EFFECT OF SURYANAMASKAR PRACTICES ON SELECTED PHYSICAL PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES AMONG SCHOOL GIRLS

A Thesis Submitted to Pondicherry University in Partial Fulfillment of the Requirement for Award of the Degree of

DOCTOR OF PHILOSOPHY
IN
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I hereby declare that the thesis entitled, "**EFFECT OF SURYANAMASKAR PRACTICES ON SELECTED PHYSICAL PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES AMONG SCHOOL GIRLS"** being submitted to the Pondicherry University, in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Physical Education in the Department of Physical Education and Sports, Pondicherry University, is a bona fide work done by me under the guidance of **Dr. D. SULTANA,** Professor, Department of Physical Education and Sports, Pondicherry University and that it has not previously formed on the basis for the award of my Degree, Diploma, Fellowship or any other similar title of any candidate of any University or Institution.

(ADHAVAN. S)

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Dedicated

To

My Lovable Family Members

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INTRODUCTION

"Sun salutation can motivate and warm you, even on the darkest, coldest winter day."

Carol Krucoff

Yoga

To begin with it is important to know what we as human beings are and what our life is, under the divine wisdom, the earth has evolved from matter to plant life and then to animal life. Also evolution from animal to man is not final. Right from the stage of evolution the humanity is under the way of dark and light with all the signs of imperfections. To acquire all the qualities of the divine is the final purpose of nature's evolution. For acquiring such a final purpose of divinity, one must be ready for a firm resolution springing from one's heart and such progression can be by experiences of spiritual path.

It is here the yoga hastens progress that can be made in many lives is made in a few years. The meaning of the word yoga in its true sense is to join our external consciousness without true self the divine within our self which is again one everywhere. The word yoga is derivative from the sanskrit root 'Yuj'. The importance is to bind, join, and assign and yoke, to straight and deliberate one's attention on, to use and apply.

It means the correcting of the mind, intellect, the emotions, the will, which yoga assumes, it means a self-confidence of the soul which allows one to expression at life in all its parts regularly.

To develop deep in the yoga is one of the six hundred systems of Indian values. It was by Sage Patanjali's in his standard effort, the yoga sutras involving 195 concise sayings were compiled which details that yoga is a state where all activities of the mind are channelized in one direction and the mind is free from disturbances. **(B.K.S. Iyengar)**

Origin of Yoga

In the recent age, the origin and the source of yoga is not given much importance. However the word yoga' has now become a domestic word. "Historically yoga was more than a particular learning. Yoga, a way of life, a culture and an everyday life which includes not just methods, ideas, but also eating habits, morning ablutions prayer, social communication, and work culture.

Yoga is a rooted wisdom of ethics was the foundation of the special, social, space order which developed in this part of the world-known as India. The genesis and the concept of yoga are traced since ancient times. It was found to have first explained in the great shastras (texts), well-known as the Vedas are the repertoire known to mankind. Such composed scriptures, the Vedas, clarify and control every feature of life, from best reality to all experienced activities. Here, and in much classical literature to follow, is where one can see indication of the origin of yoga. The Vedas themselves were ancient mantras, originally sung in the forests by Rishis (seers) who lived in remote and lead an ascetic life. Hindu tradition itself put the Vedas as early as more than 10,000 years.

Development of Yoga

Evidences of the yogic practices were found since the days of Indus civilisation, such findings are from the many archaeological sites there in. Yoga has been related by many to Stone Age shaman is however there is no effective link except few matches in their methods.

The modern yoga methods are correlated in the Indian philosophy and it has been followed for its religious and divine aspect.

Vedic Period

This era signifying the presence of the Vedas has been found to be followed by the Hinduism. The main purpose the study of yogic principles was to eradicate the imperfections of the mind and to keep the physical body a first to stimulate the power.

Classical Period

The second century consist of patanjali's, which describes the yoga sutra

formation also cover the regulation of classical yoga and helps to train the philosophy of raja yoga.

Post-Classical Period

The eight limbs of yoga well founded in this period are Yama or bubli restraints niyama or special observation of discipline asanas or physical postures, pranayama or proper and controlled breathing.

Modern Yoga

At different periods the acceptance of yoga has increased gradually and individuals dedicating their life for practicing the yoga owing to the awareness of health problem and value of life preferably for preventing disease and wide spread prevalence of infection.

Petals of Yoga

1. Yama — Social Disciplines
2. Niyama — Individual Disciplines
3. Asana — Posture
4. Pranayama — Regulation of Breathing
5. Prathyahara — Withdrawal of Senses
6. Dharana — Concentration
7. Dhyana — Mediation
8. Samadhi — Self-Realization

The Bhagavad-Gita gives description of the period of yoga in the following words. Yoga is neither for the person too much and treats neither exceptionally in sensory pleasures, nor for the person sleeps too much or stays alert too long.

Koshas of Yoga

Allowing to yoga of physiology, the human structure includes of five bodies or sheaths which explanation for the different parts or dimensions of human dimensions of human being by Swami Jnaneshvara Bharati. These five sheaths are identified as:

1. Annamaya kosha — Physical Body
2. Pranamaya kosha — Vital Energy Body
3. Manonmaya kosha — Mental Body
4. Vijnyanamaya kosha — Intellectual Body
5. Anandamaya kosha — Bliss Body

Benefits of Yoga

Physiological Benefits

- Constant autonomic nervous system equilibrium
- Pulse rate reductions
- Respiratory rate losses
- Blood Pressure reductions (of special importance for hypo reactors) Galvanic Skin Response (GSR) rises
- EEG - alpha waves rise (theta, delta, and beta waves also increase during different phases of meditation)
- EMG action decreases
- Cardiovascular efficacy increases
- Respiratory competence increases
- Grip strength rises
- Reaction time improves

Psychological Benefits

- Mood recovers and subjective well-being growths
- Anxiety and Depression lessening
- Hostility losses
- Concentration increases
- Memory develops
- Attention increases
- Learning efficiency develops
- Self-actualization growth
- Social skills rises
- Well-being growths

Biochemical Benefits

- Glucose losses
- Sodium falls
- Total cholesterol reductions
- Triglycerides lessening
- HDL cholesterol rises
- LDL cholesterol drops
- VLDL cholesterol falls
- Cholinesterase rises
- Catecholamine's drop
- ATPase rises

Meaning of Suryanamaskar

In this present era of modern development encapsulated with time constraints, the importance of yoga has taken a fillip and the spread across the world is manifold due to scientific authentication.

'Surya' means the sun and namaskar means bend down in with proper forms and due to its benefits has been acclaimed as the best exercise for all the modern day's ills of assumptive lifestyle. As the sun has been worshipped since ancient times by one and all also it's the symbol of spiritual consciousness. Suryanamaskar stimulates the pingalanadi by the absorbance of solar energy by the body. It contains asanas, pranayama, mantra and mediation techniques also Suryanamaskar channelizes and stabilize the physical as well as mantel stages. There are twelve postures in regular method and the rhythm and energy are the essential that make up Suryanamaskar. This gives energetic body and balance of the mind.

Ways and Guidelines of Suryanamaskar

The yogic request the fresher's to learn the presence of all asanas before easing them and requested to perform the entire schedule. Every posture in Suryanamaskar is intended to attention a specific body movement. The posture follows as the body to be completely relaxed and feet slightly together and keeping the arms along both of the side and eyes closed. Being alert while breathing such

inhaling exhaling the air. Try to look at the chakra which strengthens and channelizes the chakras.

Suryanamaskar which is not only helps to keep the body flexible also helps to channelizing the pineal and the hypothalamus. Suryanamaskar carries good health and make disease's life.

History of Suryanamaskar

The account of Suryanamaskar from 1600 AD to 2006 AD makes and development over the period of Mughal rule. Maratha Dynasty British rule and almost sixty year's independence Samarth Ramdas Swami. Suryanamaskar made an important port in gym training and this training was also constant in the peshva command. However the progress got demised during British rule. The British rule had a different education pattern of India. English language was put in the curriculum and was insisted as the medium of instruction for education.

The tradition sustained even after the princely conditions were combined into independent India. In Maharashtra almost all the schools trained in drill Indian games and Suryanamaskar 1960 the activities are continued and regulated by the limited numbers of students.

Basic Features of Suryanamaskar

The Suryanamaskar consists of five important aspects those are

Physical postures

There are twelve physical postures synchronizing with the signs of the zodiac. Through the sun seemingly travels through universe it passes over each of this holy house in turn and it remains in every zodiac for about thirty days and thought to triumph over every sign as it attains its field. Each posture in Suryanamaskar relates to one these marks of the zodiac.

Breathing

The entire movement of Suryanamaskar from start to finish is coordinated with breathing. Each position is related with inhalation, exhalation and holding the

breath. Nobody is forced to any abnormality, as the breathing relates to the pattern one would usually and normally do in relation to the physical movement. Correct involuntary breathing should follow naturally without any earlier instructions. Though, parts of the exact relationship between movement and breath are given to confirm it is ended perfectly, for it is a main part of the practice. Without organization between the breath and the movement many of the benefits of Suryanamaskar may become effective.

Mantras

Related with each of the twelve postures of Suryanamaskar is a particular mantra. A mantra is a combination of syllables, sounds or slogans, understood by ancient sages, which make sure generally known in India for thousands of years. They are suggestive sounds and complete their power of vibration has subtle, so far powerful and strong effects on the mind and body. These mantras are related with each of the twelve postures of Suryanamaskar for a particular mantra.

Once Suryanamaskar is combined with correct breathing and these bija mantras, the whole mind and intelligence are eager. These bija mantras make the vibration and it is this which produces the energy. Mantras may or may not have exact meanings the vibrations which they form should reach every fiber of one's being. The mantras of Suryanamaskar are strengthened sound.

Awareness

Already attempt to assimilate these mantras with each position powerfully recommend that first perfect the physical movements and organization of breath in Suryanamaskar to improvement the maximum benefits.

Relaxation

This is not strictly a part of Suryanamaskar. It is necessary supplementary practice that should be done without fail on completing rounds. Any relaxation can be adopted, but the best method is shavasana.

Techniques of Suryanamaskar

Suryanamaskar is an ancient meditative technique also called as one kind of yoga which is the skill of solar vitalize. This contains asanas; pranayama, mantras and mudras also contain three aspects procedure and vital energy and regularity. Suryanamaskar consist of 12 postures chanted in particular arrangement which is particular breathing pattern. The benefits of Suryanamaskar are to vitalize and clear the entire system and decreases fat from all [parts of human body and tones each and every muscle.

Suryanamaskar is beautiful attitude in its basic, so there are to physical techniques available and every pose would only take up between 30 – 40 seconds to complete the cycle might not lost for more than 10 minutes and never forget 2 minutes for relaxation.

Development of Suryanamaskar

Suryanamaskar is a sarvasundar vyayam where each limb of the body becomes uniform exercise and is attached with training the mind to focus. The aim of every individual is health is wealth by performing Suryanamaskar daily one can be achieve maximum advantage with minimal anxiety. The spiritual benefit follows the physical and intelligent benefits at much later phase of one's age. Suryanamaskar is the basis in the Rig Veda and helps the rishis to analyses the human body anatomy, circulatory system, digestion of food, respiratory system, nervous system etc. also which helps humans to lead strong and quite life.

Table 1.1

Difference between Slow and Fast Suryanamaskar

S.No	Slow Suryanamaskar	Fast Suryanamaskar
1.	Do in a slow manner	Do in a quick manner
2.	Each of the twelve poses will held for 30 seconds	12 poses will complete with in 2 minutes
3.	Each round took 6 minutes to complete and 5 rounds will complete within 30-40 minutes	Fifteen rounds will exercise in 30-40 minutes

Mental Development in Children

In the science of yoga, there are definite branches that control the functioning behavior and receptivity of the brain. Although the brain is a highly capable instrument of knowledge, this capacity sometimes undergoes periods of recession. In certain cases the brain is working very slowly. In others, the brain is evolved nut dissipated.

Therefore, some children are dull in mind, some are very intelligent, but their thought patterns and processes are dissipated. Also one can find children oscillate at one moment they are very intelligent and in the next moment they become less intelligent and not receptive then will find another category of children are very intelligent and consistent.

Dullness, dissipation, oscillation and one pointed ness are different stages in the evaluation of the human brain. When children are intelligent and consistent, it is important to ensure that they do not regress. When children are sometimes intelligent and sometimes foolish, must see that some kind of unification is but dissipated, finally the tuning or transforming the dull brain into an intelligent brain.

Mantra and Memory

The final point is the problem of memory. Memory is a great problem for children, i.e. the problem of encoding, storage and retrieval. All these processes combined are known as memory. Once solved the problem of memory and it means solving the greatest problem in education. To find a method to improve the child's memory and introducing something truly revolutionary into the educational system is a task to be accomplished. People have tried different methods. But in order to develop the memory, children have to be guided through the path of mantra. The mantra hastens the activation of the subconscious mind and unconscious planes. With the help of mantra in concentration of Suryanamaskar will easily enhance the memory level in children.

Loosening Exercises

Front and Back Bending of Waist

- Inhale, Stretch up the hands and bend back.
- Return to the upright position and stand straight for whereas.
- Exhale and bend frontward.
- Try to dash the ground with praises (don't stress manually, try as much as you can).
- Arise and bend back throughout inhalation.
- Repeat 4 or 5 spells.
- This is exact for waist and spine.
- Don't practice the onward bending - if you have back pain or spine related any other problem.

Side Bending and Twisting of Waist

- Keep the legs about a meter at a distance.
- Increase the hands sideways similar to the ground whereas inhaling.
- Turn to the right till the right hand touches the right heel while exhaling.
- Take the left palm in the air.
- Appearance to the left palm.
- Rise with inhalation.
- Repeat the alike on left.
- Bend with Twisting - Repeat this accepting that the right foot is touched with the left hand and left foot with the right hand.

Twisting the Waist

- Stand straight with hands extent parallel to the ground, feet about 1/2 meter at a distance.
- Keep the legs strong on the ground.
- Rotation to the right.
- Right hand straight forward and left hand twisted at elbow touching the chest.
- Keep exhaling through the twist.
- Come back whereas inhaling.
- Repeat on the left.

- All twisting should be above the waist. Under the waist, continue the body straight and firm. No flexible at the knee joints.
- Repeat and raise the speed.
- Slow down gradually and come to stand still.
- Stand and take rest. Close your eyes for a while and relax your complete body.

Loosening of Shoulder

- Stand straight but relaxed, arms sideways the body takes the right hand back and up. Exchange in anticlockwise direction.
- Slowly increase the speed of turning.
- Return to creative position.
- Repeat with left hand.
- Repeat with both hands calm.

Loosening of Neck

- Stand erect but related, arms beside the body.
- Twist the neck forward and exhale.
- Inhale energies up. keep going back as much as u can.
- Come up gradually to starting position. Repeat this for 4/5 times.
- Turn your neck to left side.
- Bring to straight position.
- Now bend to right and come back to unique.
- Similar ways you can bend your neck for 4/5 times.
- Then you can replace the neck clockwise and anticlockwise.
- Bend your neck forward and replace for 5 times clockwise and the reverse for 5 times.

Suryanamaskar and Mantras

There are 12 mantras with four portions to each mantra. The first part is the chanting of Aum, the second part is the chanting of a 'Bija Mantra', the third part is a part of a Rig Veda the sun has 12 names those are Mitra, Ravi, Surya, Bhanu, Khaga, Pushan, Hiranyagarbha, Marcichi, Aditya, Savitha. There are 3 Rig Vedic chants are used in 12 mantras. The bijaakashara help the chanting feelings in of AUM mantra

which starts from the stomach, heart, brain and the overall body a stimulating the selected chakras digestion, respiratory and sensory action. Also Suryanamaskar engaged as deksha and performing for 41 days in the super image and guru gain loads of spiritual and cosmic energy aspiration and requirements are fulfilled it should be done with grid bakthi.

Sun salutation is one of the supreme combinations of physical movements. Including among 12 postures 6 postures were repetition and performed as 2 cycles complete one round first with right and then left leg. During the performances activates the psychic and carry hormonal balance and completion of Suryanamaskar. The contraction and expansion of chest cavity and to gain flexibility in spinal cord also stimulating the glands and organs.

The basic foundation of asanas which provides its energy and the feet and hands are act like 2 conductors of the battery so the position of hand and feet should not vary when the action (triangle, Z, Plank, Cobra) controls the body from top to bottom. If the smallest change has been occurs in the position of hands and feet's which breaks the flow of nerve current in the body. So abolishing the energizing of the asanas. The 12 salutation of sun daily by vocally or mind at this period chant the mantras through doing the sun salutation one set of salutation contains 2 rounds one with right leg and other one is with left leg. Chant one mantra at the start and every original sequence. Perform the first mantra and so on. The 12 mantras performed as 12 sets of sun salutation also practice less than 12 rounds of sun salutation. Chanting mantras spreads Sun Salutation benefits it has indirect however strong effects on both mind and body. There are 12 mantras which compliment different abilities of Sun and add a deep spiritual touch to the whole practice.

The active exercise is not usually observed as part of yoga practices but it is such a good technique of loosening up all the joints and muscles in the body, as well as manipulating all the internal organs, that it has been involved. It is an excellent workout to do in the morning after taking a bath and before doing any other yoga performances. If sensations tired at any time of the day, this workout will return lost energy, both physically and mentally.

Suryanamaskar is included of 12 positions, each of which relates to one of the 12 symbols of the zodiac. One complete round of Suryanamaskar contains of these 12

positions performed in series twice. Related with each of the 12 positions is a mantra, which for optimal benefit should be constant orally or intellectually.

Table 1.2

Suryanamaskar Mantras

S.no	Pose	Mantra	Meaning
1	Pranamasana(Prayer Pose)	Om Mitraaya Namaha	Who is friendly to all
2	Hasta Uttanasana (Raised arms pose)	Om Ravaye Namaha	The shining one, the healthy one
3	Hasta Padasana (Hand to Foot pose)	Om Suryaya Namaha	Who is the dispeller of dark and liable for brining activity
4	Ashwa Sanchalanasana (Equestrian pose)	Om Bhaanave Namaha	One who lights, the bright one
5	Dandasana (Stick pose)	Om Khagaya Namaha	Who is all permitting, one who moves over the sky
6	Ashtanga Namaskara (Salute with eight parts or points)	Om Pooshne Namaha	Giver of nutrition and satisfaction
7	Bhujangasana (Cobra pose)	Om Hiranyagarbhaaya Namaha	Who has golden color intelligence
8	Parvatasana (Mountain pose)	Om Mareechaye Namaha	The giver of light with unlimited number of rays
9	Ashwa Sanchalanasana (Equestrian pose)	Om Aadityaaya Namaha	The son of aditi the cosmic great mother
10	Hasta Padasana (Hand to Foot pose)	Om Savitre Namaha	One who is guilty for life
11	Hastauttanasana (Raised arms pose)	Om Aarkaaya Namaha	Worthy of praise and wonder
12	Tadasana	Om Bhaaskaraya Namaha	Giver of wisdom and cosmic lighting

It is good to chant the sun salutation mantras with the proper intonations. Learn the correct mantra chanting beside with the video. Comprise these mantras in daily practices of Suryanamaskar and feel a sense of unity with the sun.

