METHODOLOGY

SAMPLE:

The samples of this study are randomly selected from the college with their date of birth lying between 1984 and 1991 in boys. The selected age groups of the subjects were from 18 to 25 years. In each group 15 subjects were selected. All the selected subjects were non-sportsman staying either in college hostels or at their residence to ensure the untrained development in endurance abilities. In all, 75 subjects were tested initially and the same 75 subjects were tested finally after every month for six months with training imparted on them. The tests were conducted for two days for four hours approximately on each group of 15 subjects. In all, 75 subjects were considered for obtaining the difference between the development of endurance through various methods supplemented with pranayama and without pranayama. Every subject was allotted with a code and a separate self-contained form for test results. The tests were selected in the aspects of development of endurance for volleyball. In growth height and weight is evaluated whereas in development of endurance abilities and their complex forms are considered for evaluation. The tests were administered individually under standard conditions applicable for specific tests and the time period required between two tests is amply considered.
### Table No. 1:
Coding procedure and colors adopted for the samples

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**NOTE:**

CTP = CONTINUOUS TRAINING + PRANAYAMA + VOLLEYBALL
CT = CONTINUOUS TRAINING + VOLLEYBALL
ITP = INTERVAL TRAINING + PRANAYAMA + VOLLEYBALL
IT = INTERVAL TRAINING + VOLLEYBALL
VB = VOLLEYBALL

18, 19, 20, 21, 22, 23, 24, 25 = AGE GROUPS

**VARIABLES:**

**DEPENDENT VARIABLES:**
1. Endurance of Boys

**INTERWEAVING VARIABLES:**
1. Sex: Boys
2. Age: 18 to 25 years.
4. Times: Initial and Final

**INDEPENDENT VARIABLES:**

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TRAINING OF PRANAYAMA

GROWTH TESTS:
1. Height.
2. Weight.

ENDURANCE TESTS:
3. VO₂ max through Canadian fit test (20 meters shuttle run).
4. Metabolic Equivalent through Canadian fit test (20 meters shuttle run).
5. 800 meters run for endurance.
6. VO₂ max through Cooper test (12 minute run or walk test).
7. Physical Fitness Index through Harvard Step Test.

DEFINITION OF THE GROWTH AND DEVELOPMENT FACTORS:
1. Height: Height is the total vertical length of an individual from the point vertex to the ground (Centimeters).
2. Weight: Weight is the complete mass of an individual standing on the weighing scale with optimum clothing (Kilograms).
3. Cardiorespiratory (CR) Endurance: Cardio respiratory endurance is the most basic component of physical condition. Most of us have had the feeling of being in relatively good shape and understand that vigorous exercise on a regular basis will allow us to perform skills or work without becoming tired. However, the concept of cardiorespiratory endurance is much more complicated than just being in shape. It can be defined as the ability of the circulatory and respiratory systems to adjust to vigorous exercise and to recover from the effect of that exercise. Cardiorespiratory endurance is very complex and involves the functioning of the heart, the lungs, the blood and its capacity to carry oxygen, the blood vessels and capillaries supplying blood to all parts of the body, and ultimately the muscle cells, which use the oxygen to provide the energy necessary for continuing exercise.
4. Metabolic rate: MET is the energy unit – and indicates the aerobic fitness level. At rest it is 1 MET and during exercise it should be able to reach between 10 to 20 METS i.e., 10 to 20 times of resting level.

5. Maximum oxygen uptake capacity (VO$_2$ max): The aerobic capacity is measured by the maximum amount of oxygen which can be consumed by the working muscles in one minute (VO$_2$ max). When VO$_2$ max is divided by the body weight of the sportsmen then we get the relative VO$_2$ max i.e., the amount of oxygen consumed per kilogram of body weight per minute (Milliliters).

TOOLS AND MEANS:

There are lot of endurance ability tests or means and tools. Lists of the items of several of the most used endurance tests, and indicates the types of items included in such tests: General Motor Ability test Batteries-

(1) Barrow Motor Ability Test (men) - standing long jump, softball throw for distance, zigzag run, wall pass using volleyball, six pound medicine ball put, 60 yard dash, (indoor battery).

(2) Cozens General Athletic Test (men) - Baseball throw for distance, football punt for distance, bar snap (parallel bars), standing long jump, dips (parallel bars), dodging run, and quarter-mile run.

(3) Scott Motor Ability Test (women) - Volleyball throw for distance four-second dash, wall pass using volleyball, standing long jump, obstacle run.

(4) Newton Motor Ability Test - standing long jump, hurdle run, scrambles (agility run).

(5) Larson Motor Ability Test (men) - Indoor battery - Chins (pull-ups), vertical jump, dips, dodging run, and bar snap. Outdoor battery - Chins (pull-ups), bar snap, vertical jump, baseball throw for distance.

(6) Latchaw Motor Achievement Test (elementary children) - volleyball wall pass, volleyball wall volley, vertical jump, standing long jump, shuttle run, soccer wall volley, softball repeated throws.
All these motor abilities test batteries deal with specific age, sex or category and the coefficients of the reliability and validity are not stable and vary in wide range if applied in the present study. These motor ability tests are useful to distinguish specific groups of students, and it is difficult to separate the individuals according to their categories.

So these test batteries are not useful to study the comparison of the development of endurance abilities in volleyball players imparted with endurance training with or without pranayama for present study. Hence research scholar used some of the selected endurance ability tests which are applicable to the selected age group and samples and are universally accepted and established standard tests for assessing development of endurance abilities.

