to build specific abilities.

- Increased training load along with a prolonged preparation period and extensive competitive period also puts high pressure on the nervous system. Supplemental training creates a desirable "switch-off" mechanism for the physical and mental stress accumulated from this.

As a result of long-term sports training, muscle imbalances can develop in the athlete's body. The cardiovascular and pulmonary systems are usually loaded individually. Loading occurs when some
muscle groups are neglected and not strengthened during training. Only partial loading of the muscle takes place, depending on the given sport. The muscle groups become unbalanced either by overloading certain muscle groups through ‘one-sided’ training, or by weakening some muscle groups through lack of involvement or practice. In fencing for example, the non-weaponed side become less developed than the other side. Such ‘one-sided’ loading produces damage, disturbance, and injury to the motor system. An effort must be made to avoid this imbalance in order to ensure overall fitness.

The task of some of the Yoga exercises is to correct and compensate for the developed muscle imbalance by regular, systematic practice of compensation exercises, correct the one-sided effect of training by promoting general harmonious development of the body and by improving the individual physical systems. Overall, these Yoga exercises have the effect of compensating and correcting the imbalance which results from one-sided loading of the muscles. Yoga exercises are the most complex, rational and complete activity for overcoming the one-sided effects as well as becoming aware of the insufficiently loaded muscle groups by a sport, will enable an athlete to select the appropriate Yoga exercises for compensation of the muscle imbalances.

After intensive training or competition, it is necessary to immediately start the process of regeneration. Regeneration is a
biological process fostered by athletes for regaining strength and prevention of injuries. It is an inseparable part of sports preparation.

Some Yogic exercises, which are called regeneration exercises, are useful here. Psycho physiologically, such exercises generally optimize passive attention, which leads to greater autonomic control. Yogic exercises 'gather' attention, as in meditation, enabling the regeneration of the entire body by developing a favorable mental state (parasympathetic dominance). Physically, they are the most important means of active muscle regeneration. This system of selected or modified Yogic exercises relaxes the loaded, stiff, and shortened muscles that are the product of hard training or competition. These exercises speed up the regeneration of the frequently loaded muscle groups.

There are three basic types of muscle relaxation, all of which are included in Yoga regeneration exercise programme:

- Stretching - relaxation of the shortened and painful muscles by stretching.

- Post-isometric relaxation (semi-active method) – executed usually with the assistance of a therapist or teammate. Such relaxation develops after isometric tension of muscles for the duration of 10-30 seconds against a low resistance. This active stretching of muscles includes inhibition of motor-neurons and
the related muscles which significantly release the muscles in the phase of relaxation (it seems that the body induces a defensive inhibition against over-loading. For example, such inhibition of motor-neurons forces the wrestler to terminate a 'bridge' position).

- Anti-gravitational relaxation – an active method of auto relaxation. It is a modification of the above mentioned method, which substitutes the resistance provided by the therapist or teammate during the isometric tension with the weight of the athlete's own limbs, or trunk. It also uses the natural resistances against which the muscles are isometrically contracted, held for 15-20 seconds, and released (such as elevated limbs, trunk, etc.). This is a simple method the athlete can do without aids. The goal is to develop muscle relaxation following the phase of muscle contraction.

- Yoga exercises producing regeneration based on the principle of the muscles, in fact, release and relax after stretching for a specific time period in a tense and isometric position against specific resistance. This results in inhibition of motor neurons. Such relaxation differs from common stretching exercises, which passively stretch the shortened muscles without deliberate focus on influencing motor neurons. Yogic exercises providing regeneration influence the vital neuro-vegetative plexuses
(Chakras) and the endocrine glands. By doing this, the metabolism and overall-regeneration of the athlete is positively enhanced.