Benefits of Suryanamaskar

The body mind spirit combination is may be one of the most important differences that yoga has over other exercises practices. In case of practicing Suryanamaskar or sun salutation in hatha yoga, those benefits are located at the fore front. As well as ability to knowledge those benefits trusts on daily commitment into performing sun salutation exercises.

Suryanamaskar vs. Low Impact Workout

It could be well to consider an exercise routine that can be completed in 10 minutes or less to have good effects. This is the case with Suryanamaskar, which is a low influence exercise that suggestions wellbeing and psychological benefits. It is careful as a low influence workout that that shares the elements of resistance and cardio vascular training into care. Certainly, thing that sets sun salutation distant from the relaxation are pleasure of its benefits does not end at the physical level. It drives outside and into mind where in the results is future success.

Suryanamaskar vs. Other Types of Workout

In relationship to other workout types, Suryanamaskar may be has distant mire health benefits and less health dangers. Meaningful those hazards and benefits are that other workout procedures will help gain a better thoughtful of own security, while at the same time preparing with the knowledge need to select the right workout routine by hand.

While cardiovascular trainings have their own segment of standard benefits, the health community is also awake of the limited to this type of training, for example, the extreme fat burning experience activated by the performance of these cardio vascular trainings stop at the time also training. There are other physical hazards with cardio vascular trainings such as rending or tiring joints in example of resistance training, the benefits are talented growth of muscle mass, fat burning and increase in bone density. It is tender and time consuming.

Physical Benefits

- It stimulates oxygenation of blood, which is good for cardio vascular system.

- It bounces muscles and making them more flexible to avoid wounds.
- It increases digestive function such that body effectively removes all forms of poisons.
- It controls function in endocrine system and all other glands collected in it.
- It tones abdomen that creates a flat stomach and develops bowel movement.

Mental Benefits

- It increases ability to focus and concentrate.
- It allows effectively combating stress, anxiety and overcoming depression.
- It helps the production of serotonin in body, which is responsible for mounting that feel good sensation.
- It stimulates well coordination between mind and body, which is valuable in every day arrangement of communications.

General Benefits

- Tones up the digestive system by the alternative extending and compression of abdominal structures. It initiates digestion and grows clear of constipation and dyspepsia strengthens abdominal muscles.
- Carefully ventilates the lungs, and oxygenates the blood.
- Acts as cleansing agent, by getting clear of vast amount of carbon dioxide and other poisonous gases.
- Tones up the nervous system and increases memory.
- Stimulates sleep and calms anxiety.
- Regulation the activity of the endocrine glands specially the thyroid gland.
- Restores the skin and avoid skin disorders.
- Expands muscle flexibility.
- In women, inspires the breasts to help resolution generally. Returns any lost elasticity complete stimulation of glands and strengthen of pectoral muscles.
- This helps to clear menstrual cycle irregularity for easy child birth.
- Checks loss of hair and gray.
- Helps decrease fat.
- Decrease abdominal status of the Adam's apple.
- Helps to keep the body clean away from the nasty smells.

- Gives exact style and ease of action of the organ.
- Helps to keep the soul of youthfulness forever.
- Widens chest and smartens arms.
- To keep the spine and belly flexible.
- Gives good health strength etc.

Statement of the Problem

The purpose of the study was to find out the effect of Suryanamaskar practices on selected physical physiological and psychological variables among school girls.

Objectives of the Study

1. To analyze the effect of Suryanamaskar with mantras on particular physical physiological and psychological variables among school girls.
2. To analyze the effect of slow Suryanamaskar on particular physical physiological and psychological variables among school girls.
3. To analyze the effect of fast Suryanamaskar on particular physical physiological and psychological variables among school girls.
4. To compare the training effects of the Suryanamaskar practices on physical physiological and psychological variables among school girls and find out the better group from the analyses for health benefits.

Delimitations

The study was delimited to the following factors

1. The subjects of the study were confined sixty school girls were selected randomly from Jothi Vallalar Higher Secondary School, Periyakalapet at Pondicherry.
2. The subjects were divided into four equal groups namely experimental group I (SNWMG= 15) underwent Suryanamaskar with mantras, group II (SSNG= 15) underwent Slow Suryanamaskar, Group III (FSNG= 15) underwent Fast Suryanamaskar and Group IV served as control (CG= 15).
3. The age limit of the subjects should be between 12 to 14 years.
4. The following dependent variables selected for this study were BMI and Flexibility (Physical variables), FVC, FER, PER, FEV1 and Endurance

(Cardio Respiratory) (Physiological variables) and memory meaningful and meaningless (Psychological variables).

5. Suryanamaskar with mantras, slow and fast Suryanamaskar practices were only considered as independent variables.
6. The duration of the training period was twelve weeks and five sessions per week.

Limitations

The study was limited for the following

1. No effort was put in to find out the effect of environmental changes during pre and post tests and the training period.
2. Though the subjects were motivated verbally, no attempt was made to differentiate their motivation level during testing and training period.
3. The quantum of physical exertion, life style and physiological stress and other factors that affect the metabolic functions were also considered as limitations.
4. Previous experience in training was not considered.
5. The test and reading were taken as the normal room temperature.

Hypotheses

The researcher had gone through various related research studies completed on this area. Based on the available literature, keeping the above logical concepts, the following hypotheses have been formulated. It was hypothesized that

1. There would not be any significant improvement on selected physical variables due to the effect of Suryanamaskar practices.
2. There would not be any significant improvement on selected physiological variables due to the effect of Suryanamaskar practices.
3. There would not be any significant improvement on selected psychological variables due to the effect of Suryanamaskar practices.
4. There would not be any significant difference on Suryanamaskar practices between the experimental groups and control group.

Meaning and Definition of the Terms

Yoga

Yoga is the union of the individual self with the universal self. The word "yoga" comes from the Sanskrit root yuj which means "to join" to "to yoke". **(Iyengar, 2001)**

Yoga consist of physical and mental discipline, with control of breath and all other function practiced in order to attain one period concentration of mind, spiritual union with the supreme. **(Ashok Majumdar, 1999)**

Suryanamaskar and Mantras

Suryanamaskar is a form of sun worship and can trace its origin back to the Veda's. The literal meaning of Suryanamaskar is salutation to the sun. Suryanamaskar consists of 12 different postures and is done along with chanting of mantras in every posture. Suryanamaskar is traditionally performed on empty stomach at sunrise which is considered the most spiritually favorable time and facing the rising sun. **(Anamika.S, 2013)**

BMI (Body Mass Index)

Body mass index is derived from body mass related to stature, to assess the normally of one's body weight. **(Mc Ardle and Katch, 2006)**

Body mass index is the ratio of body weight/ height2. **(Robergs and Roberts, 2000)**

Flexibility

Flexibility can be defined as the range of motion in a joint that refers the ability of the muscles and tendons to elongate within the limitation of that joint. **(Birch and George, 2005)**

FVC (Forced Vital Capacity)

The amount of air can be powerfully exhaled from the lungs after taking the deepest breath possible. **(www.topendsports.com)**

FER (Forced Expiratory Rate)

The flow of air from the lungs during measurement of forced vital capacity. **(www.topendsports.com)**

PER (Peak Expiratory Rate)

Peak flow meter, a small, hand held device used to monitor person ability to breath out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways. **(www.topendsports.com)**

FEV1 (Forced Expiratory Volume in the One Second)

FEV1 is the maximal amount of air can forcefully exhale in one second. **(www.topendsports.com)**

Endurance (**Cardio Respiratory)**

Cardio respiratory endurance can be defined as the functional efficiency of the heart and lungs. The functional efficiency is defined as the success of the heart, blood vessels and lungs in satisfying the oxygen requirements of the body. **(Sinha, et.al. 2010)**

Memory

Memory is the means by which we draw on our past experience in order to use this information in the present. **(Sternberg, 1999)**

Significance of the Study

1. This study will help to identify the appropriate methods among the types namely, Suryanamaskar practices, to improve the selected physical, physiological and psychological abilities of BMI, Flexibility, FVC FER, PER, FEV1, endurance (cardio respiratory), memory meaningful and meaningless.
2. The result of this study will be of immense help to the yoga instructors, physical education teachers, fitness trainers and coaches to frame or modify the existing schedule of practices.
3. The result of this study will be addition to the existing knowledge in the field of Suryanamaskar practices.
4. The result will be further helpful to those people who have very less infrastructure of other facilities.

REVIEW OF RELATED LITERATURE

Chapter II

REVIEW OF RELATED LITERATURE

Need For Related Literature

Today yoga as based on the systematic facts and values. All should identify then even physical work essentials capacity and not everybody can do such work. So that one can display his activities permitting to his physical functioning capacity exercise will positively make physical physiological and psychological modifications in human body.

Study of the related literature indicates finding evaluation and assessing reports of unplanned observation and research estimation those are related to individual research reports.

Studies on Physical Variables

Milind V. Bhutkar, et al., (2012) conducted the effect of sun salutation on muscle strength and endurance of the body composition and there were 79 subjects were performing sun salutation of 24 cycles the duration of training was 24 weeks 6 days per week. The muscle strength was resolute by 1 repetition maximum will be (1 RM) using bench press and shoulder press technique strength of leg and back muscles were measured by back and leg dynomonometer**.** General body endurance was assessed by push up and sits up test. Body composition was calculated by considering % body fat using Brog scale. By using bench press training the muscle strength were indicated significant increases in male (29.49 ± 9.70 to 36.12 ± 9.09 Kg, P< 0.001) and female (10.5 ± 4.42 to 13.16 ± 4.44 Kg, P<0.001) subjects. Strength by shoulder press similarly increased (males; 22.96 ± 9.57 Kg to 26.53 ± 11.05 Kg, P< 0.001, females; 6.83 ± 2.78 to 8.83 ± 3.87, P< 0.001). Endurance by push-ups and sit-ups presented similar results in male (19.0 ± 9.58 to 21.98 ± 8.98, P<0.001 and 24.92 ± 10.41 to 29.84 ± 12.64, P<0.001 respectively) comparing to female (14.66 ± 6.80 to 18.56 ± 6.97 and 13.16 ± 7.75 to 19.23 ± 8.25, P<0.001 respectively) subjects. Notable decrease in body fat percent was experimental only in female (27.68 ± 5.46 to 25.76 ± 4.72, P<0.001) but not in male subjects. Body mass index however reduced in

both the groups (z=4.37, P<0.001 and t= 5.41, P<0.001 respectively). Also strength of the subjects were calculated by shoulder press similarly increases.

Chidambara. S Raja. (2012) examined the effect of yogic practices on flexibility, total cholesterol and blood pressure. For this research thirty male students were selected expect physical education and fine arts at Annamalai University in the age of 18 to 25 years old. They were divided into 2 equal groups each group involved of fifteen subjects and the group I took part in yoga practices and group II act as control group and this group does not involved in any special training. The training period for this study was examined for flexibility, total cholesterol and blood pressure (systolic and diastolic). Using the Boehringer Mannhein Kit Method taking 5 ml of blood and blood pressure was assessed with the help of sphygmomanometer. The study reveals that the yoga practices group achieved the flexibility and blood pressure.

Gauri Shankar & Bhavita Pancholi. (2011) identified the effect of Suryanamaskar and yogic practices on a resting pulse rate, blood pressure, flexibility and upper body muscle endurance. From the Suman deep Vidyapeeth University were selected 80 subjects and were divided into 2 groups male and female the age of each subject is between 18 – 40. The subjected were suggested to perform 2 Suryanamaskar sequence daily for 10 minutes each followed by rest for 5 minutes duration of the training was 2 weeks. The post hoc test showed a significant increases in flexibility and the push-ups and decreasing the blood pressure of yoga group and few an in control group. Suryanamaskar is active in increasing hamstring flexibility and enlightens upper body muscle endurance and helps to decrease the blood pressure.

Shivesh Shukla. (2010) examined 30 female students were randomly selected and the age of the student were between 14 – 16 years and to measure the effect of Suryanamaskar practice on the body composition of female students and calculated by body fat percentage by skin fold caliper at the biceps, triceps, suprailac and subscapular. The duration of investigation was 6 weeks and 5 days per week in every 30 minutes. The ratio has been analyzed and which gives the valuation to body composition chart by using JVGA Durnin and MM Rahaman paired‘t’ test and the result has been valued and the significance 0.05 level and The’t’ value has differentiate between experimental group and control group were 0.18 which is less

than the essential value 2.14.The obtained value‘t’ value for the experimental group by using pre and post mean value is 0.10 which is essential value of 2.14. Secondary for the control group. The‘t’ value was 0.40 there is also less than the essential value 2.14.This shows that they are having nearly closer value in percentage of fat and body composition. The‘t’ value of the pre and post value mean of the experimental group and control group was 0.05 level. This indicates that the investigation difference between experimental and control group and may be credited for the fact that the selected age group have the fat percentage of very low level and dynamic participant have confused value. This implies this Suryanamaskar practice shows no effect on the body composition of female students.

Shenbagavalli. A & Divya. K. (2010) conducted the effect of specific yogic exercise and combination of specific exercise with autogenic training programme and physiological variables such as pulse rate and vital capacity, percent body fat, psychological variables such as job anxiety, occupational stress and biochemical variables such as HDL, LDL and fasting blood sugar of the college male students. 60 male subjects were selected the age of the subject were between 20 to 30 years old from the Alagappa University and they were randomly selected and assessed as the subjects for the purpose of this study and random group continuously specific yogic exercise and combination of specific yogis exercise and autogenic training group. The 60 subjects were divided into 3 groups those are experimental group I directed by specific yogic exercise and experimental group II consist of specific yogic exercise and with autogenic group and control group these groups were subjected to pre and post test prior to the experimental treatment. The experimental groups contributed in their respective duration of 12 weeks, six days in a week throughout the study. Analysis of covariance (ANCOVA) was insisted to conclude the significant of mean difference between the three groups. When F ratio was found to be significant the Scheffe’s post hoc test was applied to test the importance of pairs of the adjusted final group means. Practice of the combination of particular yogic exercises with auto genic training and particular yogic exercises programme is relevantly effective in promoting required changes in the dependent variables.

Betsy Donahoe Fillmore, et al., (2010) examined the effects of yoga intervention on balance, flexibility and strength in adolescent girls between 14 to 18

years through yoga is being promoted to all ages and for a suitable sample 33 female adolescent joined in yoga training twice in a week and walking programme thrice in a week. The duration of training programme was 7 weeks the trainer lead led the group and instructed by a registered yoga therapist by a person by watching a tape the trainer led started session per and post measurements of weight and hamstring flexibility, body fat, strength and balance were together. The mean were calculated by using all the variables Levine's test for equality of variances were run to determine baseline uniformity. Repeated measures general linear model tests were conducted to test for both within and between subject's factors, as well as relations between the two. Data were normally distributed and groups were not significantly different at baseline (P_ 0.05). There was a statistically significant within subject difference (pre and post test) for range of motion right (P_0.034) and range of motion left (P_ 0.036) as measured by the 90/90 hamstring flexibility test. There were no statistically significant differences between the trainer and video led group for any of the measured variables. Yoga may be a useful addition to therapy programs and deliver a method to keep this age group promoted in exercise.

Choudhary. R & Krzysztof Stec. (2010) determined the effect of dynamic Suryanamaskar on the flexibility of selected physical education students from Banaras Hindu University, Varanasi. The purpose of this study was performing by selecting the dept. of physical education BHU. A total of 20 male students were nominated and used as one practice group. Dynamic Suryanamaskar was measured the independent variable and flexibility was measured the dependent variable. Test was for flexibility. The repeated measures design was used for this study. Same group 20 participants were produced. Tests were organized in equal rests of two weeks. The tests started four weeks earlier to the dynamic Suryanamaskar (DSN) treatment and took place every two week thereafter, for a total of three times. Tests took place every two weeks during the treatment and after the conclusion of the treatment, they were sustained for the following of four week period. To examine the effect of dynamic Suryanamaskar on flexibility of selected physical education students at Banaras Hindu University, Varanasi, one-way ANOVA was utilized at 0.05 level of significance. In connection to flexibility a significant ($p< 0.05$) effect of dynamic Suryanamaskar was originate.

Raju P. S, et al., (2003) evaluated the lung functions and comparison of Indian boy 1555 normal healthy students from Hyderabad city. The age of the group was 5 to 15 years old. The anthropometric factors such as height, sitting height, weight and chest circumference were measured and body surface area (BSA) and percent body fat (% Fat) were divided. The lung functions studied were FEV1, FVC, FEV1% and PEFR. The height, sitting height, weight, BSA, Chest circumference, body fat as well as FEV1, FVC, FEV1%and PEFR were equivalent with Indian boys. The height for age, weight of age and weight for height was found to be lower than 50^{th} percentile of NCHS standards in the students calculated. Likewise the lung function ideals of the subjects found to be lower than the ideals of conforming western people. Regression equations were resulting to calculate FEV1, FVC and PEFR by physical appearances. Height, chest circumference and fat free mass were the best analysts for FEV1, FVC and PEFR. Age, height, sitting height, weight, chest circumference and fat free mass indicated significant relationship with lung functions.

Studies on Physiological Variables

Madanmohan & Ananda Balayogi Bhavanani. (2013) studied the impact of the Suryanamaskar on physiological functions. Suryanamaskar is an integral part of yoga practice and consists of a sequence of movements coordinated with deep breathing. While a number of trainings have been reported on the beneficial effects of yoga training, there is no report on the effect of Suryanamaskar training on pulmonary function, respiratory pressure and hand grip strength. So they decided to steady the effect of Suryanamaskar training on forced expiratory volume, forced expired volume in first second, peak expiratory flow rate, maximum expiratory pressures, maximum inspiratory pressure and hand grip strength and hand grip endurance. 42 school children in the age group of 12 to 16 were randomly divided into two groups of 21 each. Group I was skilled in Suryanamaskar for 6 months while group II formed the control group. In both the groups the above stated parameters were planned before and after 6 months of the study period. In group I subjects, peak expiratory flow rate, maximum expiratory pressures, maximum inspiratory pressure, forced expiratory volume and forced expired volume in the first second increased relatively following Suryanamaskar training. Hand grip strength and hand grip endurance also increased significantly after the training. On the other hand, in the control group there was in

significant in these parameters. Hence it was recommended that Suryanamaskar be used as an effective and in expensive method to improve pulmonary functions and general health of adolescent school children.