MEANS USED

1. Personal data bank: It is used to collect the information of an individual. Personal data bank consists of the following aspect: Full name, date of birth and age, diet (vegetarian/ mix), sportsman / non-sportsman, height and weight.

2. Motor ability tests:
   - 20 meters shuttle run (Canadian fit test) for metabolic rate.
   - 20 meters shuttle run (Canadian fit test) for Maximum oxygen uptake capacity (VO₂ max).
   - 800 meters run for endurance
   - VO₂ max through Cooper test (12 minute run or walk test).
   - Physical Fitness index through Harvard Step Test.

PROCEDURE:

Prana and Pranayama:

Pranayama is an exact science. It is the fourth Anga or limb of Ashtanga Yoga. “Tasmin Sati Svasa prasvasayorgavitvicchedah Pranayamah”—Regulation of breath or the control of Prana is the stoppage of inhalation and exhalation, which
follows after securing that steadiness of posture or seat, Asana. Thus is Pranayama defined in Patanjali Yoga Sutras, Chapter II - 49.

‗Svasa‘ means inspiratory breath and ‗Prasvasa‘ is expiratory breath. Breath is external manifestation of Prana, the vital force. Breath like electricity is gross Prana. Breath is Sthula, gross. Prana is Sukshma, subtle. By exercising control over this breathing you can control the subtle Prana inside. Control of Prana means control of mind. Mind cannot operate without the help of Prana. The vibrations of Prana only produce thoughts in the mind. It is Prana that moves the mind. It is Prana that sets the mind in motion. It is the Sukshma Prana or Psychic Prana that is intimately connected with the mind. This breath represents the important fly-wheel of an engine. Just as the other wheels stop when the driver stops the fly-wheel, so also other organs cease working, when the Yogi stops the breath. If you can control the fly-wheel, you can easily control the other wheels. Likewise, if you can control the external breath, you can easily control the inner vital force, Prana. The process, by which the Prana is controlled by regulation of external breath, is termed Pranayama.

Just as a goldsmith removes the impurities of gold by heating it in the hot furnace, by strongly blowing the blow-pipe, so also the Yogic student removes the impurities of the body and the Indriyas by blowing his lungs, i.e., by practising Pranayama.

The chief aim of Pranayama is to unite the Prana with the Apana and take the united Pranapana slowly towards the head. The effect or fruit of Pranayama is Udghata or awakening of the sleeping Kundalini.

Seat of Prana:

The seat of Prana is heart. Though the Antahkarana is one, yet it assumes four forms, viz., (i) Manas, (ii) Buddhi, (iii) Chitta and (iv) Ahamkara according to the different functions it performs. Likewise, though Prana is one, it assumes five forms viz., (1) Prana, (2) Apana, (3) Samana, (4) Udana and (5) Vyana according to the different functions it performs. This is termed as Vritti Bheda. The principal Prana is called Mukhya Prana. The Prana, joined with Ahamkara, lives in the heart. Of these five, Prana and Apana are the chief agents.
The seat of Prana is the heart; of Apana, the anus; of Samana, the region of the naval; of Udana, the throat; while Vyana is all-pervading. It moves all over the body.

Kapalabhati:

Do Rechaka and Puraka rapidly like the bellows of a blacksmith. This destroys all the disorders of phlegm. Detailed instructions are given separately.

Madhya (Central) Nauli
Vama (Left) Nauli
Dakshina (Right) Nauli

The Time:

The practice of Pranayama should be commenced in Vasanta Ritu (spring) or Sarad Ritu (autumn) because in these seasons success is attained without any difficulty or troubles. The Vasanta is the period from March to April. The Sarad, autumn, lasts from September to October. In summer do not practise Pranayama, in the afternoon or evening. In the cool morning hours you can have your practice.

Three Bandhas:

There are four Bhedas (piercing of divisions) viz., Surya, Ujjayi, Sitali and Basti. Through these four ways, when Kumbhaka is near or about to be performed, the sinless Yogi should practise the three Bandhas. The first is called Mula Bandha. The second is called Uddiyana, and the third is Jalandhara. Their nature will be thus described. Apana which has a downward tendency is forced up by contracting and drawing the anus upwards. This process is called Mula Bandha. When Apana is raised up and reaches the sphere of Agni (fire), then the flame of Agni grows long, being blown about by Vayu. The Agni and Apana come to or commingle with Prana in a heated state. Through this Agni, which is very fiery arises in the body the flaming of fire which rouses the sleeping Kundalini. Then the Kundalini makes a hissing noise, becomes erect like a serpent beaten with a stick and enters into the hole of Brahmanadi (Sushumna). Therefore Yogins should daily practise Mula Bandha. Uddiyana should be performed at the end of Kumbhaka and at the beginning of inhalation. Because Prana ‘Uddiyate’—goes up the Sushumna
in this Bandha, it is called Uddiyana by the Yogins. Being seated in the Vajra posture and holding firmly the two toes by the two hands near the two ankles, he should gradually upbear the Tana (thread or Nadi, the Sarasvati Nadi) which is on the western side of Udara (the upper part of the abdomen, above the navel), then to neck. When Prana reaches Sandhi (junction) of navel, slowly it removes the diseases of the navel. Therefore this should be practised perfectly. Uddiyana can be done in standing posture also. When you practise in standing posture, place your hands on the knees or a little above the knees. Keep the legs a little apart.