After practicing and mastering the basic four steps viz., body awareness (body control), breath awareness (breath control), attention focus (self-discipline), and concentration, as stated above, an athlete starts practicing meditation and autogenic training (i.e., body awareness, attention focus and concentration) to restore and maintain psycho physiological balance by altering inner responses. The programme must be arranged in such a way so that an athlete must enjoy, rejuvenate and re-energize the body for enriching top performance. As an Olympic coach and having long standing experience, Kogler (1999)\(^6\) suggests that if an athlete is not successful in achieving better results inspite of well coordinated physical fitness level, he/she must take assistance from the discipline of Yoga. Many researchers also support that combined practice of Yogic postures and scheduled exercise can improve athletic performance (Bera et al., 1993)\(^7\); (Rajan, 1992)\(^8\). The above discussion, indicates that Yoga has a great contribution of enhancing sports performance.

Scientific principles of sports training help significantly to enhance the efficiency in physical performance of athletes participating in various games and sports (Cumming, 1969); (Matveyev, 1981). Sport coaches also use appropriate training strategies or scientific schedules to improve the performance of sportsmen. Although various research, in the area of exercise-physiology have explained the role of respiration in sports performance (Byrne-Quinn et al., 1971); (Martin et al., 1979) a very low number of sports coaches are aware of it. Even during the regular schedules of sports training, generally, athletic coaches do not consider the importance of control of respiration (i.e. control of breathing). On the contrary, control of respiration has good relationship with various motor abilities (Campbell, 1958); (Ganguly and Bhole, 1985); (Lloyd, 1998). These reports in turn, indicate that control of respiration or control of breathing has real significance in improving strength and power.

---

In the area of research in Yoga, it has also been observed that the training in control of respiration has significant relationship with grip strength (Moorthy et. al., 1982)²⁶.

Patanjali, the founder of yoga science, explains that the control of Prana is the regulation of inhalation and exhalation and is accomplished by eliminating the pause between inhalation and exhalation of expanding it by retention. Then by regulating the motion of the lungs, the heart and the vagus nerve are controlled. The autonomic nervous system regulated processes in our bodies, which are not normally under our voluntary control-processes such as secretion by the digestive organs, the beating of the heart and the movement of the lungs. The science of Pranayama is thus intimately connected with the autonomic nervous system and brings its functions under conscious control through the functioning of the lungs. Here is a unique exception to the rule that the autonomic nervous system governs processes that are self-regulating and not under voluntary control. Though the act of respiration is for the most part involuntary, voluntary control in this area is easily achieved, for the depth, duration and frequency of respiration can be consciously modulated quite readily. It is for this a control of breath constitutes an obvious starting

---
point toward attainment of control over the functioning of the autonomic nervous system.

If we look at physiology from this point of view we begin to realize that the material body (which we have tended up to this time to regard as primary) is, in fact secondary. Its existence is based on something more fundamental than itself. The flow of energy creates and sustains the tissues of the body, and if the energy pattern is sufficiently changed then the physical body will change. If the energy pattern is altered drastically enough the body can be completely transformed, either for better or worse. Thus, yoga provides an altered energy pattern so as to improve proper nerve-muscle coordination and that, in fact, brings gain in performance.

However, when one sits down and deliberately begins to work with the breathing and to manipulate it, he can gradually begin to see changes in the way his body functions, even, in some cases, in its appearance. The same thing happens when one goes through life experiences that have tremendous effects on the way the energy flows.

If the energy pattern shifts, some parts of the body are poorly supplied (undernourished) with Prana, then an individual will eventually become sick. A degeneration or malignancy may result in some sort of
disease, which will inevitably become evident, weak body part of an athlete can be improved through yogic breathing.

The crucial point is that the breath is perhaps the only physiological process that can be either voluntary or involuntary. One can breathe making his breath do whatever he wishes, or he can ignore it, and after a while the body simply begins to breathe on its own. Breathing becomes reflexive. The body can’t operate without breath, so if conscious control of the breath is abandoned, some unconscious part of the mind begins functioning, picks it up and starts breathing for us. Something is triggered in the lower part of the brain that stimulates the breathing. So if the breath is ignored, breathing will go on anyhow. But in this case, breathing falls back to control by primitive parts of the brain. The unconscious realms of the mind where emotions, thoughts and feelings (of which we may have little or no awareness) become involved, and they wreak havoc with the rhythms of the breath. Once the breath becomes a part of one’s awareness, he begins to wonder how he ever managed to live when he was ignoring it. When the breath flows through one’s nostril there is a certain total feeling, both in the mind and in the body. When the breath shifts there is a shift of feeling tone. This awareness, in fact, may bring top performance in sports.