Tamal Chakraborty, et al., (2013) studied the effect of simple yogic exercise programme and selected pulmonary function test of forty elderly individual of both gender. The age was between 50 – 70 years, with no active medical disorders. The study was conducted at a selected yoga center in Siliguri town of Darjeeling district of West Bengal. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow rate (PEFR) were measured once primarily and again after six weeks of yoga training under direction of a certified yoga instructor. Two instruments were used; a) vitalograph gold standard spirometer, b) wright's peak flow meter. There was certain improvement of ventilatry functions as shown by significant increase in FVC, FEV1 and PEFR that was valued after six weeks.

Sinha Biswajit, et al., (2013) conducted the Suryanamaskar (SN) a popular tradition Indian yogic practice called 'Sun salutation' contains twelve physical postures and backward and forward bending postures. The practice of twelve postures in sequence makes one round of its practice. Many people practice it as part of their daily physical fitness program. No study is available to compare cardiorespiratory reactions of Suryanamaskar with bicycle exercise (BE). Hence 20 healthy Yoga trainers practicing various yogic practices including Suryanamaskar since last 7-8 years were taken for study. They performed Suryanamaskar in the laboratory according to their normal daily practice routine. The subject also completed incremental load bicycle exercise test till exhaustion on their second visit for measuring their VO2 max. Suryanamaskar and BE were related at three similar exercise intensity levels in terms of % of VO2 max. The exercise intensities were light (10-20% VO2 max), moderate (21-40% VO2 max) and high intensities (41-50% VO2 max). Heart rate at high work intensity was significantly higher in bicycle exercise than Suryanamaskar ($P<.001$). Ventilation and carbon dioxide output were significantly higher in bicycle exercise than Suryanamaskar at high exercise intensity ($P<0.001$). Whole, cardiorespiratory stress is less in Suryanamaskar than bicycle exercise.

Baljit Singh Sekhon & P. V. Shelvam. (2013) assessed the result of physical activity on selected bio-motor variables among university male students. To realize this resolve of the research 30 male students were selected as focuses that were from the several departments, Nagaland University, Lumani. The age of the selected focuses was 18- 25 years. They have been divided into 2 groups each group consist 15 members. Group I undertook yogic exercise programme and group II performed as control did not participate in any training programme. The subjects were confirmed on selected standard variables such as agility, strength and endurance prior to any instantly after the training period. The selected standard variables such as agility were calculated by shuttle run based on the bent knee sit ups the strength was calculated. Based on the 12 min running and walking the endurance was calculated. The estimated covariance was used to find the important changes between the experimental and control group on selected standard variables individually. From all the circumstances 0.5 level of confidence were fixed for the measurements. The result of the current research shows that there were important differences has been occurred between the experimental group and control group on agility, strength and endurance.

C. K Ewart. (2012) conducted the effect of three months yogic practices on ventilatry functions. Sixty healthy male volunteers (age ranged 21 to 33 years and height of 178 ± 3.52 cm) drawn randomly from BSF personnel joined in the study. Participants experienced yoga under supervision of professional yoga instructor two hours daily five days a week along with their daily routine events. Standing in height, weight and dynamic lung function tests are forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and maximum voluntary ventilation (MVV) were valued before and after three months of yoga training. Tiffeneau index (TI) was planned before and after the thought training. After three months of yogic practices there was in significant change in body weight with a tendency of reduction. MVV increased significantly ($P< 0.01$) while the other factors are FVC, FEV1 and TI did not variation significantly. Increase in MVV indicates that yogic practices promote the pulmonary capacity of expert which can help in enhancement of ventilatry functions.

Fareeda A Balikai, et al., (2012) examined the research works has been done to show the positive effects of yoga. Hence the primary objectives are about the effect of nadi shodhana pranayama (NP) and Suryanamaskar (SN) on pulmonary functions

(PFs). The secondary objective is the relationship between the effects of two. 50 young healthy students (male and female) aged between 18 to 24 years of Government of Ayurveda Medical College, Mysore were skilled daily for 3 months. Students were divided into two groups of 25 each. Group I students practicing NP, 20 cycles for 20 min, Group II students practicing Suryanamaskar, 10 cycles for 20 min. record of pulmonary functions are vital capacity (VC), forced expiratory volume at the end of first second (FEV1), peak expiratory flow rate (PEFR) and Maximum voluntary ventilation (MVV) were carried on electronic spirometer 'MEDSPIROR' and respiratory rate was observed clinically at the end of each month and after three months of training. Results presented perfection in all pulmonary functions and a significant decreases in respiratory rate in both the groups but a statistical marked improvement was observed in VC, FEV1and PEFR in Group I compared to Group II present study reveals that practicing of both NP and Suryanamaskar for a short period can produce significant improvement an all pulmonary functions by increasing respiratory muscle strength and endurance.

Vinayak. P. Doijad & Anil. D. Surdi. (2012) determined the yoga is deliberated to be a very good exercise for maintaining good health and also has a deep effect on the lung functions. The present work was done to find the effects of pulmonary function test using short term yoga practice was conducted on 60 students, (40 boys and 20 girls) who approached voluntarily as subjects for the scheme with written agreement. It was a group study on I M.B.B.S. students, 60 in number (40 boys and 20 girls).Their age ranged between 18 to 20 years. Many pulmonary function tests were measured. The instrument used was 'MEDSPIROR' Pneumotachometer. FVC, FEV1 %, MVV and PEFR were creating to be high in both boys and girls students. From this study it was determined that the yoga training has been promoted to increase the respiratory efficiency for healthy individuals as well as different therapy or as assistant to conservative therapy in respiratory diseases.

Divesh Chaudhary & Mohammad Ahsan. (2012) assessd the effect of yoga training on physiological characteristics of college students. Another purpose of the study was to increase the physiological level of under graduate students.30 students were selected randomly from under graduate students of Shri Ram College, Muzaffarnagar (U.P). Standard and advanced conditions administrative physiological variables (Lung Capacity, Vital Capacity, Blood Pressure and Pulse Rate) were

measured for the valuation of yoga training program. To find out the result of yoga training programme on physiological characteristics of under graduate college students't' was used as statistical tool. The level of significance was at 0.05. The result exposed that there was significant ($p<0.05$) effect of yoga training on physiological characteristics of college students. Exercise of selected yoga training program also assisted to improve physiological characteristics of college students.

Sasikumar. A, et al., (2011) conducted the effects of Suryanamaskar and yogic practices. Through increasing scientific research in Suryanamaskar and yoga beneficial aspects are travelled in varied angle. In yoga the sun is showed by suryanadi the pranic station which carries the dynamic life giving force. Suryanamaskar is the co-ordination of asana and pranayama. Suryanamaskar has been combined into physical education in many public and private schools across the country. The ultimate goal is to develop the physical health and increase the capacity of sportsmen with real cardio-respiratory efficiency. This research was designed to estimate the effects of a 45 days daily practice of Suryanamaskar on blood pressure (BP), heart rate (HR), respiratory rate (RR), forced vital capacity (FVC) and peak expiratory flow rate (PEFR) in school students of both gender's. 115 school students aged 10 to 14 years were engaged for the research. The students were trained to perform Suryanamaskar for 45 days study period. The cardio vascular and respiratory factors BP, HR, RR, FVC and PEFR were measured before and after practice of Suryanamaskar. The results shown that the systolic blood pressure, PEFR and FVC increased significantly and RR, HR and diastolic blood pressure decreased significantly later the practice of Suryanamaskar. The positive effects of Suryanamaskar can be useful to all schools to improve the physical health and sports activities of the students.

Balasubramanian. K, et al., (2011) studied the yoga plays a main role by getting the beneficial effect in asthmas, diabetes, hypertension and respiratory difficulties. Some yoga has both defensive as well as remedial values. Positive controls in the life style of the people can be carried through Yoga. Yoga can make them mindful of their body and promote make them understand the need of sensitive and physical wellbeing. The present research has been mainly planned to find out the effect of selected yogic practices and physical training on motor ability and

physiological variables of college men. To achieve the purpose of this study, the experimental design, the subjects, the standard variables and test of measuring them and their variables and procedures to apply them have been scientifically presented. Thirty subjects were selected randomly from the Alagappa arts college in Karaikudi. For the study the normal age of the students was 18 to 21 years. The selected students were more divided randomly into three group's namely yogic practices physical training and control groups. All the subjects were normal and strong students; the sample was measured as the true descriptive of population. The each group has a 10 numbers.

Bhagirathi. (2011) investigated the effect of yoga on selected physiological variables (resting heart rate, respiratory rate, blood pressure, vital capacity and peak expiratory flow rate) of school girls living in most dirty and least polluted areas of Bhopal city. This research will be helpful to the student to improve his/her health along with control of various emotions like love, anger, affection, and greediness that deliver strong control over body and mind particularly to overcome most of dangerous diseases like Insomnia, Arthritis, Asthma, Blood pressure (Low/High), Diabetes, Depression, Fatigue and Nervousness etc. 500 girls were randomly chosen from St. Joseph's Convent School, Bhopal, their age ranged 12 to 16 years and they were split into two groups. 250 girls from more polluted area and 250 girls from least polluted area of Bhopal. Pre-test and post-test of the selected physiological variables have been taken during the course of research study. They have gone together and attended the yoga classes in their school. The post-tests have been taken two times at the end of fourth and fifth month by trained doctors under the observation of the expert. Lastly the results were taken and understood that the yoga exercises were most beneficial for girls because it practically found major improvement in all respiratory functions i.e. peak flow expiratory volume, respiratory rate, vital capacity, resting heart rate, blood pressure (systolic and diastolic), height, weight and body mass index during post test I and post test II. Only the vital capacity and respiratory rate of subjects has been originated insignificant during post test I at the specific level of significance.

Ahmed Q. R, et al., (2010) examined the short term practice of yoga (30 and 60 days) for an hour day-to-day can improve the respiratory function. Male subjects (n= 50, age 30 to 50 years) were randomly selected respiratory parameters (FVC,

FEV1, PEFR, FEF (25 – 75%) and MVV) were resolute by using a multifunctional high tech spirometer. Yoga (posture and pranayama) practice for a month is given no significant improvement in pulmonary parameters. However, when the subjects constant it for next 30 days, i.e. after 60 days significant changes were eminent in FVC ($p< 0.01$), FEV1 ($p< 0.01$) and PEFR (0.05). the result also exposed in 30 days yoga training caused in a significant increases in FVC in elder group of people (age 41 to 50 years) where as in younger group (age 30-40 yrs.) the variations were not so prominent. This result indicates that a short term (30 days) yoga practice rapidly improves respiratory functions in moderately elder people (age 41-50 yrs.), when many of them in our tropical country undergo in a primary level of respiratory problem. Regular practice of yoga (posture and pranayama) can be preventing it by increasing the ability of respiratory muscles.

Pratima M. Bhutkar. (2008) determined the modern era the medical groups are having so, much enthusiasm towards yoga Suryanamaskar is a part of yogic exercise or training and it's thought to be consist of all round exercise. The recent research has tested inefficiency of regular training of Suryanamaskar on improving the cardio respiratory endurance fitness. Form this study we concluded that Suryanamaskar training which could improve the cardio respiratory efficiency for the patients as well as healthy individuals.

Sinha B. (2004) conducted the Suryanamaskar exercise contains 12 postures which are practiced by some of the yoga practitioner. The present research was undertaken to observe analytically the energy cost and different cardio respiratory changes during the practice of Suryanamaskar. 21 male subjects from the Indian army practiced yogic exercises for six days in a week in three months. The yogic practice program consisted of hatha yogic asanas (28 min), pranayama (10.5 min) and meditation (5 min) at first yoga training programme practiced the kapala bhathi for 2 minutes than the yoga mudra for 2 minutes after the rest till oxygen consumption and heart rate (HR) came to resting value. Subjects implemented Suryanamaskar for 3 min 40 seconds on a normal. After three months of training at the beginning of the fourth month subjects performed whole yogic practice program in the laboratory as they practiced during their training period and experiments were accepted their pulmonary ventilation, carbon dioxide output, oxygen consumption, heart rate and other cardio respiratory parameters were calculated during the real practice of Suryanamaskar. The

oxygen consumption was maximum in the eighth posture (1.22 ±0.073 1 min) lower in the first posture (0.35±0.02 1 min). Total energy cost during the practice of Suryanamaskar was 13.91 kcal and at an average of 3.79 kcal / min. through practice highest heart rate was 101 ± 13.5 b.p.m. as an aerobic exercise Suryanamaskar appeared to be perfect as it involves both static stretching and slow active component of exercise with ideal stress on the cardio respiratory system.

Studies on Psychological Variables

Amit Kauts & Neelam Sharma. (2012) investigated the concentration means fullness unity, balance. It is the concentrating of attention upon a specific object. Memory is an aptitude to recollection or remembers past events or previously learnt evidence or abilities. The process of concentration of attention and a power of recalling (memory) are the major causes in knowledge. By the yogis improvement of concentration and memory power has been observed. The main objective of the research was to evaluate the influence of yoga component on concentration and memory. For the research 800 adolescent were selected among 159 were highly stressed and 142 were having low stress students were selected on the center of scores achieved through stress battery. Experimental group and control group was known pre test to evaluate their concentration along with short term memory. A yoga component involving of yoga asanas, pranayama, meditation and prayer a value of coordination programme was controlled on the experimental group for 7 weeks.

Ghanshyam Singh Thakur, et al., (2011) examined the self-control training on thirty normal subjects of both genders (mean age 25.83±3.41 years) were taken in a self-control training group and were tested for three types of Nostril breathing practices and Breath Awareness (BA) effects. Namely verbal memory presentation of numerical data such as Digit Span Forward (DSF) and Digit Span Backward (DSB) as well as associated knowledge memory functions by Wechsler Memory Scale. The interferences included Right Nostril Breathing (RNB), Left Nostril Breathing (LNB). Alternate Nostril Breathing (ANB) and Breath Awareness are taken for the duration of 30 minutes daily. The repetitive measure ANOVA analysis shown a significant increase in both DSF and DSB memory performance due to RNB at $P<0.001$ level and increased DSB score due to ANB at $P<0.014$ level with a non- significant

increase due to LNB proposes that the RNB helps both DSF and DBF memory performance. Though, the LNB effect on left hemisphere helps to return the memory function of right hemisphere. This research completes that the RNB increases numerical data recovery mostly as a result of left brain stimulation.

Visalakshi N. & Thenmozhi S. (2011) evaluated the response inhibition and the process of brains recognition capability participants were unmediated at the time of testing period expensive functions and attention. The test consist of letter cancellation, digit vigilance trials tasks and control of oral word association and the test of animal name, also consist of go and go test, stop signal test, N back test, verbal and visual test. The statistical analysis concludes that there was important difference in the expensive function between the children with LD, children with LD- ADHD and children without LD and ADHD also there is no significant difference in the expensive function between children with LD and children with LD-ADHD.

Rangan R. et al., (2009) conducted the memory is more related with the temporal center than other cortical areas. The spatial and verbal are two main models of memory. Which relay to right and left of the hemisphere of the brain. Many researchers having beneficial effect of yoga on memory and temporal functions of the brain. The main goal of the research was to differentiates and compare the effect of on Guru Kula Education System (GES) with a school by the Modern Education System (MES) on memory. Forty nine boys were selected and the age of the boys between 11-13 years were selected from each of two residential schools. One MES and other GES, undergone if quality and daily practices. The same boys were matched in the socio economic status. The GES educational database is based on yoga modules while the MES delivers a conventional modern education programme. Memory was evaluated by means of standard spatial and verbal memory tests related to Indian conditions before and after an academic year. The present research reveals that the GES accepting total personality development accepting yoga way of life is more active in improving visual and verbal memory scores than the MES.

METHODOLOGY

Chapter III

METHODOLOGY

This chapter deals with the procedure followed in the selection of subjects, selection of variables, instrument reliability, tester and reliability of data, orientation to the subjects, experimental design, pilot study, training programme, description of Suryanamaskar, test administration, collection of data and statistical procedures applied for analyzing the data.

Selection of Subjects

The purpose of the study was to find out the effect of Suryanamaskar practices on selected physical, physiological and psychological variables among school girls. To achieve this there were 60 school girls were selected randomly from the school of Jothi Vallalar Hr. Sec School located at Peryiakalapet, Puducherry. The age limit of the subjects was ranged from 12 to 14 years the selected subjects were divided into three experimental groups and one control group. Each group consists of 15 subjects and named as Experimental group I, II, III and control group. Experimental group I underwent Suryanamaskar with mantras (SNWMG), Group II underwent slow Suryanamaskar (SSNG), Group III underwent fast Suryanamaskar (FSNG) and Group IV served as control group (CG). The experimental groups underwent the training for a period of 12 weeks for 5 sessions per week.

All the subjects were informed about the nature of the study and their consent was obtained to cooperate till the end of the experiment and testing period. The subjects were withdraw their consent and they felt discomfort during the period of their participation but there were identified no dropouts.

Selection of Variables

The goals of practice may be directed towards the increase in physical, physiological and psychological variables. The investigator had gone through the relevant literature and its various aspects in association with the guide and other experts in this area. The variables were selected after considering the feasibility and availability of proper techniques and instruments. In this experimental study, three

experimental (SNWMG, SSNG and FSNG) groups with different practices were given while one group was kept as control group to assess the difference.

Hence, the following independent and dependent variables were selected an d are presented below.

Independent Variables

1. Suryanamaskar with Mantras
2. Slow Suryanamaskar
3. Fast Suryanamaskar

Dependent Variables

a) Physical Variables

i) Body Mass Index (BMI)
ii) Flexibility

b) Physiological Variables

i) Forced Vital Capacity (FVC)
ii) Forced Expiratory Rate (FER)
iii) Peak Expiratory Rate (PER)
iv) Forced Expiratory Volume in the First Second (FEV1)
v) Endurance (Cardio Respiratory)

c) Psychological Variables

i) Memory Meaningful
ii) Memory Meaningless

Instrumental Reliability

All the instruments used for this study were reliable and consistent. Tanita body composition, Sit and reach box, Peak flow meter and Stopwatch which are available in the Department of Physical Education and Sports, Pondicherry University, Puducherry and Memory drum were also available in the Department of

Psychology, Pondicherry University, Puducherry. The reliability was also established by test - retest method.

Tester Reliability

Three months before the commencement of the pilot study, the reliability of data was established by using 10 subjects at random. To ensure reliability, test and retest method was executed. In between the test and retest, one day rest was given to all the subjects. The same testing personnel by using the same equipment's under identical conditions tested all the various tested all the various investigations twice they have been subjected and the intra class coefficient of correlation used to find out the reliability of the data and the result which are given in table 3.1.