The Bandha called Jalandhara should be practised at the end of Puraka. Jalandhara is of the form of contraction of the neck and is an impediment to the passage of Vayu upwards. When the neck is contracted by bending the head downwards, so that the chin may touch the chest, Prana goes through Brahmanadi. Assuming the seat, as mentioned before, one should stir up Sarasvati and control Prana. On the first day Kumbhaka should be done four times, on the second day ten times and then five times separately. On the third day, twenty times will do and afterwards Kumbhaka should be performed with the Bandhas and with an increase of two times per day.

Control of Breath:

The first important step is to master the Asana of posture or to control the body. The next exercise is Pranayama. Correct posture is indispensably requisite for the successful practice of Pranayama. An easy comfortable posture is Asana. That pose is the best which continues to be comfortable for the greatest length of time. Chest, neck, and head must be in one vertical line. You should not bend the body either forwards or laterally, i.e., either on the right or left side. You should not sit crooked. You should not allow the body to collapse. You must not bend the body either forwards or backwards. By regular practice the mastery over the pose will come by itself. Fatty people will find it difficult to practise the Padma Asana or the Lotus Pose. They can sit on the Sukha Asana (comfortable pose) or Siddha Asana (perfected pose). You need not wait for practising Pranayama till you get full mastery over the Asana. Practise Asana and side by side you can practise Pranayama also. In course of time, you will acquire perfection in both. Pranayama can also be practised by sitting in the chair erect.
In Bhagavad-Gita, the Immortal Song of Lord Krishna, you will find a beautiful description of seat and pose: “In a pure secret place by himself established in a fixed seat of his own, neither too high nor too low, with cloth, black antelope-skin and Kusa grass one over the other, there, making the mind one-pointed, with thought and the functions of the senses controlled, steady on his seat, he should practise Yoga for the purification of the Self, holding the body, head and neck erect, firm, gazing steadily at the tip of the nose without looking around” (Ch. VI—10, 11, 12).

Pranayama is the control of the Prana and the vital forces of the body. It is regulation of the breath. This is the most important step. The aim of Pranayama is the control of Prana. Pranayama begins with the regulation of the breath for having control over the life-currents or inner vital force. In other words, Pranayama is the perfect control of the life-currents through control of breath. Breath is external manifestation of the gross Prana. A correct habit of breathing must be established by the regular practice of Pranayama. In ordinary worldly persons the breathing is irregular.

If you can control the Prana you can completely control all the forces of the Universe, mental and physical. The Yogi can also control the Omnipresent manifesting power out of which all energies take their origin, whether concerning magnetism, electricity, gravitation, cohesion, nerve-currents, vital forces or thought-vibrations, in fact the total forces of the Universe, physical and mental.

If one controls the breath or Prana, the mind also is controlled. He who has controlled his mind has also controlled his breath. If one is suspended, the other is also suspended. If the mind and Prana are both controlled one gets liberation from the round of births and deaths and attains immortality. There is intimate connection between the mind, Prana and semen. If one controls the seminal energy, the mind and Prana are also controlled. He who has controlled his seminal energy has also controlled his Prana and mind.

He who practises Pranayama will have good appetite, cheerfulness, handsome figure, good strength, courage, and enthusiasm, a high standard of
health, vigour and vitality and good concentration of mind. Pranayama is quite suitable for the Westerners also. A Yogi measures the span of his life not by the number of years but by the number of his breaths. You can take in a certain amount of energy or Prana from the atmospheric air along with each breath. Vital capacity is the capacity shown by the largest quantity of air a man can inhale after the deepest possible exhalation. A man takes fifteen breaths in a minute. The total number of breaths comes to 21,600 times per day.

Varieties of Pranayama:

“Bahya-abhyantar-stambha-vritti-desaa-kala
Sankhyabhih patiditishto deergha-sukshmah.”

Three Types of Pranayama:

There are three types of Pranayama, viz., Adhama, Madhyama and Uttama (inferior, middle and superior). The Adhama Pranayama consists of 12 Matras, Madhyama consists of 24 Matras and the Uttama occupies a time of 32 Matras. This is for Puraka. The ratio between Puraka, Kumbhaka and Rechaka is 1:4:2. Puraka is inhalation. Kumbhaka is retention. Rechaka is exhalation. If you inhale for a period of 12 Matras you will have to make Kumbhaka for a period of 48 Matras. Then the time for Rechaka will be 24 Matras. This is for Adhama Pranayama. The same rule will apply to the other two varieties. First, practise for a month of Adhama Pranayama. Then practise Madhyama for three months. Then take up the Uttama variety.

Salute your Guru and Sri Ganesa as soon as you sit in the Asana. The time for bhyaasa is early morning 4 a.m., 10 a.m., evening 4 p.m., and night 10 p.m., or 12 p.m. As you advance in practice you will have to do 320 Pranayamas daily.

Sagarbha Pranayama is that Pranayama, which is attended with mental Japa of any Mantra, either Gayatri or Om. It is one hundred times more powerful than the Agarbha Pranayama, which is plain and unattended with any Japa. Pranayama Siddhi depends upon the intensity of the efforts of the practitioner. An ardent enthusiastic student, with Parama Utsaha, Sahasa and Dridhata (zeal, cheerfulness and tenacity), can effect Siddhi (perfection) within six months; while a happy-go-
lucky practitioner with Tandri and Alasya (drowsiness and laziness) will find no improvement even after eight or ten years. Plod on. Persevere with patience, faith, confidence, expectation, interest and attention. You are bound to succeed. Nil desperandum—Never despair.