The above literature and traditional claims in turn suggest that control of respiration, especially control of breathing through activation
of "Ida-Nadi", "Pingala-Nadi" and "Susumna-Nadi" (over all nostril dominance) may be useful in improving the performance in athletics. Review of literature on sports sciences also revealed non-availability of any research reports in this area. So, also the effect of nostril breathing (specially, nostril dominance) on physical performance of athletes is not known. Even no attempt has been made so far by any other researcher to investigate the importance of control of breathing in physical and physiological performance. It was, therefore, thought desirable to undertake the present study.

**Statement of the Problem**

The purpose of this study was to find out the effect of nostril dominance on selected physical and physiological variables.

**Delimitations**

1. The study was delimited to the following physical and physiological variables.

   A. Physical Variables:

   1. Vertical Jump
   2. Chin-ups
   3. Shuttle Run
B. Physiological Variables

1. Peak Flow Rate
2. Vital Capacity
3. Blood Pressure (Systolic, Diastolic)
4. Hemoglobin content
5. Resting Heart Rate
6. Maximum Heart Rate
7. Maximal Oxygen Uptake (Vo2 max)
8. Respiratory Rate
9. Physical Work Capacity (PWC)

2. Study was further delimited to investigate the effect of nostril dominance breathing viz -

(a) Left nostril dominance

(b) Right nostril dominance

(c) Both nostril dominance

Limitations

Followings were considered as limitations of the study:

1. Extra practice, if any of the subjects in case of highly motivated individuals, with the desire to perform better than others, was not controlled and considered as one of the limitation for this study.
2. No special motivational technique were used to encourage the subjects to do their best during their practice or the tests and there was no way of determining whether the subject had the same degree of motivation during the pre-test and the post-test.

3. The personal habits of the subjects and their state of mind as well as emotional stresses and strains, owing to work experiences were also considered as limitations.

**Hypothesis**

The scholar had gone through the research literature, analyzed the traditional concept of Ida, Pingla and Sushumana and based on all this understanding it was hypothesized that

(a) There will be significant effect of nostril dominance on selected physical and physiological variables.

(b) The three forms of nostril dominance left, right and both nostril, will have significantly different effects on selected physical and physiological variables.
Definition and Explanation of the Terms

Yoga

The silencing of the mind's activities, which lead to the complete realization of the intrinsic nature of the supreme person, is called Yoga²⁷.

Ida-Nadi

This Nadi originates from the left side of the base of the spine and while traversing upward in a spiral way, reaches the roof of the left nostril. Ida Nadi primarily controls all those activities which are anabolic or constructive in nature, which conserve the energy and give cooling effect to the body. This Nadi, symbolically equated with female aspect, is ascribed the blue colour and is being governed by the Moon as its presiding deity. When we experience vital energy (Prana) flowing towards the left side of our body, we are generally left nostril dominated. This state is known as activation of Ida-Nadi.

Pingla-Nadi

This Nadi arises from the right side of the base of the spine and while traversing upward in the spiral way reaches the roof of the right nostril. Pingla Nadi primarily controls all those activities which are

catabolic or destructive in nature, and which consume the energy and generate the heat in the body. This Nadi, symbolically equated with the male aspect, is described the red colour and is considered as being governed by the Sun as its presiding deity. When we experience vital energy (Prana) flowing towards the right side of our body, we are generally right nostril dominated. This state is known as activation of Pingala-Nadi.