Table 3.1

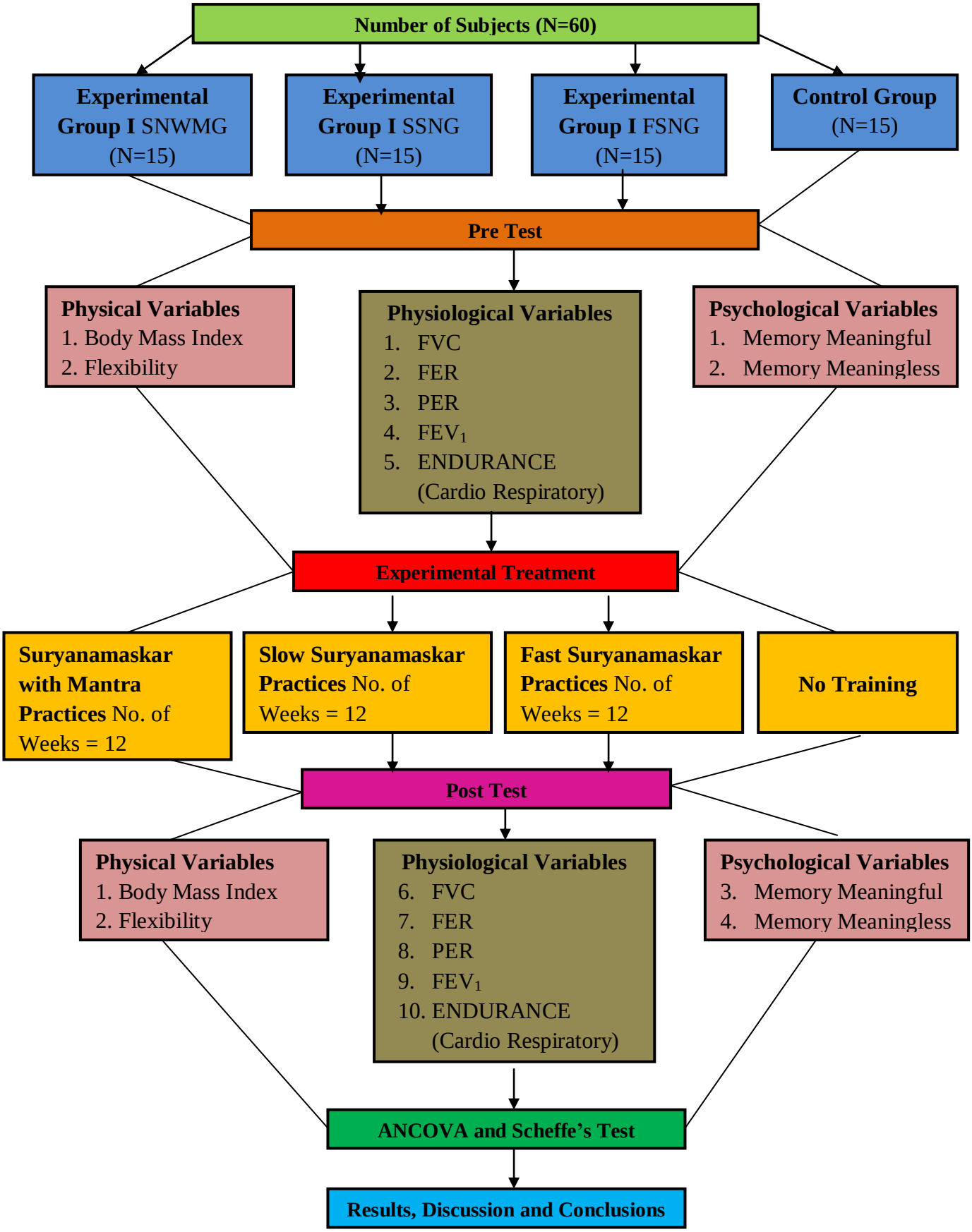
Intra Class Co-Efficient of Correlation on Selected Variables

S.No	Variables	'r' value
1	Body Mass Index (BMI)	0.89*
2	Flexibility	0.81*
3	Forced Vital Capacity (FVC)	0.93*
4	Forced Expiratory Rate (FER)	0.93*
5	Peak Expiratory Rate (PER)	0.93*
6	Forced Expiratory Volume in the One Second (FEV1)	0.93*
7	Endurance (Cardio Respiratory)	0.89*
8	Memory Meaningful	0.92*
9	Memory Meaningless	0.92*

Orientation of the Subjects

The investigator explained the purpose of the training programme and explained the involvement of the subjects. Before the commencement of the training programme, the Suryanamaskar practices were thought to Group I, II and III. The session was spent on five days to practice the techniques. This helped them to perform the training perfectly by avoiding injuries.

FLOW CHART SHOWING THE METHODOLOGY



Experimental Design

For the purpose of the study 60 girls were selected randomly from Jothi Vallalar higher Secondary School, Periakalapet, Puducherry. They were in the age of 12 – 14 years. The selected 60 subjects were divided into four groups each group consist of fifteen subjects. Group I were trained Suryanamaskar with Mantras, Group II were trained Slow Suryanamaskar, Group III were trained Fast Suryanamaskar and Group IV acted as the control group. All the subjects were tested on selected physical, physiological and psychological variables and they participated in the research voluntarily and cheerfully without any compulsion.

Pilot Study

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the load. For this, 20 subjects were selected at random and divided into four groups of five each, in which Group I undergone Suryanamaskar with mantras, Group II underwent slow Suryanamaskar and Group III underwent fast Suryanamaskar. Based on the response of the subjects in the pilot study, the training schedule was constructed for main study by the investigator.

Training Programme

During the training period, the experimental groups underwent their respective training programmes for five days per week for twelve weeks in addition to their regular school activities. Experimental group I (SNWMG) underwent Suryanamaskar with mantras, Group II (SSNG) underwent slow Suryanamaskar and Group III (FSNG) underwent fast Suryanamaskar practices for 12 weeks and Group IV served as the control. The details are cited in training schedule. The training schedule for all the three experimental groups were prescribed in the table 3.2 to 3.4. The workout lasted for 45 minutes every day and the intensity was increased progressively on different phases. However they were involved in regular activities as per the school routine.

The participants underwent their respective training programme under the strict supervision of the investigator. All the subjects involved in the training programmes were questioned about their stature the entire training period. None of

them reported to any injuries. However, muscle soreness was reported in the early weeks, but it subsided later.

Training Schedule

The training was scheduled in the morning session for five days for twelve weeks.

Table 3.2

Training Programme

Experimental Group I (Suryanamaskar with Mantras)

Weeks	Name of the Practices	Repetition	Duration (mints)	Intensity
I-IV	Starting Prayer (According to the Religion)	1	2 ½	Low
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	3 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
V-VIII	Starting Prayer (According to the Religion)	1	2 ½	Medium
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	4 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
IX-XII	Starting Prayer (According to the Religion)	1	2 ½	High
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	5 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	

Table 3.3

Experimental Group II (Slow Suryanamaskar)

Weeks	Name of the Practices	Repetition	Duration (mints)	Intensity
I-IV	Starting Prayer (According to the Religion)	1	2 ½	Low
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	6 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
V-VIII	Starting Prayer (According to the Religion)	1	2 ½	Medium
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	7 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
IX-XII	Starting Prayer (According to the Religion)	1	2 ½	High
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	8 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	

Table 3.4

Experimental Group III (Fast Suryanamaskar)

Weeks	Name of the Practices	Repetition	Duration (mints)	Intensity
I-IV	Starting Prayer (According to the Religion)	1	2 ½	Low
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	9 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
V-VIII	Starting Prayer (According to the Religion)	1	2 ½	Medium
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	12 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	
IX-XII	Starting Prayer (According to the Religion)	1	2 ½	High
	Loosening Exercises (Pavanamuktasana Series I and II) (Asana Pranayama Mudra and Bandhas) (Swami Satyananda Saraswathi)	1	5	
	Suryanamaskar (Bihar School of Yoga)	15 Cycle	30	
	Relaxation	1	5	
	Prayer Ending	1	2 ½	

Suryanamaskar Cycle

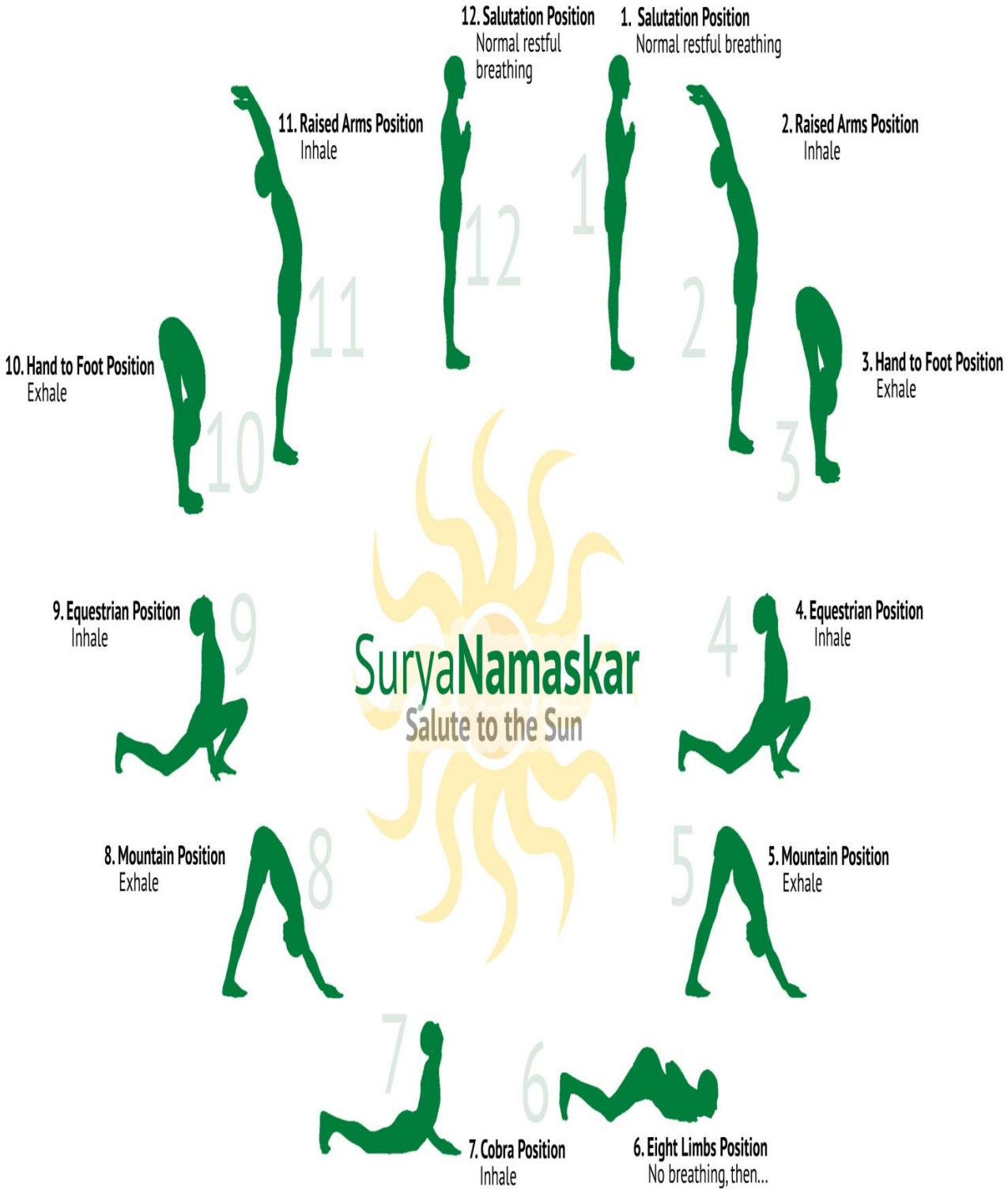


Fig 3. (i)

Description of Suryanamaskar Practices with Mantras

Position 1: Namaskarasa or Pranaamasana

Start by (opposite the way of the sun) standing upright keeping your feet calm. Place your palms combined together in front of the chest (at the heart) Angli mudra (prayer position). Create assured your body is as straight as probable. Keep the stomach in, chest forward, neck starched up, knee caps shorten. These benefits to bring into mind calm and peaceful area. This posture stimulates the anahatha chakra. Chant the mantra **Om Mitrayaah Namaha…….**

Position 2: Ardha Chandrasan or Hasta Utthanasana

Now exhale while you expanse your hands over your head, palms opposite rising. Now superior of the body backwards and stretch the muscles of abdomen and chest. This posture helps to high the energy toward the upper parts of the body forced by inhalation. Chant the mantra **Om Ravaye Namah……**

Position 3: Padahastasana

Exhale and bend forward in the waist till palms touch the ground in line with the toes. Don't bend knees while performance. At first may find it demanding to achieve the perfect position but try to bend as much as possible without bending in knees. (Keep the legs straight and upright to the ground). Chant the mantra **Om Suryaya Namah…….**

Position 4: Ashwa Sanchalanasana

On your next inhalation, prolong the left leg back and droplet the knee to the ground. The right knee to the knee bend id bent and kept between the hands the right foot placed level on the ground. Lift the spine and open the chest. Think at the eyebrow midpoint. Chant the mantra **Om Bhanave Namah…….**

Position 5: Parvatasana

From the fourth state, both the hands are carried down and palms placed on the floor. Right leg is also taken back and placed close the left one, waist and buttocks fully raised up. Any one or both the heels are moved forward and backward. Breath is inhaled and exhaled frequently. On the exhalation carry the right leg back to join with the left leg. Consecutively raise the buttocks and lower the head between the arms, so that the body methods a triangle with the floor. Try to place the heads flat on the ground. Focus consciousness at the neck region. Chant the mantra **Om Marchaye Namah……**

Position 6: Ashtanga Namaskara

Exhaling smoothly fall both knees to the ground and gradually shot the body down at an angle as carry the chest and chin to the ground. All eight limbs the forehead, chest, both the palms, both the toes, knees must touch the ground and rest of the body not moving the floor. Later only eight portions rest on the ground, it is called "Ashtanga" position. The buttocks are reserved up. Hold the breath. Chant the mantra **Om Pushne Namah….**

Position 7: Bhujangasana

On the inhalation, lower the hips while forceful the chest forward and upward with the hands, until the spine is completely arched and the head is opposite. The knees and lower abdomen remain beyond the floor. Focus the mindfulness at the base of spine and feel the version from the advancing pull. Chant the mantra **Om Hiranyagarbhaaya Namah….**

Position 8: Pravatasana

Exhale and develop back to posture 5. Chant the mantra **Om Marichaye Namah….**

Position 9: Ashwa Sanchalanasana

Inhale and swing the right leg forward between the hands. The left leg rests back. Restart position 4. Chant the mantra **Om Adityaya Namah….**

Position 10: Padahastaasana

Exhaling, bring the left foot forward, joint both the legs and restart position 3. Chant the mantra **Om Savitre Namah….**

Position 11: Hastauttanasana

Inhale, elevation of the trunk up and bend backward. Restart position 2. Chant the mantra **Om Arkaya Namah….**

Position 12: Pranamasana

Flatten the body and carry the hands in front of the chest. Restart position 1. Chant the mantra **Om Bhaskaraya Namah….**

Test Administration

Physical Variables

1. Body Mass Index (BMI)	Tanita Body Composition Analyzer
2. Flexibility	Sit and Reach Box (Centimeters)

Physiological Variables

1. Forced Vital Capacity (FVC)	Peak Flow Meter (Liters)
2. Forced Expiratory Rate (FER)	Peak Flow Meter (Liters)
3. Peak Expiratory Rate (PER)	Peak Flow Meter (Liters)
4. Forced Expiratory Volume in the First Second (FEV1)	Peak Flow Meter (Liters)
5. Endurance (Cardio Respiratory)	Cooper's 9 Min Run and Walk (Meters)

Psychological Variables

1. Memory Test	Memory Drum (No. of Trails)

Body Composition

Purpose

To measure the body mass index in the body.

Equipment

Tanita body composition analyzer (300 A).

Procedure

Step I: Press the (on/off) key to turn on the power

Step II: Enter clothes weight

Step III: Enter sex and body category

Step IV: Enter age

Step V: Enter height

Step VI: Set target body fat percentage

Step VII: Step on

Step VIII: Taking measurement

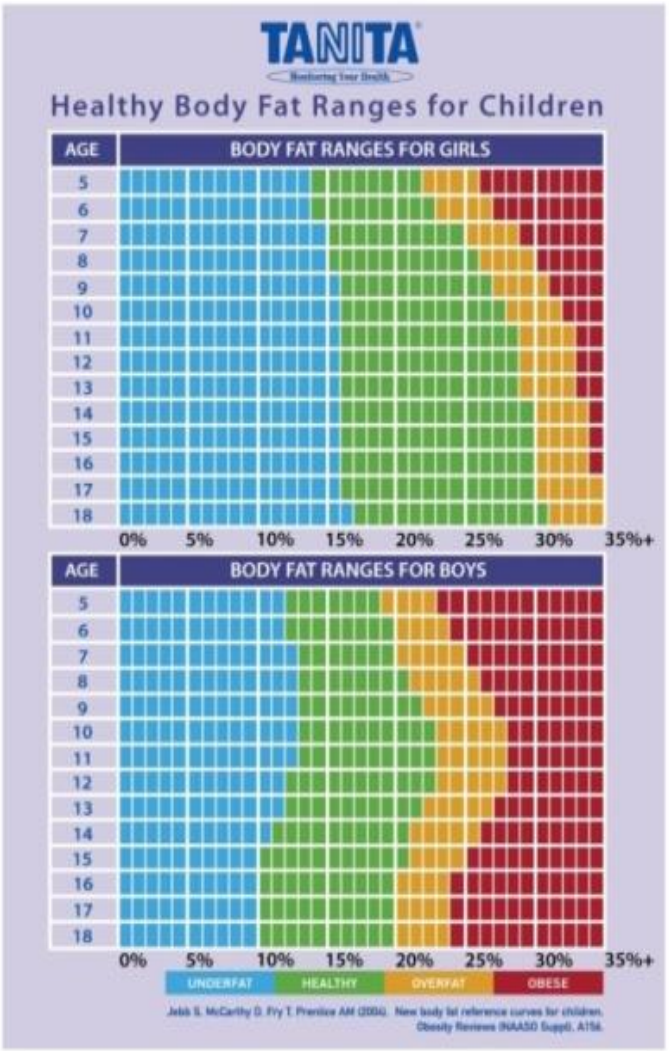
Step IX: Weight is showed on the upper position of the LCD

Step X: Impendence measurement

Step XI: Measurement is now completed

Scoring

Reading will be noted in the print from the apparatus after completed of the process.



Flexibility

Purpose

To measure the level of flexibility

Equipment

Sit and reach box (otherwise a ruler can be used and a step or box)

Procedure

The test includes sitting on the floor with the legs starched out straight forward. Shoes should be removed. The soles of the feet are placed flat beside the box. Both knees would be locked and pushed flat to the floor the tester may help by holding them down. The palms opposite downwards and the hands on top of each other or side by side, the subject touches forward beside the calculating line as fat as possible. Confirm that the hands continue at the same level, not one getting further forward than the other. After some practice scopes, the subject ranges and holds that position for a one or two second while the distance is noted. Make sure there are no irregular movements.