Exercise No. 1:

Sit on Padmasana. Close your eyes. Concentrate on Trikuti (the space between the two eye-brows). Close the right nostril with your right thumb. Inhale slowly through the left nostril as long as you can do it with comfort. Then exhale very very slowly through the same nostril. Do twelve times. This is one round.

Then inhale through the right nostril by closing the left nostril with your right ring and little fingers and exhale very slowly through the same nostril. Do twelve times. This is one round.

Do not make any sound during inhalation and exhalation. Repeat your Ishta Mantra during the practice. In the second week of practice, do two rounds, in the third week, three rounds. Take rest for two minutes when one round is over. If you take a few normal breaths, when one round is over, that will give you sufficient rest and you will be fresh for the next round. There is no Kumbhaka in this exercise. You can increase the number of rounds according to your strength and capacity.

Exercise No. 2:

Inhale through both the nostrils slowly and gently. Do not retain the breath. Then exhale slowly. Do 12 times. This will constitute one round. You can do 2 or 3 rounds according to your capacity and strength and time at your disposal.

Exercise No. 3:

Sit on your Asana. Close the right nostril with your right thumb. Then inhale slowly through your left nostril. Close the left nostril with your right ring and little fingers and open the right nostril by removing the right thumb. Exhale very slowly through the right nostril. Then draw the air through the right nostril as long as you can do it with comfort and exhale through the left nostril by removing the right ring and little fingers. There is no Kumbhaka in this Pranayama. Repeat
the process 12 times. This will constitute one round.

Exercise No. 4:

Meditate that the single letter, the Supreme light—Pranava or OM—is the origin or source of the three letters A, U and M. Inhale the air through Ida or left nostril for the space of 16 Matras (seconds), meditate on the letter ‘A’ during that time; retain the air for the space of 64 Matras, meditate on the letter ‘U’ during the time; exhale through the right nostril for the space of 32 Matras and meditate on the letter ‘M’ during that time. Practise this again and again in the above order. Begin with 2 or 3 times and gradually increase the number to 20 or 30 times according to your capacity and strength. To begin with, keep the ratio 1:4:2. Gradually increase the ratio to 16:64:32.

Deep Breathing Exercise:

Each deep breath consists of a very full inhalation, through the nose and a deep, steady exhalation also, through the nose.

Inhale slowly as much as you can do. Exhale slowly as much as you can do.

During inhalation, observe the following rules:
1. Stand up. Place the hands on the hips, the elbows will be out and not forced backward. Stand at ease.
2. Lengthen the chest straight upwards. Press the hip bones with the hands in downward direction. A vacuum will be formed by this act and the air will rush in of its own accord.
3. Keep the nostrils wide open. Do not use the nose as a suction pump. It should serve as a passive passage for both the inhaled and the exhaled air. Do not make any sound when you inhale and exhale. Remember that correct breathing is noiseless.
4. Stretch the whole upper part of the trunk.
5. Do not arch the upper chest into a cramped position. Keep the abdomen naturally relaxed.
6. Do not bend the head far backwards. Do not draw the abdomen inwards. Do not force the shoulders back. Lift the shoulders up.

During the exhalation observe the following rules carefully:
a. Allow the ribs and the whole upper part of the trunk to sink down gradually.
b. Draw the lower ribs and abdomen upwards—slowly.
c. Do not bend the body too much forward. Arching of the chest should be avoided. Keep the head, neck and trunk in a straight line. Contract the chest. Do not breathe the air out through the mouth.
d. Exhale very, very slowly without producing any noise.

4. Expiration simply takes place by relaxing the inspiratory muscles. The chest falls down by its own weight and expels the air out through the nose.

5. In the beginning, do not retain the breath after inhalation. When the process of inhalation is over begin exhalation at once. When you have sufficiently advanced in your practice, you can slowly retain the breath from five seconds to one minute according to your capacity.

6. When one round of three deep breathings is over, you can take a little rest, ‘Respiratory pause’—by taking a few normal breaths. Then start the second round. During the pause, stand still in a comfortable position with hands on hips. The number of rounds can be fixed according to the capacity of the practitioner. Do 3 or 4 rounds and increase one round every week. Deep breathing is only a variety of Pranayama.

Kapalabhati:

‘Kapala’ is a Sanskrit word; it means skull. ‘Bhati’ means to shine. The term ‘Kapalabhati’ means an exercise that makes the skull shine. This Kriya cleanses the skull. So this is taken as one of the Shat-Karmas (six cleansing processes in Hatha Yoga).

Sit on Padmasana. Keep the hands on knees. Close the eyes. Perform Puraka and Rechaka rapidly. This should be practised vigorously. One will get perspiration profusely. This is a good form of exercise. Those who are well-versed in Kapalabhati can do Bhastrika very easily. There is no Kumbhaka in this Pranayama. Rechaka plays a prominent part. Puraka is mild, slow and long (Dirgha). But the Rechaka should be done quickly and forcibly by contracting the abdominal muscles with a backward push. When you do Puraka, release the abdominal muscles. Some people naturally make a curve of the spine and bend their heads also. This is not desirable. The head and the trunk should be erect.
Sudden expulsions of breath follow one another as in Bhastrika. To start with, you can have one expulsion per second. Gradually you can have two expulsions per second. To begin with do one round in the morning consisting of 10 expulsions only. In the second week, do one round in the evening. In the third week, do two rounds in the morning and two rounds in the evening. Thus every week, gradually and cautiously increase 10 expulsions to each round till you get 120 expulsions for each round.