**Susumna – Nadi**

This Nadi also arises from the base of the spine and traverses up along the mid-line between Ida and Pingala Nadis. It reaches the opening in the base of the skull and through it, the brain itself. It is ascribed the white colour and as being governed by the Agni (fire) as its presiding deity. In normal circumstances this central channel (Madhyapatha) remains inactive and the Prana Shakti does not operate through it. But when through the Yogic practices, the functions governed by the Ida and Pingala Nadis are brought in absolute harmony and when they begin to function as an integrated manner, without any disturbance or obstruction, the subtler aspect of the pranic energy as gets free from the botheration of maintaining these activities, start operating through the sushumna Nadi. As the Sushumna Nadi gets activated and the Pranic energy starts flowing upward, it slowly throws open the entirely new dimension of experience which is not limited by the time and space. The rising of Prana through the
activated Susumna Nadi is known as the awakening of Kundalini Shakti. When we experience vital energy (Prana) flowing through the middle part of our body or the energy is distributed equally on both sides of our body are generally both nostril dominated. This state is known as activation of Susumna-Nadi.

**Nostril Dominance**

We breathe day and night even during sleep. Breathing pattern changes generally after each every 1 hour (approx) from right nostril to left nostril or vice-versa. When flow of breathing is more through right nostril, we call it right nostril dominated. When flow of breathing is more through left nostril, we call it left nostril dominated. Similarly, if the flow of breathing is equal (approx) through both the nostrils, we call it both nostril dominated.

**Peak Flow Rate**

The basis of Peak Flow Rate for monitoring the ventilatory functions were the amount of air and maximum rate of flow during an expiration followed by deepest possible inspiration. This can be measured with a peak flow meter.
Vital Capacity

The maximal volume of gas that can be expelled from the lungs following the maximal inspiration is called vital capacity\textsuperscript{28}.

Vital capacity is the maximum amount of air, which can be transported in one voluntary expiration\textsuperscript{29}.

Blood Pressure

Blood pressure is the pressure exerted on the walls of the arteries as the heart pumps blood through the body. Systolic blood pressure is obtained when blood is ejected into the arteries; diastolic pressure is obtained when the blood drains from the arteries\textsuperscript{30}.

Haemoglobin

Haemoglobin is a complex molecule found in red blood cells, which contain iron (heme) and protein (globin) and is capable of combining with oxygen\textsuperscript{31}.

Heart Rate

Heart rate is the number of times the heart beats per minute\textsuperscript{32}.

\textsuperscript{28} Astrand and Rodahl, Text Book of Work Physiology, p. 199.
\textsuperscript{30} Clarke, Physical Fitness Research Digest, p. 8.
\textsuperscript{32} Ibid, p. 251.
Vo2 Max

The maximal rate at which oxygen can be consumed per minute is the power or capacity of the aerobic or oxygen system\textsuperscript{33}.

Respiratory Rate

Number of beats taken in a minute or number of inspiration/expiration in a minute\textsuperscript{34}.

Physical Work Capacity

Physical work capacity may be defined as the capacity of an individual to carry on work to the point of fatigue.

The work performed may be continuous or/and progressive in nature.

Significance of the Study

Physical education teacher, coaches, sport scientists, and yoga scientists have been working over a considerable period of time to develop economical and effective means of training so as to enable sports persons to attain high performance in various games and sports.

\textsuperscript{33} Ibid, p. 550.
\textsuperscript{34} Ibid, p. 184.
The investigator felt that the Yogasnas and Yoga Danda require maximum effect on changing the nostril dominance.

1. This study will help the teachers of physical education, coaches and Yoga experts by way of pointing out the effectiveness of nostril dominance on physical and physiological variables.

2. The study may reveal physical, physiological variables as a result of participating in training programme of Yogic competition and sports training.

3. On the basis of the result of the study, physical education professionals and sports coaches may adopt the most appropriate programme of training to bring about the optimum result in selected physical and physiological variables as per the requirements of the different games and sports.

4. The study will provide guide line to physical education teachers, yoga teachers and athletes give more concentrate on nostril dominance which may inference the athletic performance.

5. The study gives scientific base to improve ancient Indian culture and discipline of Yoga, which our ancestors advised for general well being and healthy living.