Scoring

The maximum distance was measured as centimeters from the best of three trials.

Peak Flow Meter

Purpose

To measure lung functions (i.e. FVC, FER, PER and FEV1)

Equipment

Peak flow meter

Procedure

First make sure the subject have no food or gum in mouth and stand up. Put the indicator on the measure of the peak flow meter at 0. Assign the mouth piece to the peak flow meter. Take a deep breath, than place the peak flow meter mouth piece in mouth and close lips strongly around the outside of the mouthpiece (don't put in tongue inside the mouthpiece). Breath out as hard and as fast as possible (using a "huff" slightly than a full breath out). Record the assessment on the measure before moving the indicator on the measure back to 0. At least three efforts must be completed. The standard products of lung function are of forced vital capacity (FVC) and forced expired volume in one second (FEV1). These can be measured with a full maximal expiration. Illuminate to the subject that they must clear lungs entirely, closure their lips round the mouth piece, and blank their lungs as hard and fast as probable.

Scoring

Record the highest value of all attempts. The assessment noted in liters per minute.

Cooper's 9 min run and walk

Purpose

The purpose was to assess the endurance (cardio respiratory) for girls.

Equipment

To conduct this test, 400 meters track, stopwatches, a whistle and score sheet were used.

Procedure

The 400 meters track was kept ready with making at every fifty meters. The subjects were divided into groups. When are group was running, the designated patterns from the other group acted as lap scores. The subjects were instructed to run, jog or walk according to their capacity without stopping for 9 minutes. The subjects of the first group started running for the whistle and continued to run, jog or walk and covered as much as possible distance during the 9 minutes period. When the 9 minutes was over the whistle was blown and the subjects stopped progressing forward but they showed on the stand on the spot. The persons helping as lap scores kept the record of the number of laps completed.

Scoring

The number of completed distance was recorded.

Memory Test

Purpose

To measure the subject's memory for meaningful words is better than that of meaningless words.

Equipment

A list containing of 10 words which are meaningful and another list covering 10 words which are meaningless, memory drum (on which these two lists are previously attached)

Procedure

Memory drum is correctly adjusted so that it replaces at proper speed (2 sec). The subject is placed easily in a position such that she is able to see the opening of the memory drum visibly and the following guidelines were given. You will find a list of words looking one after the other. These are words which are meaningful. You must study these words by heart. Later on you will have to repeat the whole list of the words in the same order. The experimenter then presents the list of meaningful words to the subject. Later each performance, the experimenter records down the replies given by the present the list of meaningful words till the subject is capable to memory the whole list twice simultaneously without mistakes in the same order. The number of trials taken by the subject to memory the list of meaningful words is noted down. The experimenter then presents the list of meaningless words to the subject in same way.

Scoring

The number of the trails taken by the subject to memory the list twice simultaneously without mistakes in the same order is noted down.

Collection of Data

The data on selected dependent variables for pre–tests and post–tests were collected two days before and after the training programme respectively. On the first day BMI, flexibility, FVC, FER, PER and FEV1 were tested and also endurance (cardio respiratory) and memory meaningful and meaningless were tested on the second day.

Statistical Procedure

The data collected from the four groups before and after the experimental period were statistically examined for significant improvement by using analysis of covariance (ANCOVA). Whenever the 'F' ratio was found to be significant, Scheffe's test was used as post- hoc test to determine which of the paired means differed significantly. In all cases the criterion for statistical significance was set at 0.05 level of confidence ($P< 0.05$). All the statistical analysis was accepted with the help of SPSS 16 version.

ANALYSIS OF DATA AND RESULTS OF THE STUDY

Chapter IV

ANALYSIS OF DATA AND RESULTS OF THE STUDY

Overview

In this chapter the analysis of the data and the results of the study were discussed. The purpose of the study was to find out the effects of Suryanamaskar practices on selected physical, physiological and psychological variables among school girls. To achieve this purpose of the study, 60 school girls were selected at random from Jothi Vallalar Higher Secondary School, Peryiakalapet, Puducherry. The age of the subjects ranged between 12 to 14 years. The selected subjects were divided into three experimental groups and a control group with fifteen subjects in (n=15) each. Experimental group I underwent Suryanamaskar with mantras (SNWMG), Group II underwent slow Suryanamaskar (SSNG), Group III underwent fast Suryanamaskar (FSNG) and Group IV served as control (CG) for the training period of 12 weeks. Subjects of the four groups (SNWMG, SSNG, FSNG and CG) were tested on selected criterion BMI, flexibility, FVC, FER, PER, FEV1 Endurance (Cardio Respiratory), memory meaningful and meaningless prior to and after the 12 weeks of training period. The data pertaining to the variables in this study were statistically examined by using analysis of covariance (ANCOVA) for each variable separately. Whenever 'F' ratio of adjusted post test was found to be significant, the Scheffe's test was, used as post–hoc test to determine the paired mean differences.

Test of Significance

This was the crucial portion of the thesis in arriving at the hypothesis, which was ended either by accepting the hypothesis or rejecting the same in accordance with the result obtained in relation to the level of confidence fixed by the investigator.

Level of Significance

The probability level below which we reject the hypothesis was termed as the level of significance. The 'F' ratios obtained by analysis of covariance were compared to the 0.05 level of confidence.

In using analysis of covariance, 'F' ratio of 2.77 was needed for significance at the 0.05 level at the degree of freedom 3 and 56. The test is usually called the tests of significance since the whether the difference among the pre-test and post- test scores of the sample is significant of insignificant.

In the present study if obtained values were greater than the table value at 0.05 level null hypotheses was rejected to the effect that there existed significant difference among the means of the group compared. And if obtained values were less than the required values at 0.05 level, the null hypotheses was accepted to the effect that there existed no significance difference among the means of the groups under study. In additions to the test of significance of adjusted means, significance between paired adjusted final means was also tested by computing Scheffe's post hoc test.

The purpose of the experimental study was to examine the effect of Suryanamaskar practices on selected physical, physiological and psychological variables while controlling the pre test. The analysis of covariance (ANCOVA) was used to analyze the statistical differences of the four groups were compared and analyzed according to the variables. The research hypotheses were tested using the results from the analysis of covariance at 0.05 level of significance.

The relative effect of independent variables on selected variable was determined through the collected data by using appropriate statistical techniques and results are presented below.

Table 4.1

ANALYSIS OF COVARIANCE FOR BODY MASS INDEX (BMI) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	18.80	17.82	17.06	17.73	**B**	23.147	3	7.716	2.481
S.D.	2.33	1.69	1.40	1.45	**W**	174.18	56	3.110	
Post-test Mean	19.08	18.96	17.90	18.00	**B**	17.476	3	5.825	3.058*
S.D.	2.03	1.29	1.06	0.83	**W**	106.67	56	1.905	
Adjusted Post-test Mean	18.49	18.98	18.29	18.07	**B**	6.320	3	2.107	3.036*
					W	38.170	55	0.694	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.1 shows that the pre test means values on BMI of CG, SNWMG, SSNG and FSNG are 18.80, 17.82, 17.06 and 17.73 respectively. The obtained 'F' ratio 2.481 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on BMI. The post test means values on BMI of CG, SNWMG, SSNG and FSNG are 19.08, 18.96, 17.90 and 18.00 respectively. The obtained 'F' ratio 3.058 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on BMI. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 18.49, 18.98, 18.29 and 18.07 respectively. The obtained 'F' ratio 3.036 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on BMI. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on BMI.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.2

Table 4.2

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF BMI

SNWMG	CG	SSNG	FSNG	Mean Difference	CI
18.98	18.49	-	-	0.49	0.876
18.98	-	18.29	-	0.69	
18.98	-	-	18.07	0.91*	
-	18.49	18.29	-	0.2	
-	18.49	-	18.07	0.42	
-	-	18.29	18.07	0.22	

Table 4.2 shows that the mean difference values between SNWMG and FSNG are 0.91 respectively which is greater than the confidence interval value 0.876 at 0.05 level of confidence. The results showed that there were a significant difference between SNWMG and FSNG on BMI. The mean difference value between SNWMG and CG, SNWMG and SSNG, CG and SSNG.CG and FSNG, SSNG and FSNG are 0.49, 0.69, 0.2, 0.42 and 0.22 which are lesser than the confidence interval value 0.876 at 0.05 level of confidence. The result showed that there is no significant difference on BMI

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on BMI are graphically represented in the figure 4 (i).

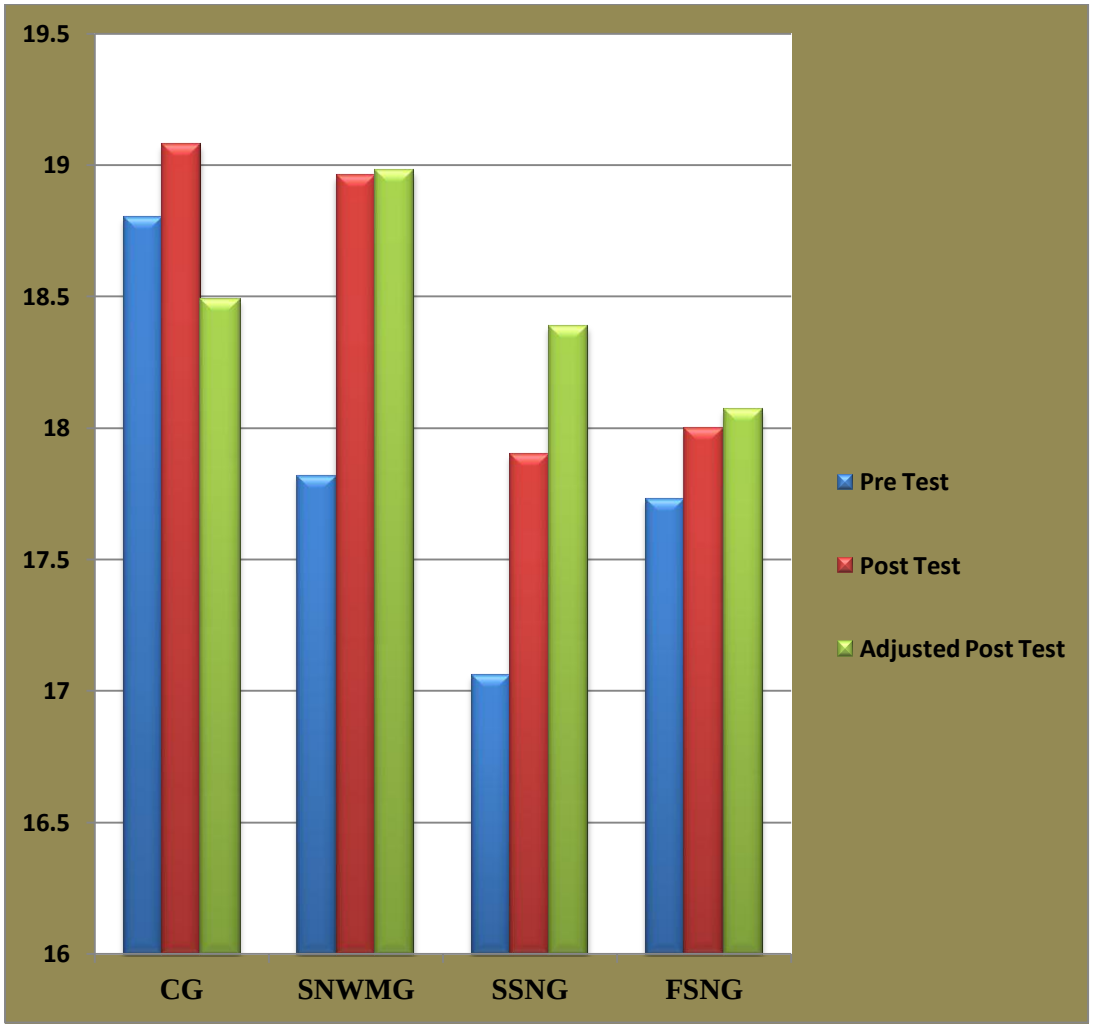


Fig 4 (i)

Mean difference among Control and Experimental Groups on Body Mass Index (BMI)

Table 4.3

ANALYSIS OF COVARIANCE FOR FLEXIBILITY OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	21.33	21.93	21.47	21.77	**B**	3.379	3	1.126	0.392
S.D.	1.30	1.88	1.95	1.55	**W**	160.9	56	2.874	
Post-test Mean	19.77	24.77	23.91	23.29	**B**	217.1	3	72.37	24.9*
S.D.	1.68	2.13	1.54	1.38	**W**	163.0	56	2.911	
Adjusted Post-test Mean	20.01	24.51	24.05	23.17	**B**	182.9	3	60.97	65.4*
					W	51.31	55	0.933	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.3 shows that the pre test means values on flexibility of CG, SNWMG, SSNG and FSNG are 21.33, 21.93, 21.47 and 21.77 respectively. The obtained 'F' ratio 0.392 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on flexibility. The post test means values on flexibility of CG, SNWMG, SSNG and FSNG are 19.77, 24.77, 23.91 and 23.99 respectively. The obtained 'F' ratio 24.9 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on flexibility. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 20.01, 24.51, 24.05 and 23.17 respectively. The obtained 'F' ratio 65.4 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on flexibility. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on flexibility.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.4

Table 4.4

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF FLEXIBILITY

SNWMG	SSNG	FSNG	CG	Mean Difference	CI
24.51	24.05	-	-	0.46	1.017
24.51	-	23.17	-	1.34*	
24.51	-	-	20.01	4.5*	
-	24.05	23.17	-	0.88	
-	24.05	-	20.01	4.04*	
-	-	23.17	20.01	3.16*	

Table 4.4 shows that the mean difference values between SNWMG and FSNG, SNWMG and CG, SSNG and CG, FSNG and CG are 1.34, 4.5, 4.04, and 3.16 respectively which are greater than the confidence interval value 1.017 at 0.05 level of confidence. The results showed that there were significant differences between SNWMG and FSNG, SNWMG and CG, SSNG and CG, FSNG and CG on flexibility. The mean difference values between SNWMG and SSNG, SSNG and FSNG are 0.46 and 0.88 respectively which are lesser than the confidence interval value 1.017 at 0.05 level of confidence. The result showed that there is no significant difference between SNWMG and SSNG, SSNG and FSNG on flexibility.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on flexibility are graphically represented in the figure 4 (ii).

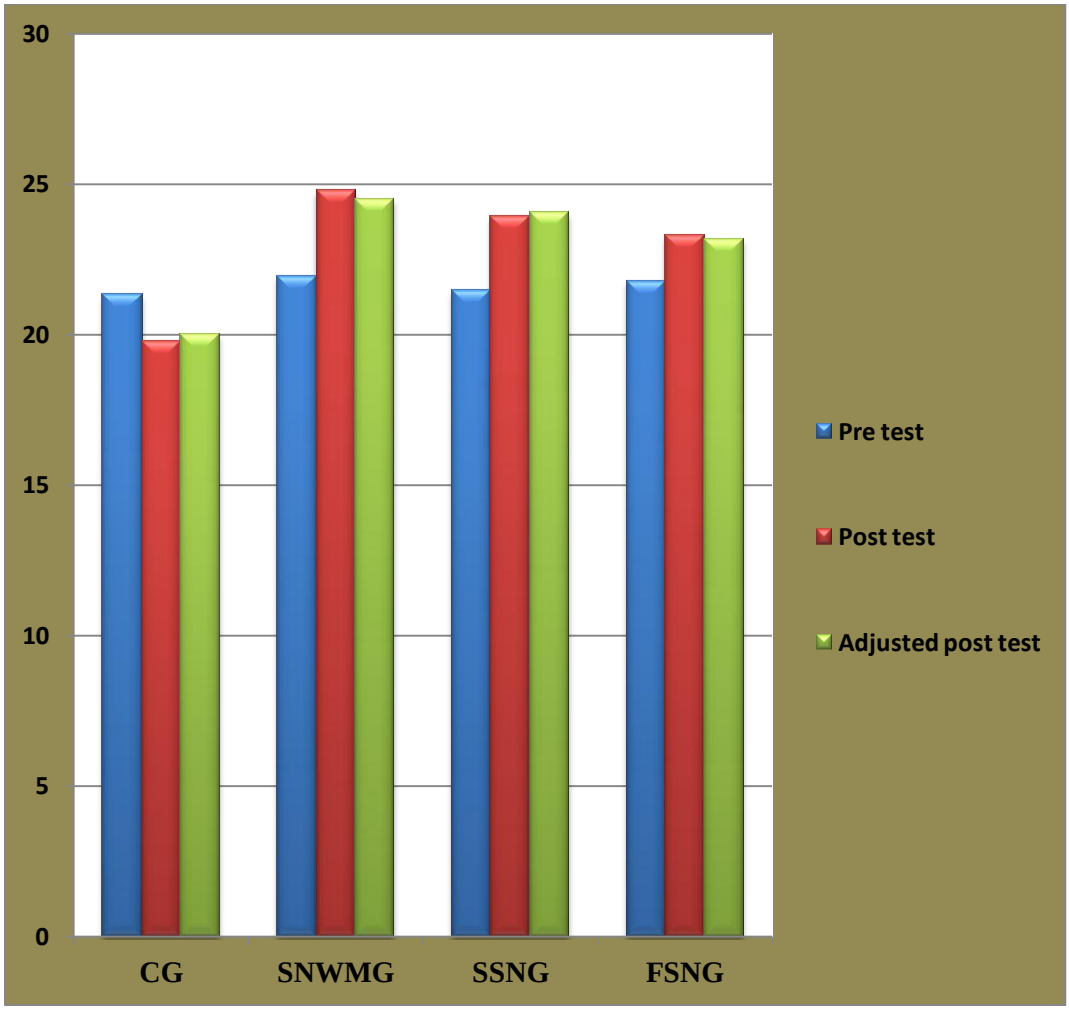


Fig 4 (ii)

Mean difference among Control and Experimental Groups on Flexibility

Table 4.5

ANALYSIS OF COVARIANCE FOR FORECED VITAL CAPACITY (FVC) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	1.01	1.01	0.86	0.98	**B**	0.238	3	0.079	0.656
S.D.	0.34	0.34	0.34	0.36	**W**	6.778	56	0.121	
Post-test Mean	0.97	1.36	1.15	1.65	**B**	3.802	3	1.267	9.64*
S.D.	0.35	0.31	0.27	1.65	**W**	7.364	56	0.131	
Adjusted Post-test Mean	0.94	1.33	1.23	1.64	**B**	3.780	3	1.260	16.2*
					W	4.297	55		

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.5 shows that the pre test means values on FVC of CG, SNWMG, SSNG and FSNG are 1.01, 1.01, 0.86 and 0.98 respectively. The obtained 'F' ratio 0.656 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on flexibility. The post test means values on FVC of CG, SNWMG, SSNG and FSNG are 0.97, 1.36, 1.15 and 1.65 respectively. The obtained 'F' ratio 9.64 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on flexibility. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 0.94, 1.33, 1.23 and 1.64 respectively. The obtained 'F' ratio 16.1 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on FVC. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on FVC.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.6

Table 4.6

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF FVC

FSNG	SNWMG	SSNG	CG	Mean Difference	CI
1.64	1.33	-	-	0.31*	0.291
1.64	-	1.23	-	0.41*	
1.64	-	-	0.94	0.7*	
-	1.33	1.23	-	0.1	
-	1.33	-	0.94	0.39*	
-	-	1.23	0.94	0.29*	

Table 4.6 shows that the mean difference values between FSNG and SNWMG,FSNG and SSNG,FSNG and CG, SNWMG and CG, SSNG and CG are 0.31, 0.41, 0.7,0.39 and 0.29 respectively which are greater than the confidence interval value 0.291 at 0.05 level of confidence. The results of the study showed that there were a significant difference between FSNG and SNWMG, FSNG and SSNG, FSNG and CG, SNWMG and CG, SSNG and CG on FVC. The mean difference values between SNWMG and SSNG are 0.1 respectively which are lesser than the confidence interval value 0.291 at 0.05 level of confidence. The result showed that there is no significant difference between SNWMG and SSNG on FVC.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on FVC are graphically represented in the figure 4 (iii).