It cleanses the respiratory system and the nasal passages. It removes the spasm in bronchial tubes. Consequently, Asthma is relieved and also cured in course of time. The apices of the lungs get proper oxygenation. Thereby they cannot afford favourable nidus (breeding grounds) for tubercle bacilli. Consumption is cured by this practice. Lungs are considerably developed. Carbon dioxide is eliminated in a large scale. Impurities of the blood are thrown out. Tissues and cells absorb a large quantity of oxygen. The practitioner keeps up good health. Heart functions properly. The circulatory and respiratory systems are toned to a considerable degree.

The External Kumbhaka (Bahya):

Draw the air through the left nostril till you count 3 OMs; throw it out through the right nostril immediately without retaining it counting 6 OMs. Stop it outside till you count 12 OMs. Then draw the breath through the right; exhale it through the left and stop it outside as before, using the same units of OM for inhalation, exhalation and retention. Do six times in the morning and six times in the evening. Gradually increase the number of rounds and the time of Kumbhaka. Do not strain or fatigue yourself.

Ujjayi:

Sit in Padmasana or Siddhasana. Close the mouth. Inhale slowly through both the nostrils in a smooth, uniform manner till the breath fills the space from the throat to the heart.

Retain the breath as long as you can do it comfortably and then exhale slowly through the left nostril by closing the right nostril with your right thumb.
Expand the chest when you inhale. During inhalation a peculiar sound is produced owing to the partial closing of glottis. The sound produced during inhalation should be of a mild and uniform pitch. It should be continuous also. This Kumbhaka may be practised even when walking or standing. Instead of exhaling through the left nostril, you can exhale slowly through both nostrils.

This removes the heat in the head. The practitioner becomes very beautiful. The gastric fire is increased. It removes all the evils arising in the body and the Dhatus and cures Jalodara (dropsy of the belly or ascites). It removes phlegm in the throat, Asthma, consumption and all sorts of pulmonary diseases are cured. All diseases that arise from deficient inhalation of oxygen, and diseases of the heart are cured. All works are accomplished by Ujjayi Pranayama. The practitioner is never attacked by diseases of phlegm, nerves, dyspepsia, dysentery, enlarged spleen, consumption, cough or fever. Perform Ujjayi to destroy decay and death.

Sitkari:

Fold the tongue so that the tip of the tongue might touch the upper palate and draw the air through the mouth with a hissing sound C C C C (or Si, Si, Si, Si). Then retain the breath as long as you can without the feeling of suffocation and then exhale slowly through both nostrils. You can keep the two rows of teeth in contact and then inhale the air through the mouth as before.

The practice enhances the beauty of the practitioner and vigour of his body. It removes hunger, thirst, indolence and sleep. His strength will be just like that of Indra. He becomes the Lord of Yogins. He is able to do and undo things. He becomes an independent monarch. He becomes invincible. No injury will affect him. When you are thirsty, practise this. You will be relieved of thirst immediately.

Sitali:

Protrude the tongue a little away from the lips. Fold the tongue like a tube. Draw in the air through the mouth with the hissing sound Si. Retain the breath as long as you can hold on with comfort. Then exhale slowly through both nostrils. Practise this daily again and again in the morning from 15 to 30 times. You can do
this either on Padmasana, Siddhasana, Vajrasana or even when you stand or walk. This Pranayama purifies the blood. It quenches thirst and appeases hunger. It cools the system. It destroys Gulma (chronic dyspepsia), Pleeha, inflammation of various chronic diseases, fever, consumption, indigestion, bilious disorders, phlegm, the bad effects of poison, snake-bite, etc. When you are caught up in a jungle or any place where you cannot get water, if you feel thirsty, practise this Pranayama. You will be at once relieved of thirst. He, who practises this Pranayama regularly, will not be affected by the bite of serpents and scorpions. Sitali Kumbhaka is an imitation of the respiration of a serpent. The practitioner gets the power of casting his skin and enduring the privation of air, water and food. He becomes a proof against all sorts of inflammations and fever.

Bhastrika:

In Sanskrit Bhastrika means ‘bellows’. Rapid succession of forcible expulsion is a characteristic feature of Bhastrika. Just as a blacksmith blows his bellows rapidly, so also you should move your breath rapidly.

Sit on Padmasana. Keep the body, neck and head erect. Close the mouth. Next, inhale and exhale quickly ten times like the bellows of the blacksmith. Constantly dilate and contract. When you practise this Pranayama a hissing sound is produced. The practitioner should start with rapid expulsions of breath following one another in rapid succession. When the required number of expulsions, say ten for a round, is finished, the final expulsion is followed by a deepest possible inhalation. The breath is suspended as long as it could be done with comfort. Then deepest possible exhalation is done very slowly. The end of this deep exhalation completes one round of bhastrika. Rest a while after one round is over by taking a few normal breaths. This will give you relief and make you fit for starting the second round. Do three rounds daily in the morning. You can do another three rounds in the evening also. Busy people who find it difficult to do three rounds of Bhastrika can do one round at least. This also will keep them quite fit.

Bhastrika is a powerful exercise. A combination of Kapalabhati and Ujjayi makes up Bhastrika. Practise Kapalabhati and Ujjayi to start with. Then you will
find it very easy to do Bhastrika.

Some prolong the practice till they get tired. You will get perspiration profusely. If you experience any giddiness stop the practice and take a few normal breaths. Continue the practice after the giddiness has vanished. Bhastrika can be done both in the morning and evening in winter. In summer do it in the morning only during cool hours.

Bhastrika relieves inflammation of the throat, increases gastric fire, destroys phlegm, removes diseases of the nose and chest and eradicates asthma, consumption, etc. It gives good appetite. It breaks the three Granthis or knots viz., Brahma Granthi, Vishnu Granthi and Rudra Granthi. It destroys phlegm which is the bolt or obstacle to the door at the mouth of Brahma Nadi (Sushumna). It enables one to know the Kundalini. It removes all diseases which arise from excess of wind, bile and phlegm. It gives warmth to the body. When you have no sufficient warm clothing in a cool region to protect yourself from cold, practise this Pranayama and you will get sufficient warmth in the body quickly. It purifies the Nadis considerably. It is the most beneficial of all Kumbhakas. Bhastrika Kumbhaka should be specially practised as it enables the Prana to break through the three Granthis or knots that are firmly located in the Sushumna. It awakens the Kundalini quickly. The practitioner will never suffer from any disease. He will always be healthy.

The number of exhalations or rounds is determined by the strength and capacity of the practitioner. You must not go to extremes. Some students do six rounds. Some do twelve also.

You can practise Bhastrika in the following manner. There is some slight change in the end. Having inhaled and exhaled quickly twenty times, inhale through the right nostril, retain the breath as long as you can do it comfortably and then exhale through the left nostril. Then inhale through the left nostril, retain the breath as before and then exhale through the right nostril.

Repeat OM mentally with Bhava and meaning throughout the practice. There are some varieties of Bhastrika wherein one nostril only is used for breathing
purposes and in another variety the alternate nostrils are used for inhalation and exhalation.

Those who wish to do Bhastrika for a long time in an intense manner should live on Khichdi, and take an enema or do Basti in the morning before starting the practice.

Bhramari:

Sit on Padmasana or Siddhasana. Inhale rapidly through both nostrils making sound of Bhramara, the bee, and exhale rapidly through both nostrils, making the humming sound.

You can carry the process till the body is bathed in perspiration. In the end inhale through both nostrils, retain the breath as long as you can do it comfortably and then exhale slowly through both nostrils. The joy which the practitioner gets in making the Kumbhaka is unlimited and indescribable. In the beginning, heat of the body is increased as the circulation of blood is quickened. In the end the body-heat is decreased by perspiration. By success in this Bhramari Kumbhaka the Yogic student gets success in Samadhi.

### TABLE .02

**WEEKLY TRAINING SCHEDULE**

<table>
<thead>
<tr>
<th>Days</th>
<th>Warming - Up</th>
<th>Main Activity</th>
<th>Pranayama</th>
<th>Cooling-Down, Stretching and Shavasana: 15 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>General 10 Minutes</td>
<td>Slow Continuous 30 Minutes</td>
<td>30 Minutes</td>
<td>5 Minutes Shavasana; 5 Minutes Cooling down exercises and 5 Minutes Stretching</td>
</tr>
<tr>
<td>Tuesday</td>
<td>General 10 Minutes</td>
<td>Volleyball Play for 30 minutes</td>
<td>30 Minutes</td>
<td>5 Minutes Shavasana; 5 Minutes Cooling down exercises and 5 Minutes Stretching</td>
</tr>
<tr>
<td>Wednesday</td>
<td>General 10 Minutes</td>
<td>Fast Continuous 30 Minutes</td>
<td>Variable Pace Method 30 Minutes</td>
<td>5 Minutes Shavasana; 5 Minutes Cooling down exercises and 5 Minutes Stretching</td>
</tr>
<tr>
<td>Thursday</td>
<td>General 10 Minutes</td>
<td>Volleyball Play for 30 minutes</td>
<td>30 Minutes</td>
<td>5 Minutes Shavasana; 5 Minutes Cooling down exercises and 5 Minutes Stretching</td>
</tr>
<tr>
<td>Friday</td>
<td>General 10 Minutes</td>
<td>Volleyball Play for 30 minutes</td>
<td>30 Minutes</td>
<td>5 Minutes Shavasana; 5 Minutes Cooling down exercises and 5 Minutes Stretching</td>
</tr>
</tbody>
</table>
The subjects were selected from the same college who are interested in volleyball and involve themselves in training for the study. In all 7 testes were selected for evaluating the growth and development of endurance abilities of the subjects between 18 to 25 years. To have the difference of data for assessing the development it was decided to organize the test on 75 subjects; 15 in each group; 5 groups in all and the same subjects to be evaluated after a gap of every one month after imparting the training as scheduled. The subjects were tested initially for their growth and development in endurance abilities from February 2010 to July 2010.
While organizing the tests the following things are observed strictly for objectivity, reliability and validity of the findings:

1. The sequence of tests will not cultivate fatigue in the subjects.
2. The condition of the subject before undergoing / performing the test is normal and motivated.
3. No exertion in daily activities.
4. Proper and comfortable kit while performing the test.
5. Condition of the surface and other physical equipment required for test.
6. Sufficient time was allotted for warming-up exercises.
7. Obtained information of diet and recovery the day before from the subject.
8. Instructions regarding the performance of the specific tests are passed before the test.