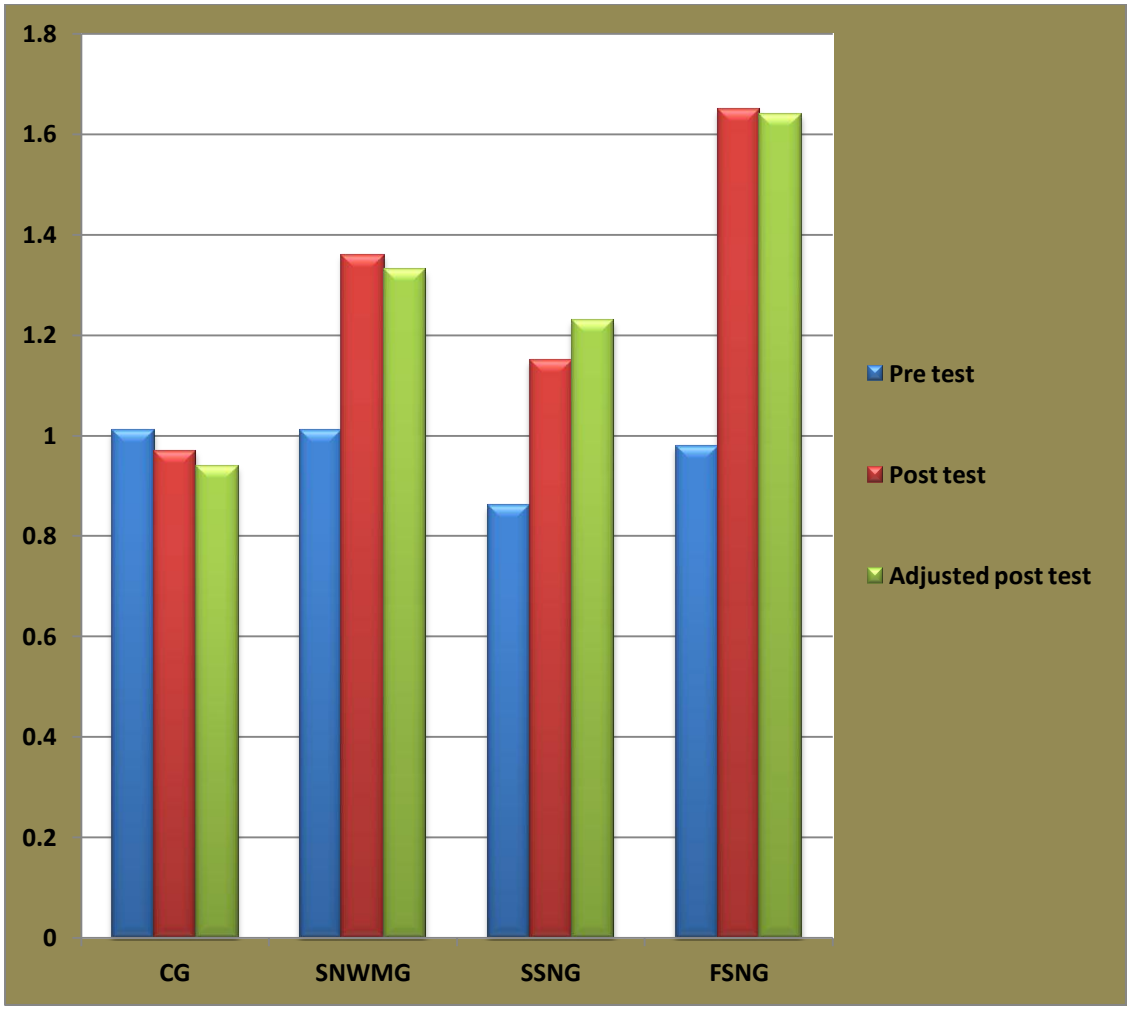


Fig 4 (iii)

Mean Difference among Control and Experimental Groups on Forced Vital Capacity (FVC)

Table 4.7

ANALYSIS OF COVARIANCE FOR FORCED EXPIRATORY RATE (FER) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	96.00	93.80	92.66	93.93	**B**	86.73	3	28.91	1.215
S.D.	3.68	4.87	5.39	5.36	**W**	1332.67	56	23.79	
Post-test Mean	96.40	98.40	98.33	98.80	**B**	52.05	3	17.35	2.537
S.D.	3.52	2.06	2.63	1.93	**W**	382.93	56	6.84	
Adjusted Post-test Mean	96.25	98.42	98.44	98.81	**B**	58.55	3	19.52	2.864*
					W	374.87	55	5.82	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.7 shows that the pre test means values on FER of CG, SNWMG, SSNG and FSNG are 96.00, 93.80, 92.66 and 93.93 respectively. The obtained 'F' ratio 1.215 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on FER. The post test means values on FER of CG, SNWMG, SSNG and FSNG are 96.40, 98.40, 98.33 and 98.80 respectively. The obtained 'F' ratio 2.537 for post test scores was less than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on FER. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 96.25, 98.42, 98.44 and 98.81 respectively. The obtained 'F' ratio 2.864 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on FER. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on FER.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.8

Table 4.8

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF FER

FSNG	SSNG	SNWMG	CG	Mean Difference	CI
98.81	98.44	-	-	0.37	2.54
98.81	-	98.42	-	0.39	
98.81	-	-	96.25	2.56*	
-	98.44	98.42	-	0.02	
-	98.44	-	96.25	2.19	
-	-	98.42	96.25	2.17	

Table 4.8 shows that the mean difference values between FSNG and CG is 2.56 which is greater than the confidence interval value 2.54 at 0.05 level of confidence. The results of the study showed that there were a significant difference between FSNG and CG. The mean difference values between FSNG and SSNG, FSNG and SNWMG, SSNG and SNWMG, SSNG and CG, SNWMG and CG are 0.37, 0.39, 0.02, 2.19 and 2.17 respectively which are lesser than the confidence interval value 2.54 at 0.05 level of confidence. The results showed that there is no significant difference on FER.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on FER are graphically represented in the figure 4 (iv).

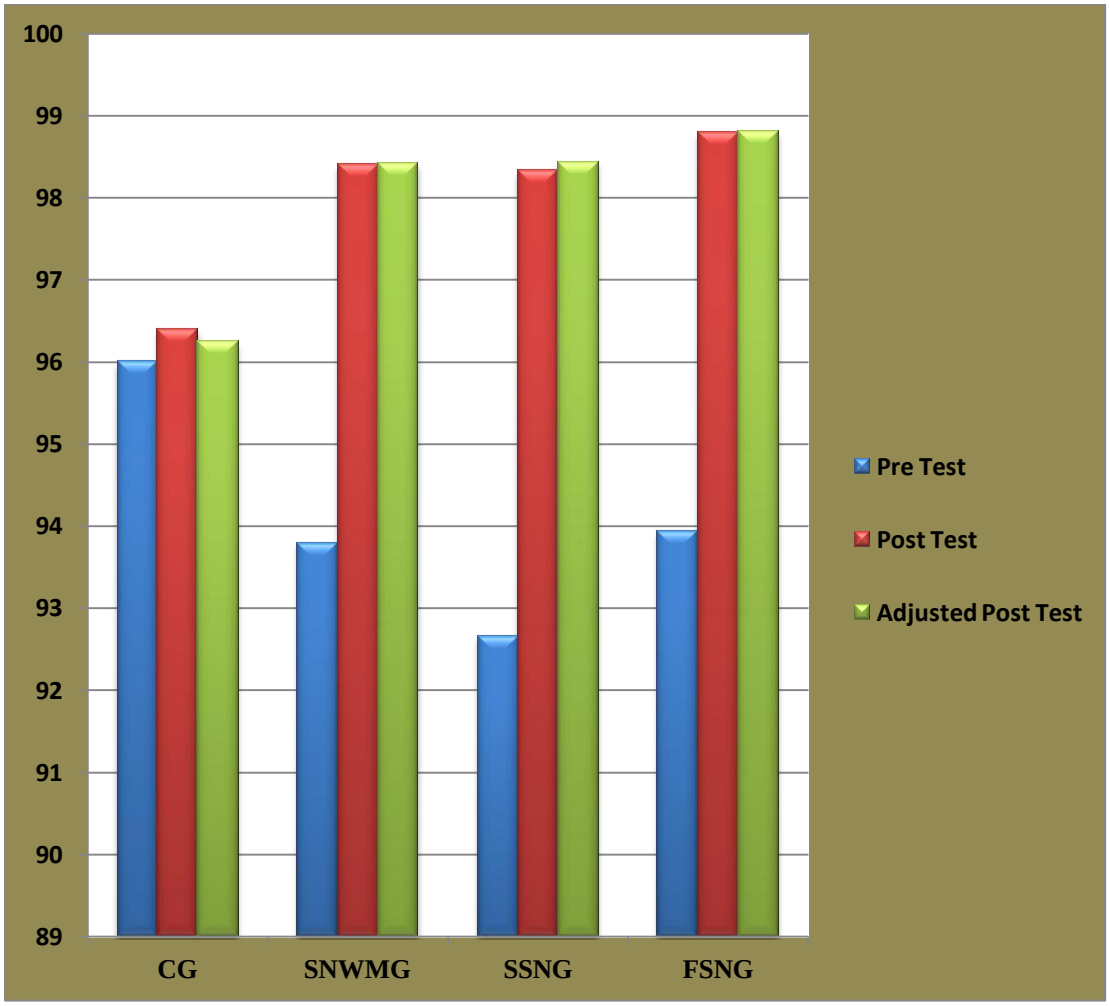


Fig 4 (iv)

Mean Difference among Control and Experimental Groups on Forced Expiratory Rate (FER)

Table 4.9

ANALYSIS OF COVARIANCE FOR PEAK EXPIRATORY RATE (PER) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	228.4	218.4	210.7	216.3	**B**	2445.38	3	815.1	0.229
S.D.	61.81	61.67	64.31	49.81	**W**	199395	56	3560.6	
Post-test Mean	227.6	281.5	249.0	287.0	**B**	35404	3	11801	3.614*
S.D.	62.74	67.29	57.81	35.43	**W**	182880	56	3265	
Adjusted Post-test Mean	219.2	281.5	255.6	288.9	**B**	44439	3	14813	20.510*
					W	39723	55	722.2	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom= 2.77.

Table 4.9 shows that the pre test means values on PER of CG, SNWMG, SSNG and FSNG are 228.4, 218.4, 210.7 and 216.3 respectively. The obtained 'F' ratio 0.229 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on PER. The post test means values on PER of CG, SNWMG, SSNG and FSNG are 227.6, 281.5, 249.0 and 287.0 respectively. The obtained 'F' ratio 3.614 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on PER. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 219.2, 281.5, 255.6 and 288.9 respectively. The obtained 'F' ratio 20.510 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on PER. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on PER.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.10.

Table 4.10

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF PER

FSNG	SNWMG	SSNG	CG	Mean Difference	CI
288.9	281.5	-	-	7.4	28.27
288.9	-	255.6	-	33.3*	
288.9	-	-	219.2	69.7*	
-	281.5	255.6	-	25.9	
-	281.5	-	219.2	62.3*	
-	-	255.6	219.2	36.4*	

Table 4.10 shows that the mean difference values between FSNG and SSNG, FSNG and CG, SNWMG and CG, SSNG and CG are 33.3, 69.7, 62.3 and 36.4 respectively which are greater than the confidence interval value 28.27 at 0.05 level of confidence. The mean difference values between FSNG and SNWMG, SNWMG and SSNG are 7.4 and 25.9 respectively which are lesser than the confidence interval value 28.27 at 0.05 level of confidence. The results of the study showed that there were a significant difference on PER.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on PER are graphically represented in the figure 4 (v).

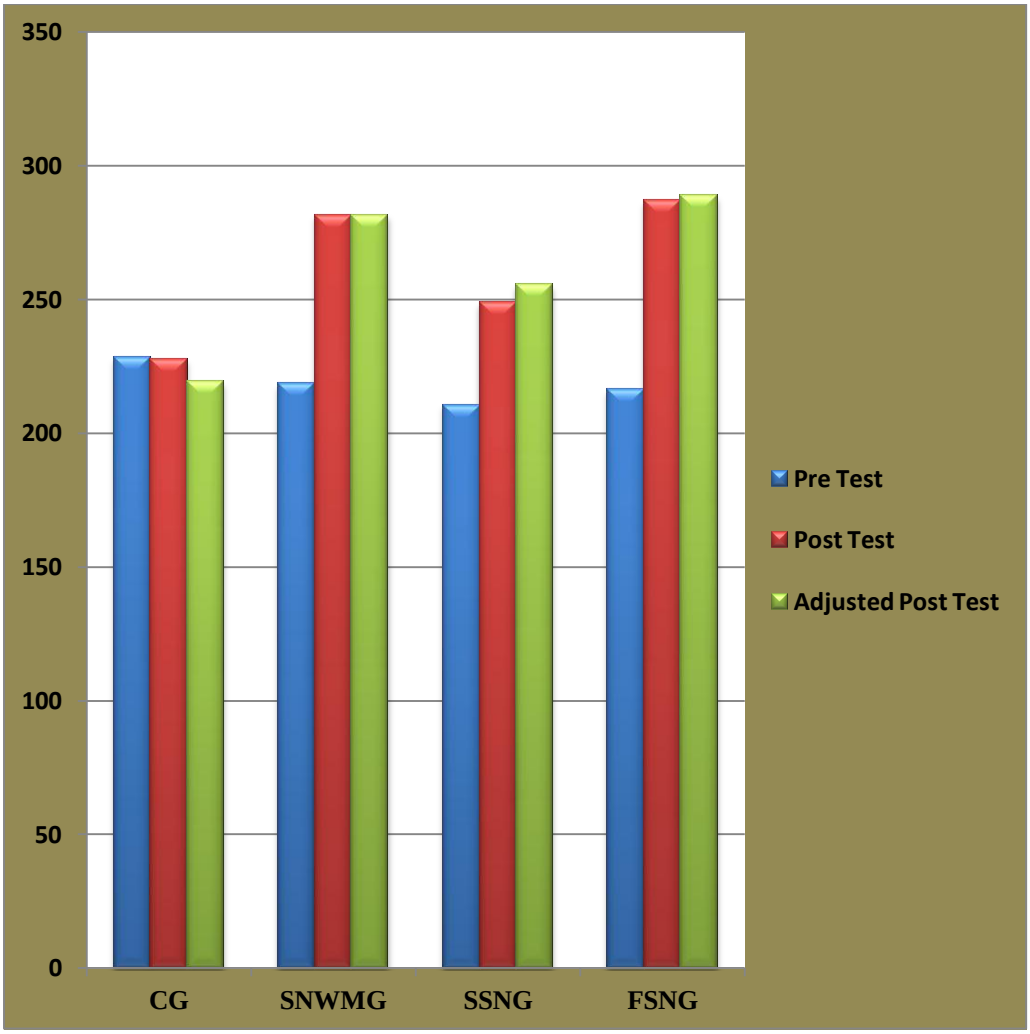


Fig 4 (v)

Mean Difference among Control and Experimental Groups on Peak Expiratory Rate (PER)

Table 4.11

ANALYSIS OF COVARIANCE FOR FORCED EXPIRATORY VOLUME IN THE ONE SECOND (FEV1) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	1.01	1.01	0.86	0.98	**B**	0.238	3	0.079	0.656
S.D.	0.34	0.35	0.34	0.36	**W**	6.778	56	0.121	
Post-test Mean	0.97	1.36	1.15	1.65	**B**	3.802	3	1.267	9.64*
S.D.	0.35	0.32	0.28	0.49	**W**	7.364	56	0.131	
Adjusted Post-test Mean	0.94	1.33	1.23	1.64	**B**	3.780	3	1.260	16.2*
					W	4.297	55	0.078	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.11 shows that the pre test means values on FEV1 of CG, SNWMG, SSNG and FSNG are 1.01, 1.01, 0.86 and 0.98 respectively. The obtained 'F' ratio 0.656 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on FEV1. The post test means values on FEV1 of CG, SNWMG, SSNG and FSNG are 0.97, 1.36, 1.15 and 1.65 respectively. The obtained 'F' ratio 9.64 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on FEV1. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 0.94, 1.33, 1.23 and 1.64 respectively. The obtained 'F' ratio 16.2 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on FEV1. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on FEV1.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post-hoc test was employed and presented in table 4.12.

Table 4.12

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF FEV1

FSNG	SNWMG	SSNG	CG	Mean Difference	CI
1.64	1.33	-	-	0.31*	0.291
1.64	-	1.23	-	0.41*	
1.64	-	-	0.94	0.7*	
-	1.33	1.23	-	0.1	
-	1.33	-	0.94	0.39*	
-	-	1.23	0.94	0.29*	

Table 4.12 shows that the mean difference values between FSNG and SNWMG, FSNG and SSNG,FSNG and CG, SNWMG and CG, SSNG and CG are 0.31, 0.41, 0.7, 0.39 and 0.29 respectively which are greater than the confidence interval value 0.291 at 0.05 level of confidence. The results showed that there were a significant difference between FSNG and SNWMG, FSNG and SSNG, FSNG and CG, SNWMG and CG, SSNG and CG on FEV1. The mean difference values between SNWMG and SSNG are 0.1 respectively which are lesser than the confidence interval value 0.291 at 0.05 level of confidence. The result showed that there is no significant difference between SNWMG and SSNG on FEV1.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on FEV1 are graphically represented in the figure 4 (vi).