In each group 15 subjects were tested in 7 variables in growth and development of endurance abilities, 4 hours were allotted in two days dividing 2 hours on each day. The sequence of the tests was so organized as to avoid fatigue, which was as follows:

Day one - Warming up for 15 minutes, Height, Weight, 800 meters run, Harvard step test and cooling down.

Day two - Warming up for 15 minutes, 20 meters shuttle run, Cooper’s test and Cooling down 10 minutes.

DAY ONE:

HEIGHT: The subject is made to stand touching the back to the marking on the wall and a scale is put at the vertex (maximum point of the head of an individual).

WEIGHT: Weight is taken by making the subject stand on the weighing scale with optimum clothes and without excess ornaments or accessories on the body.

800 METERS RUN: The subjects are made to run two rounds to the standard 400 meters track and the time is noted for the same.
HARVARD STEP TEST:

Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made but in the analysis we need to bear in mind the factors that may influence the results.

Objective:

The objective of this test is to monitor the development of the athlete's cardiovascular system.

Required Resources:

To undertake this test you will require:

- Gym bench (45cm high)
- Stop watch
- Assistant

How to conduct the test

The Harvard Step Test is conducted as follows:

- Step up on to a standard gym bench once every two seconds for five minutes (150 steps)
- Have someone to help you keep to the required pace
- One minute after finishing the test take your pulse rate (bpm) - Pulse 1
- Two minutes after finishing the test take your pulse rate (bpm) - Pulse 2
- Three minutes after finishing the test take your pulse rate (bpm) - Pulse 3
- Use the calculator below to determine your level of fitness

Analysis

Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement.
Using the three pulse rate your level of fitness can be determined as follows:

- Result = \( \frac{30000}{\text{pulse1} + \text{pulse2} + \text{pulse3}} \)

Fitness calculator

For an estimate of your level of fitness enter your pulse rates (Pulse 1, Pulse 2 and Pulse 3) and then select the 'Calculate' button.

Pulse 1 = \[\text{bpm}\] Pulse 2 = \[\text{bpm}\] Pulse 3 = \[\text{bpm}\]

How fit are you? \[\text{points}\]

Normative data for the Harvard Step Test

The following table is for 16 year old athletes.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>&gt;90</td>
<td>80-90</td>
<td>65-79</td>
<td>55-64</td>
<td>&lt;55</td>
</tr>
<tr>
<td>Female</td>
<td>&gt;86</td>
<td>76-86</td>
<td>61-75</td>
<td>50-60</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>

Table Reference: McArdle W.D. et al; Essential of Exercise Physiology; 2000

Target Group:

This test is suitable for active and sedentary athletes but not for individuals where the test would be contraindicated.

Reliability:

Reliability would depend upon how strict the test is conducted and the individual's level of motivation to perform the test.
Validity:

There are published tables to relate results to a potential level of fitness and the correlation is high.

DAY TWO:

20 METERS SHUTTLE RUNS (CANADIAN FIT TEST):

(A) It is suitable for either sex, individuals between the age of 6 and 60 in a medically fit condition. (B) The test includes a period of warm up. (C) Maximal effort is required only at the end of the test. (D) The test as such involves jogging and running at progressively increasing pace, over a 20 meters course for as long as possible. The pace is given by the audio cassette. At every sound heard, you must have reached one of the 20 meters lines and upon hearing the sound, you should pivot and reverse your direction and run at the set pace to the opposite line in time for the next audio signal. This way you run till your maximum capacity is reached. If twice in a row you can’t reach within 2 strides of the line, you have reached your max capacity and so remember the last number announced on the cassette player. This is your stage level and equates this with your score from the score sheet attached – to know your VO$_2$ max as per your age.

COOPER VO$_2$ MAX TEST:

Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made but in the analysis we need to bear in mind the factors that may influence the results.

Objective:

To monitor the development of the athlete's aerobic endurance and to obtain an estimate of their VO$_2$ max
Required Resources:
To undertake this test you will require:

- 400 meter track - marked every 100 meters
- Stop watch
- Assistant

How to conduct the test:

- The athlete conducts a 10 to 15 minute warm up
- Using the track the athlete runs/walks as far as possible in 12 minutes
- The assistant records the total distance covered to the nearest 100 metres
- The athlete conducts a cool down

Analysis:

Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement.

Performance Assessment:

For an evaluation of the athlete's performance select the age group and gender, enter the total distance covered and then select the 'Calculate' button.

Age 13-14  Gender Male  Distance meters

Assessment -
### Table 05

Normative data for the Cooper Test:

<table>
<thead>
<tr>
<th>Age</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male 13-14</td>
<td>&gt;2700m</td>
<td>2400-2700m</td>
<td>2200-2399m</td>
<td>2100-2199m</td>
<td>&lt;2100m</td>
</tr>
<tr>
<td>Females 13-14</td>
<td>&gt;2000m</td>
<td>1900-2000m</td>
<td>1600-1899m</td>
<td>1500-1599m</td>
<td>&lt;1500m</td>
</tr>
<tr>
<td>Males 15-16</td>
<td>&gt;2800m</td>
<td>2500-2800m</td>
<td>2300-2499m</td>
<td>2200-2299m</td>
<td>&lt;2200m</td>
</tr>
<tr>
<td>Females 15-16</td>
<td>&gt;2100m</td>
<td>2000-2100m</td>
<td>1700-1999m</td>
<td>1600-1699m</td>
<td>&lt;1600m</td>
</tr>
<tr>
<td>Males 17-19</td>
<td>&gt;3000m</td>
<td>2700-3000m</td>
<td>2500-2699m</td>
<td>2300-2499m</td>
<td>&lt;2300m</td>
</tr>
<tr>
<td>Females 17-20</td>
<td>&gt;2300m</td>
<td>2100-2300m</td>
<td>1800-2099m</td>
<td>1700-1799m</td>
<td>&lt;1700m</td>
</tr>
</tbody>
</table>
The following table rates performance for athletes:

<table>
<thead>
<tr>
<th>Age</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male 20-29</td>
<td>&gt;2800m</td>
<td>2400-2800m</td>
<td>2200-2399m</td>
<td>1600-2199m</td>
<td>&lt;1600m</td>
</tr>
<tr>
<td>Females 20-29</td>
<td>&gt;2700m</td>
<td>2200-2700m</td>
<td>1800-2199m</td>
<td>1500-1799m</td>
<td>&lt;1500m</td>
</tr>
<tr>
<td>Males 30-39</td>
<td>&gt;2700m</td>
<td>2300-2700m</td>
<td>1900-2299m</td>
<td>1500-1999m</td>
<td>&lt;1500m</td>
</tr>
<tr>
<td>Females 30-39</td>
<td>&gt;2500m</td>
<td>2000-2500m</td>
<td>1700-1999m</td>
<td>1400-1699m</td>
<td>&lt;1400m</td>
</tr>
<tr>
<td>Males 40-49</td>
<td>&gt;2500m</td>
<td>2100-2500m</td>
<td>1700-2099m</td>
<td>1400-1699m</td>
<td>&lt;1400m</td>
</tr>
<tr>
<td>Females 40-49</td>
<td>&gt;2300m</td>
<td>1900-2300m</td>
<td>1500-1899m</td>
<td>1200-1499m</td>
<td>&lt;1200m</td>
</tr>
<tr>
<td>Males &gt;50</td>
<td>&gt;2400m</td>
<td>2000-2400m</td>
<td>1600-1999m</td>
<td>1300-1599m</td>
<td>&lt;1300m</td>
</tr>
<tr>
<td>Females &gt;50</td>
<td>&gt;2200m</td>
<td>1700-2200m</td>
<td>1400-1699m</td>
<td>1100-1399m</td>
<td>&lt;1100m</td>
</tr>
</tbody>
</table>
Table 07

The following table can be used with experienced athletes:

<table>
<thead>
<tr>
<th>Gender</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>&gt;3700m</td>
<td>3400-3700m</td>
<td>3100-3399m</td>
<td>2800-3099m</td>
<td>&lt;2800m</td>
</tr>
<tr>
<td>Females</td>
<td>&gt;3000m</td>
<td>2700-3000m</td>
<td>2400-2999m</td>
<td>2100-2399m</td>
<td>&gt;2100m</td>
</tr>
</tbody>
</table>

**VO₂ max**

An estimate of your VO₂ max can be calculated as follows:

- (Distance covered in metres - 504.9) ÷ 44.73

For an estimate of your VO₂ max enter the Distance covered and then select the 'Calculate' button.

Distance: [ ] metres

VO₂ Max: [ ] mls/kg/min

For an assessment of your VO₂ max score see the VO₂ max page.

**Target Group**

This test is suitable for endurance athletes and players of endurance sports (e.g. football, rugby) but not for individuals where the test would be contraindicated.

**Reliability**

Reliability would depend upon how strict the test is conducted and the individual's level of motivation to perform the test.
Validity

There are published VO\textsubscript{2} max tables and the correlation to actual VO\textsubscript{2} max is high. For an assessment of your VO\textsubscript{2} max see the VO\textsubscript{2} max normative data tables.

COLLECTION OF DATA:

The subjects were selected from the same college who are interested in volleyball and involve themselves in training for the study. In all 7 tests were selected for evaluating the growth and development of endurance abilities of the subjects between 18 to 25 years. To have the difference of data for assessing the development it was decided to organize the test on 75 subjects; 15 in each group; 5 groups in all and the same subjects to be evaluated after a gap of every one month after imparting the training as scheduled. The subjects were tested initially for their growth and development in endurance abilities from February 2010 to July 2010.

STATISTICAL METHODS:

To analyze the collected data the scores are arranged according to the comparison and in sequential order so as to find out the statistical values. The following statistical variables are selected for comparing, analyzing and interpretation of numerical values and basing on which the findings are discussed.

Mean is computed by adding all the scores and then dividing by the number of scores involved. The mean is used in the study to measure the average in growth and development.

Standard Deviation is computed in the study for the measures of variability. Standard deviation reflected the magnitude of the deviations of the scores from their mean.

Correlation is computed in the study to find out the relationship of one variable to another and also to determine the validity, reliability, and objectivity of the tests.
Chapter - III

For testing the null hypothesis for the difference between various sample means the t-Test is used at significance of .05 levels.

For testing the null hypothesis for the difference between sample means, the F-Test is used and also to evaluate the significance of the difference.

The obtained values of the mean, standard deviation, correlation, t-Test, and F-Test are given in the tables below followed by the graphical representation. The graphs and tables interpretation is evaluated sequentially in the growth and development along with the comparison of normal boys to deaf-dumb boys and normal girls to deaf-dumb girls.