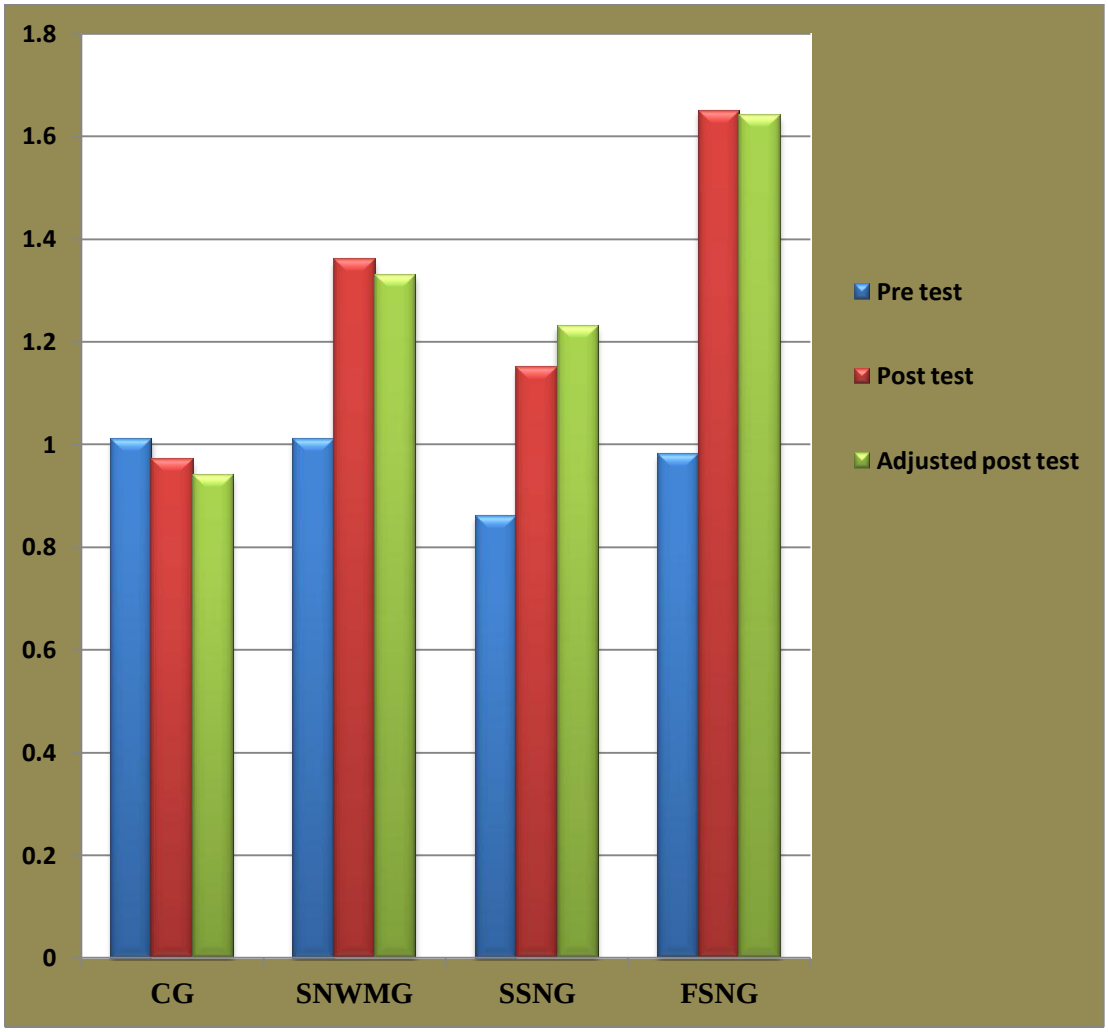


Fig 4 (vi)

Mean Difference among Control and Experimental Groups on Forced Expiratory Volume in the First Second (FEV1)

Table 4.13

ANALYSIS OF COVARIANCE FOR ENDURANCE (CARDIO RESPIRTORY) OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	1440.0	1292.7	1310.3	1460.0	**B**	336124.5	3	112041.5	1.331
S.D.	300.1	282.1	294.2	283.5	**W**	4713616.6	56	84171.7	
Post-test Mean	1330.0	1465.0	1354.0	1514.0	**B**	348671.2	3	116223	1.011
S.D.	376.2	304.6	328.6	342.5	**W**	6437270.0	56	114951	
Adjusted Post-test Mean	1271	1541	1414	1437	**B**	539700	3	179900	3.925*
					W	2521011	55	45836	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.13 shows that the pre test means values on Endurance (Cardio Respiratory) of CG, SNWMG, SSNG and FSNG are 1440.0, 1292.7, 1310.3 and 1460.0 respectively. The obtained 'F' ratio 1.331 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on Endurance (Cardio Respiratory). The post test means values on Endurance (Cardio Respiratory) of CG, SNWMG, SSNG and FSNG are 1330.0, 1465.0, 1354.0 and 1514.0 respectively. The obtained 'F' ratio 1.011 for post test scores was less than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on Endurance (Cardio Respiratory). The adjusted post test means of CG, SNWMG, SSNG and FSNG are 1271, 1541, 1414 and 1437 respectively. The obtained 'F' ratio 3.925 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on Endurance (Cardio Respiratory). The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on Endurance (Cardio Respiratory).

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.14.

Table 4.14

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF ENDURANCE (CARDIO RESPIRATORY)

SNWMG	FSNG	SSNG	CG	Mean Difference	CI
1541	1437	-	-	104	225.30
1541	-	1414	-	127	
1541	-	-	1271	270*	
-	1437	1414	-	23	
-	1437	-	1271	166	
-	-	1414	1271	143	

Table 4.14 shows that the mean difference values between SNWMG and CG is 270 which is greater than the confidence interval value 225.30 at 0.05 level of confidence. The results of the study showed that there was a significant difference between SNWMG and CG on Endurance (Cardio Respiratory). The mean difference value between SNWMG and FSNG, SNWMG and SSNG, FSNG and SSNG, FSNG and CG, SSNG and CG are 104, 127, 23, 166 and 143 which is lesser than the confidence interval value 225.30 at 0.05 level of confidence. The results showed that there is no significant difference on Endurance (Cardio Respiratory).

The pre, post and adjusted post test means of CG, SMWMG, SSNG and FSNG on Endurance (Cardio Respiratory) are graphically represented in the figure 4 (vii).

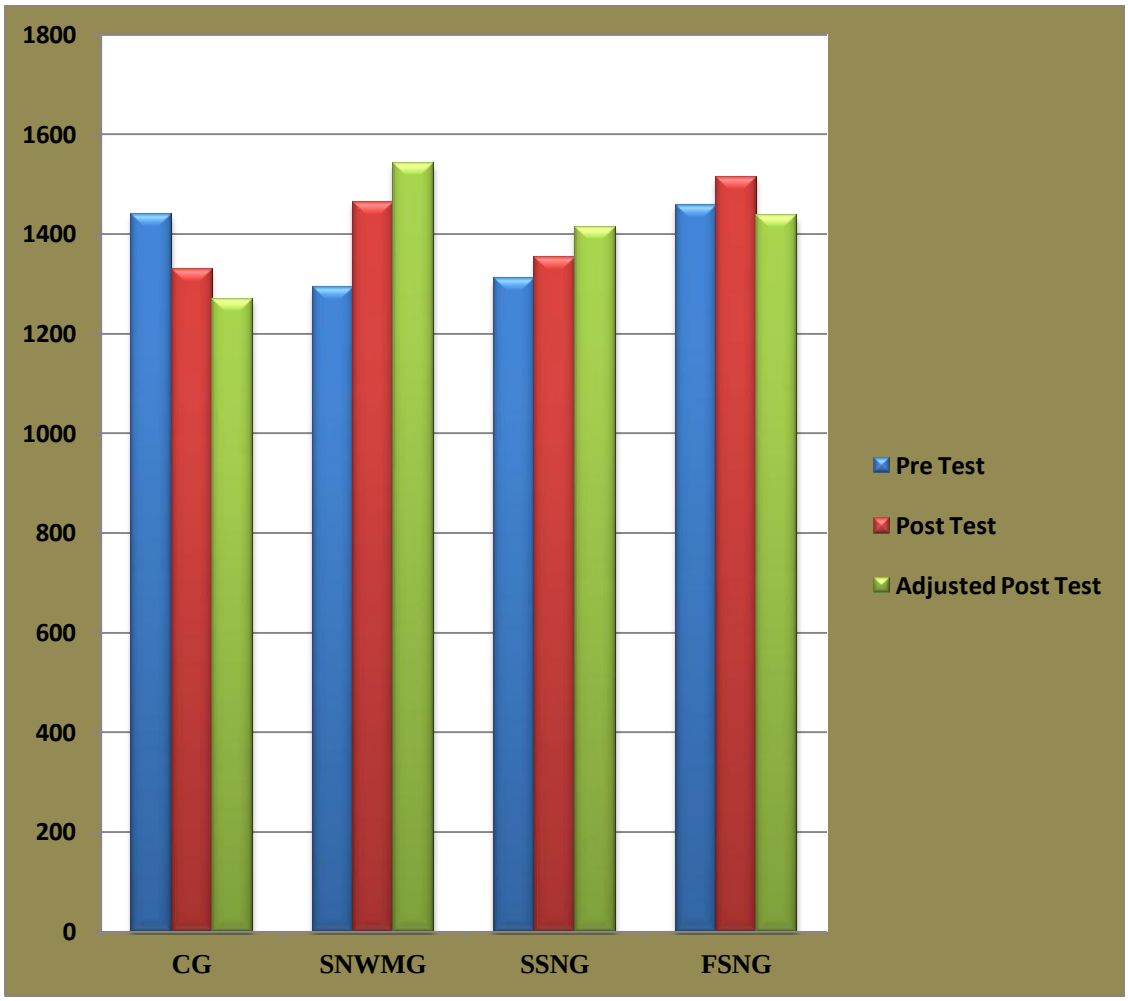


Fig 4 (vii)

Mean Difference among Control and Experimental Groups on Endurance (Cardio Respiratory)

Table 4.15

ANALYSIS OF COVARIANCE FOR MEMORY MEANINGFUL OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	6.53	6.60	6.40	6.47	**B**	0.333	3	0.111	0.22
S.D.	0.64	0.63	0.63	0.92	**W**	28.67	56	0.512	
Post-test Mean	5.93	4.47	4.13	4.47	**B**	29.12	3	9.706	12.9*
S.D.	0.79	0.51	1.06	0.99	**W**	42.13	56	0.752	
Adjusted Post-test Mean	5.91	4.38	4.22	4.49	**B**	27.24	3	9.079	23.1*
					W	21.59	55	0.393	

*Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.15 shows that the pre test means values on memory meaningful of CG, SNWMG, SSNG and FSNG are 6.53, 6.60, 6.40 and 6.47 respectively. The obtained 'F' ratio 0.22 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on memory meaningful. The post test means values on memory meaningful of CG, SNWMG, SSNG and FSNG are 5.93, 4.47, 4.13 and 4.47 respectively. The obtained 'F' ratio 12.9 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on memory meaningful. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 5.91, 4.38, 4.22 and 4.49 respectively. The obtained 'F' ratio 23.1 for adjusted post test means was greater than the table value 2.77 for 3 and 55 required for significance at 0.05 level of confidence on memory meaningful. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on memory meaningful.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post- hoc test was employed and presented in table 4.16

Table 4.16

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF MEMORY MEANINGFUL

CG	FSNG	SNWMG	SSNG	Mean Difference	CI
5.91	4.49	-	-	1.42*	1.199
5.91	-	4.38	-	1.53*	
5.91	-	-	4.22	1.69*	
-	4.49	4.38	-	0.11	
-	4.49	-	4.22	0.27	
-	-	4.38	4.22	0.16	

Table 4.16 shows that the mean difference values between CG and FSNG, CG and SNWMG, CG and SSNG are 1.42, 1.53 and 1.69 respectively which are greater than the confidence interval value 1.199 at 0.05 level of confidence. The results showed that there was a significant difference between CG and FSNG, CG and SNWMG, CG and SSNG on memory meaningful. The mean difference values between FSNG and SNWMG, FSNG and SSNG, SNWMG and SSNG are 0.11, 0.27 and 0.16 respectively which are lesser than the confidence interval value 1.199 at 0.05 level of confidence. The result showed that there are no significant differences between FSNG and SNWMG, FSNG and SSNG and SNWMG & SSNG on memory meaningful.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on memory meaningful are graphically represented in the figure 4 (viii).

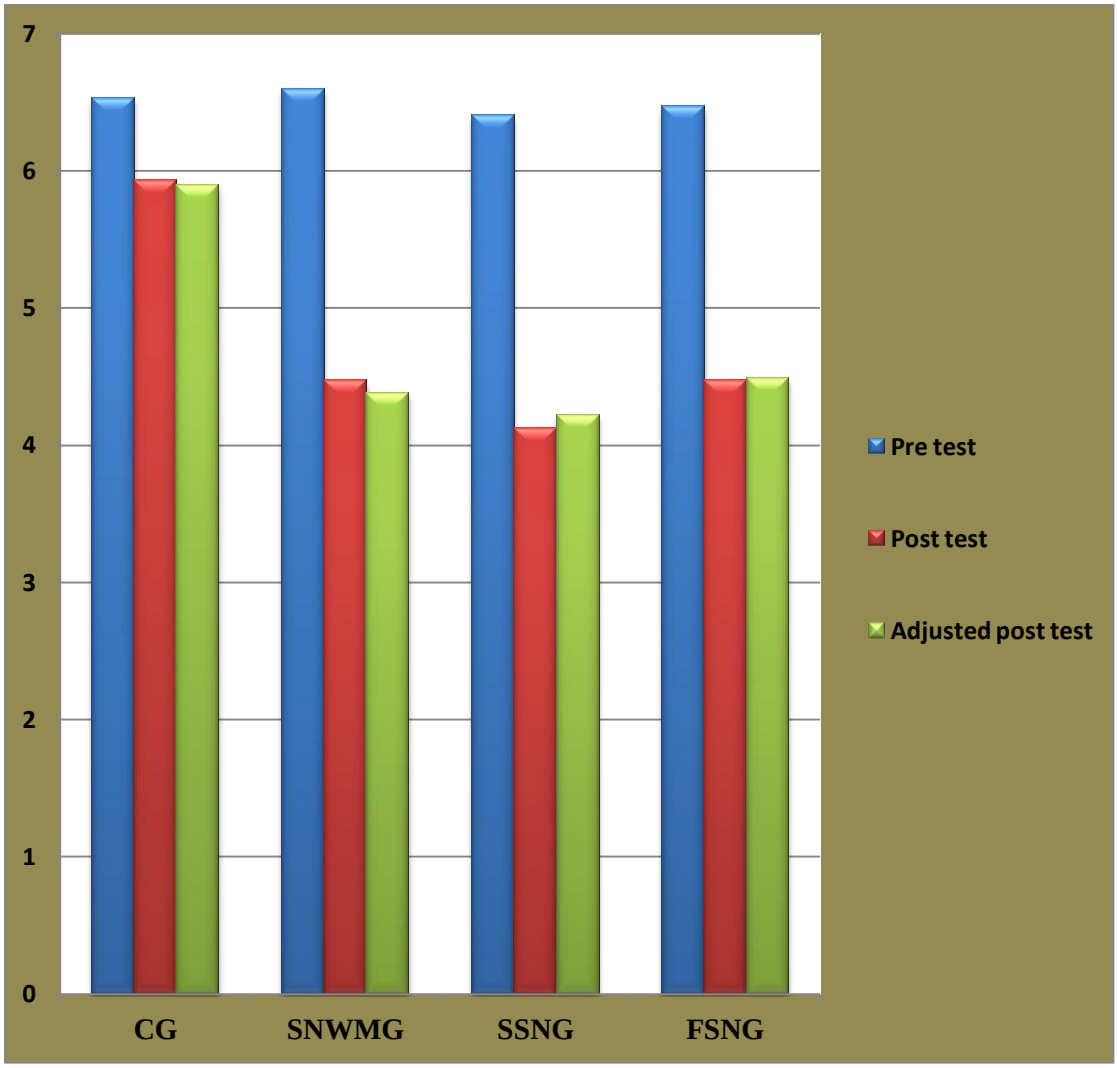


Fig 4 (viii)

Mean Difference among Control and Experimental Groups on Memory Meaningful

Table 4.17

ANALYSIS OF COVARIANCE FOR MEMORY MEANINGLESS OF CONTROL AND EXPERIMENTAL GROUPS

Groups	CG	SNWMG	SSNG	FSNG	SOV	SS	df	MSS	F
Pre-test Mean	11.47	11.47	11.13	11.20	**B**	1.383	3	0.461	0.27
S.D.	1.51	1.45	1.25	0.94	**W**	95.60	56	1.707	
Post-test Mean	11.33	8.27	8.00	8.27	**B**	112.73	3	37.58	28.7*
S.D.	1.79	0.89	0.85	0.70	**W**	73.20	56	1.307	
Adjusted Post-test Mean	11.21	8.25	8.03	8.28	**B**	109.96	3	36.65	28.3*
					W	71.15	55	1.294	

*****Significant at 0.05 level.

Required table value at 0.05 level of significance for 3 & 56, 3 & 55 degrees of freedom = 2.77.

Table 4.17 shows that the pre test means values on memory meaningless of CG, SMWMG, SSNG and FSNG are 11.47, 11.47, 11.13 and 11.20 respectively. The obtained 'F' ratio 0.27 for pre test scores was less than the table value, 2.77 for 3 and 56 required for significance at 0.05 level of confidence on memory meaningless. The post test means values on Memory Meaningless of CG, SNWMG, SSNG and FSNG are 11.33, 8.27, 8.00 and 8.27 respectively. The obtained 'F' ratio 28.7 for post test scores was greater than the table value 2.77 for 3 and 56 required for significance at 0.05 level of confidence on memory meaningless. The adjusted post test means of CG, SNWMG, SSNG and FSNG are 11.21, 8.25, 8.03 and 8.28 respectively. The obtained 'F' ratio of 28.3 for adjusted post test means was greater than the table value of 2.77 for 3 and 55 required for significance at 0.05 level of confidence on memory meaningless. The results indicated that there was a significant difference among the adjusted post test means of CG, SNWMG, SSNG and FSNG on memory meaningless.

Since the obtained 'F' ratio value was significant further to find out the paired mean difference, the Scheffe's post -hoc test was employed and presented in table 4.18.

Table 4.18

SCHFFE'S TEST FOR DIFFERENCES OF THE ADJUSTED POST –TEST PAIRED MEANS OF MEMORY MEANINGLESS

CG	FSNG	SNWMG	SSNG	Mean Difference	CI
11.21	8.28	-	-	2.93*	1.199
11.21	-	8.25	-	2.96*	
11.21	-	-	8.03	3.18*	
-	8.28	8.25	-	0.03	
-	8.28	-	8.03	0.25	
-	-	8.25	8.03	0.22	

Table 4.18 shows that the mean difference values between CG and FSNG, CG and SNWMG, CG and SSNG are 2.93, 2.96 and 3.18 respectively which are greater than the confidence interval value 1.199 at 0.05 level of confidence. The results of the study showed that there was a significant difference between CG and FSNG, CG and SNWMG, CG and SSNG on The results of the study showed that there was a significant difference between CG and FSNG, CG and SNWMG, CG and SSNG on memory meaningless. The mean difference values between FSNG and SNWMG, FSNG and SSNG, SNWMG and SSNG are 0.03, 0.25 and 0.22 respectively which are lesser than the confidence interval value 1.199 at 0.05 level of confidence. There are no significant differences between FSNG and SNWMG, FSNG and SSNG, and SNWMG & SSNG on memory meaningless.

The pre, post and adjusted post test means of CG, SNWMG, SSNG and FSNG on memory meaningless are graphically represented in the figure 4 (ix).

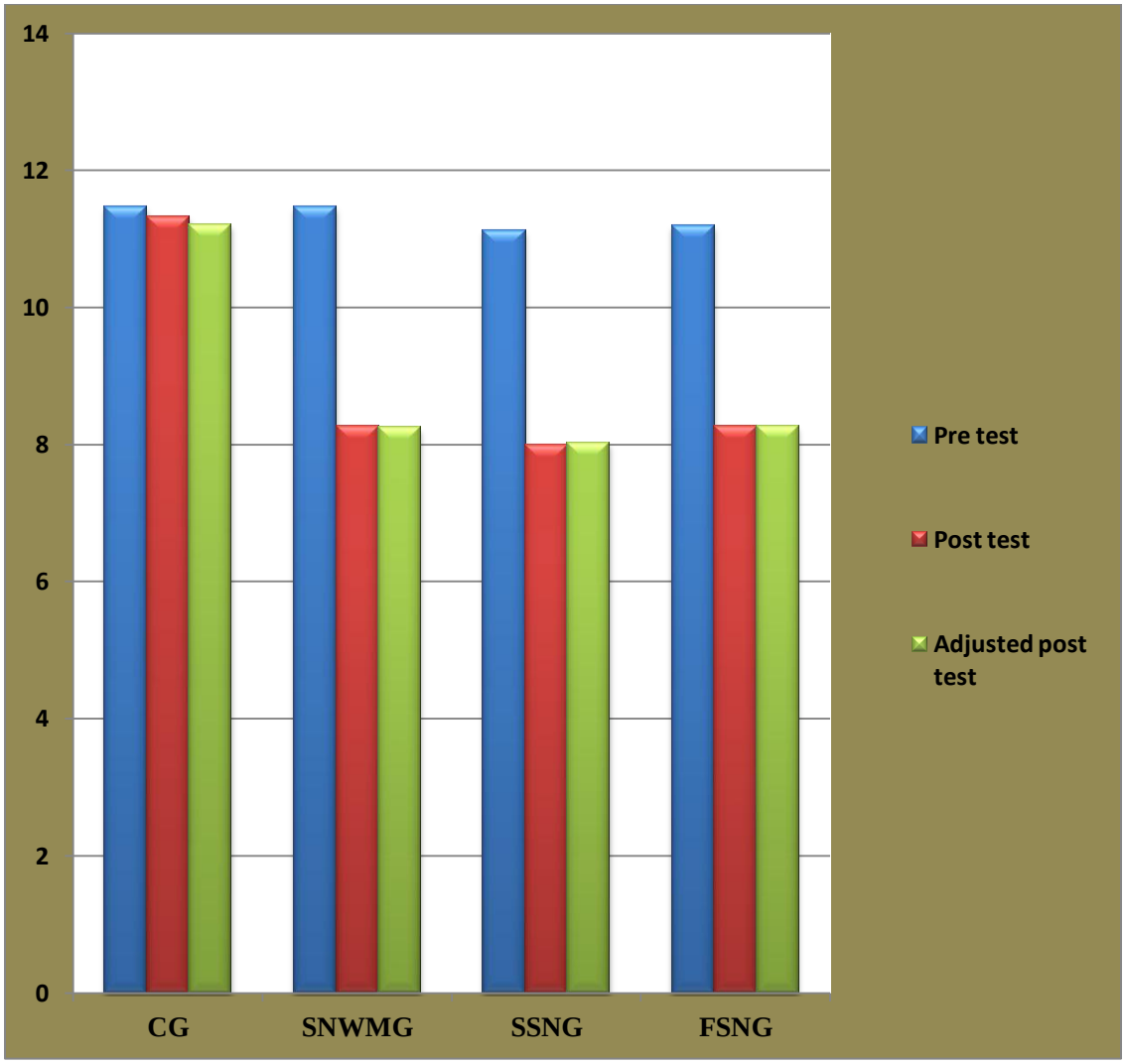


Fig 4 (ix)

Mean Difference among Control and Experimental Groups on Memory Meaningless

Discussion on Physical Variables

BMI

The findings of the study on BMI reveal that the experimental groups namely SNWMG, SSNG and FSNG had significantly improved after the training. Besides, the results of the study indicated that there was a significant difference between SNWMG, SSNG and FSNG. At the same time Suryanamaskar with mantra practices should better results in increasing BMI the other experimental groups.

The above findings are in agreement with the previous studies conducted by the following researchers. The present study was also supported by the studies of **Milind.A. Bhutkaret, et al., (2012), Shivesh Shukla (2010), Bhagirathi (2011)** and **Fondran Kristine Marie (2008).** The previous research conducted by **Tran. M. D, et.al (2001)** found that the effects of hatha yoga practices on the health related features of physical fitness. The previous research conducted by **Raju. P. S, et al (2003)** stated significant changes on BMI.

Flexibility

The findings of the study on flexibility reveal that the experimental groups namely SNWMG, SSNG and FSNG had significantly improved after the training. Besides, the results of the study indicated that there was a significant difference between SNWMG, SSNG and FSNG. At the same time Suryanamaskar with mantra practices should better results in increasing flexibility the other experimental groups

Chidambara. S Raja, (2012) found that yogic practices increase the flexibility among the college men students. The previous research conducted by **Gauris Shankar and Bhavita pancholi, (2011)** suggested that Suryanamaskar practices increase that flexibility. The above findings are in agreement with the previous studies conducted by **Shenbagavalli.A and Divya.K, (2011).** The previous research conducted by **Choudhary. R and Krzysztof stec, (2010)** stated that dynamic Suryanamaskar practices significant changes in flexibility.

Discussion on Physiological Variables

FVC, FER, PER and FEV1

The findings of the study on FVC, FER, PER and FEV1 reveal that the experimental groups namely SNWMG, SSNG and FSNG had significantly improved after the training. Besides, the results of the study indicated that there was a significant difference between SNWMG, SSNG and FSNG. At the same time fast Suryanamaskar practices should better results in increasing FVC, FER and FEV1 the other experimental groups and also fast suryanamaskar should better results in increasing PER that the other experimental groups.

The present findings very well are supported by observations made by the following studies conducted by **Madanmaohan and Ananda Balayogi Bhavani, (2013), Tamal Chakraborty, et al, (2013), Sinha Biswajit, et al, (2013) and C.K. Ewart, (2012).** The previous research conducted by **Fareeda. A Balikai, et al, (2012)** found that positive effects of nadi shodhana and Suryanamaskar increasing the pulmonary functions. The present study findings are strengthening the view point of **Vinayak. P. Doijad and Anil. D Surdi, (2012), Kaushik Halder, el al., (2012) and A.Sasikumar (2011)** found that Suryanamaskar practices significantly increase the FVC, FER, PER and FEV1.

Endurance (Cardio Respiratory)

The findings of the study on Endurance (Cardio Respiratory) reveal that the experimental groups namely SNWMG, SSNG and FSNG had significantly improved after the training. Besides, the results of the study indicated that there was a significant difference between SNWMG, SSNG and FSNG. At the same time Suryanamaskar with mantra practices should better results in increasing Endurance (Cardio Respiratory) the other experimental groups.

Bhavesh Surendra Mody, (2011) and Vishaw Gaurav, (2011) observed that the Suryanamaskar practices showed significant improvement on Endurance (Cardio Respiratory) compared to the control group. The above findings are also similar to **Pratima. M. Bhutkar, (2008), Sinha. B. (2004), Tran. M. D. et al., (2001)**. The present study also produces the similar studies.

Discussion on Psychological Variables

Memory Meaningful and Meaningless

The findings of the study on memory meaningful and meaningless reveal that the experimental groups namely SNWMG, SSNG and FSNG had significantly improved after the training. Besides, the results of the study indicated that there was a significant difference between SNWMG, SSNG and FSNG. At the same time slow Suryanamaskar practices should better results in increasing Endurance (Cardio Respiratory) than the other experimental groups.

Amit kauts & Neelam shrama, (2012) observed that the yoga practices helps to improve memory. Similarly **Kliger Kissinger fernandes rocha, (2012),** find that the yoga practices help to increasing the memory. The above findings are in agreement with the previous studies conducted by **Deborah Bowden, et al, (2012) and Ghanshyam singh thakur, et al, (2011)** stated that yoga practices increases the memory power in children's. The above findings are in agreement with the previous studies conducted by **N. Visalakshi & S. Thenmozhi, (2011) and R. Rangan, et al, (2009)**. The present study also produces the similar study.

Interpretation of the Results

Suryanamaskar is a spiritually uplifting exercise and promotes a keen awareness of the interconnectedness of our body. Mind induces a state of concentration and calm in preparation. Practicing suryanamaskar stretches all the abdominal organs, improves digestion and blood circulation, makes spine supple and tones spiral nerves.

Suryanamaskar is an ideal form of aerobic exercise having static, stretching and dynamic muscular movements involving all major joints. The increase in the strength of the major respiratory muscles and endurance on the basis of stimulation of skeletal muscles during the isometric concentration maintained during the steady state of the different postures in suryanamaskar. Also limbs by offering a complete workout for all muscle groups leading to enhanced flexibility. This may be the reason why there will be a great flexibility in the spine due to regular suryanamaskar practices with mantras.

Suryanamaskar practices produce hormonal balance there by resulting in over all good health. It helps to loosen up joints and muscles and removes nervous tension and anxiety due to the dynamic nature of the practice. Suryanamaskar leads to better oxygenation, a lower respiration and heart rate and predominance of the parasympathetic arm of the autonomic system. The different postures of suryanamaskar involve isometric contraction and chest wall expansion which may be improving strength of the intercostals muscles. It indices the respiratory muscle strength and highest MIP (Maximum Inspiratory Pressure) is obtained at lung volumes of less than 50% of total lung capacity and highest MEP is obtained at lung volumes of more than 70% of total lung capacity also improvement in the strength of inspiratory and as well expiratory muscles. It has been suggested that suryanamaskar at different speeds provides different benefits and that when it is done rapidly it warms up the body and acts as a cardio tonic, whereas when done slowly it strengthens and tones the musculature and enhances functioning of internal organs.

Suryanamaskar is combined with correct breathing and bija mantras, the entire mind and intellect are energized bija mantra create a vibration which creates the energy. Mantras acquiring stability of mind and self control or dissolving the tensions caused by modern day living. Movements should be synchronized to form one harmonious and smooth motion. It gives spiritual energy, remover of suffering are effulgent like the sun. It also enlightens the intellect and gives wisdom and reverberates in the heart. That is why all the selected physiological variables showed significant improvement due to suryanamaskar practice.

Suryanamaskar provides mental benefits to regular practitioners it is an excellent way to manage stress and alleviate depression. It will expand a tremendous amount of energy and can also help to decrease stress and gives peace of mind, and improve sleep patterns. Suryanamaskar eases stress and gives peace of mind besides increasing the levels of concentration. Finally it is helpful for reducing muscular tensions which reduces stress and it enhancing emotional will being and flexibility to stress. Because of the above said reasons and distress all the experimental groups have better memory than the control group. Moreover there won't be any significant differences found among the experimental groups because all the experimental groups were practiced suryanamaskar regularly.

Mantras during the practice removes monotony, provides harmony with in and produces soothing vibrations that removes that removes fatigue and also acts on various charkas. Bring humility and remove self binding. Ultimately the stronger the base or foundation, better the range and the power of movements. Suryanamaskar performed with deep rhythmic breathing, focused alignment and a mental state of joy makes us receptive to a higher state of consciousness.

Discussion on Hypotheses

1. It was mentioned in the first hypothesis that there would not be any significant improvement on selected physical variables due to the effects of Suryanamaskar practices. The results of the study indicate that there was significant improvement in all the physical variables due to the effects of Suryanamaskar practices. Hence, the first hypothesis was completely rejected with respect to the physical variables.
2. It was mentioned in the second hypothesis that there would not be any significant improvement on selected physiological variables due to the effects of Suryanamaskar practices. The results of the study indicate that there was a significant improvement due to the effects of Suryanamaskar practices on FVC, FER, PER, FEV_1 and Endurance (Cardio Respiratory). Hence, the second hypothesis was completely rejected with respect to the physiological variables.
3. It was mentioned in the third hypothesis that there would not be any significant improvement on selected psychological variables due to the effects of Suryanamaskar practices. The result of the study indicates that there was a significant improvement in all the psychological variables due to the effects of Suryanamaskar practices. Hence, the third hypothesis was completely rejected with respect to the psychological variables..
4. It was mentioned in the fourth hypothesis that there would not be any significant difference on the dependent variables between the experimental groups. The results of the study indicate that there was a significant difference between the experimental groups with respect to all the physical, physiological and psychological variables. Hence, the fifth hypothesis was completely rejected at 0.05 level of confidence.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of the study was find out the effect of Suryanamaskar practices on selected physical, physiological and psychological variables among school girls. To achieve this purpose of the study, 60 school girls were selected at random from Jothi Vallalar Higher Secondary School, Peryiakalapet, Puducherry. The age of the subjects ranged between 12 to 14 years. The selected subjects were divided into three experimental groups and a control group with fifteen subjects each (n=15). Experimental group I underwent Suryanamaskar with mantras (SNWMG), Group II underwent slow Suryanamaskar (SSNG), Group III underwent fast Suryanamaskar (FSNG) and Group IV served as control. The training period was fixed for 12 weeks. The experimental groups participated in the 12 weeks training program for 5 session a week (per day one session consist of 45 minutes between 6 am to 7 am).

Subjects of the four groups SNWMG, SSNG, FSNG and CG were tested on selected physical variables (BMI, Flexibility), physiological variables (FVC, FER, PER, FEV1 and Endurance (cardio respiratory) and psychological variables (Memory Meaningful and Meaningless) prior to and after the 12 weeks of training period. The data pertaining to the variables in this study were statistically examined by using analysis of covariance (ANCOVA) for each variable separately, whenever 'F' ratio of adjusted post-test was found to be significant, the Scheffe's test was used as post-test to determine the paired mean differences.

BMI was tested by Tanita body composition analyzer and flexibility was measured by sit and reach box method. Physiological variables namely FVC, FER, PER and FEV1 were assessed by peak flow meter and Endurance (cardio respiratory) are measured by cooper's 9 minutes run and walk test respectively. Psychological variables namely memory meaningful and meaningless were tested by memory test.

The data collected from the four groups before and after the experimental period statistically examined for significant improvement by using analysis of covariance. Whenever the 'F' ratio was found to be significant, Scheffe's test was

used as post-hoc test to determine which of the paired means differed significantly. In all cases the statistical significance was set at 0.05 level of confidence ($P< 0.05$).

Conclusions

In the present investigation, as a result of executing three different training programmes the following improvements occurred on selected dependent variables.

1. Suryanamaskar with mantras group, slow Suryanamaskar group and fast Suryanamaskar group showed significantly improvement in flexibility as compared to control group.
2. Suryanamaskar with mantras group, slow Suryanamaskar group and fast Suryanamaskar group showed no significantly improvement on BMI when compared to control group. Whereas Suryanamaskar with mantras group found significantly when compared to fast Suryanamaskar group on BMI and Flexibility.
3. Suryanamaskar with mantras group, slow Suryanamaskar group and fast Suryanamaskar group showed significantly improvement in FVC (Forced Vital Capacity), PER (Peak Expiratory Rate) and FEV_1 (Forced Expiratory Rate) and as compared to control group. Whereas Suryanamaskar with mantras group and slow Suryanamaskar group showed no significantly improvement on FER (Forced Expiratory Rate) as compared to control group.
4. Slow Suryanamaskar group and fast Suryanamaskar group showed no significantly improvement on endurance (cardio respiratory) except Suryanamaskar with mantras group as compared to control group.
5. Suryanamaskar with mantras group, slow suryanamaskar group and fast suryanamaskar group showed significantly improvement in memory meaningful and meaningless as compared to control group.

Recommendations by the Research Scholar

The following recommendations are made with a strong feeling that they would further encourage other professional colleagues and pave a way for further studies in this area.

1. Similar study may be designed to investigate the effects of training programmes based on gender at different age levels.

2. Similar study may be conducted other variables.
3. Training intensity and the number of training sessions can be fixed according to the age, gender and performance level of the subjects.
4. Suryanamaskar practices will be of great use for the trained subjects by increasing both the intensity of training and number of training session in a week.
5. The present study thus, needs to be strengthened or supported by more relevant research studies.

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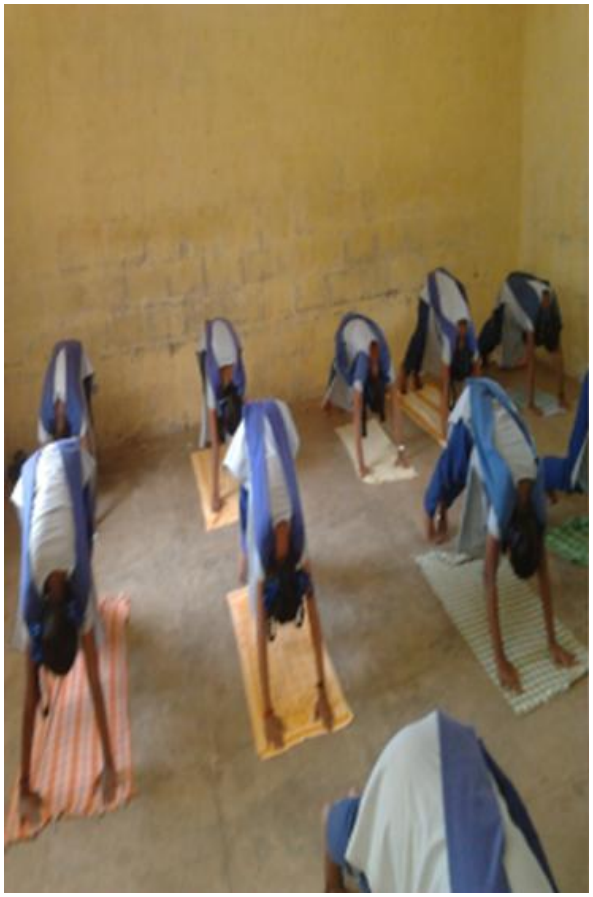
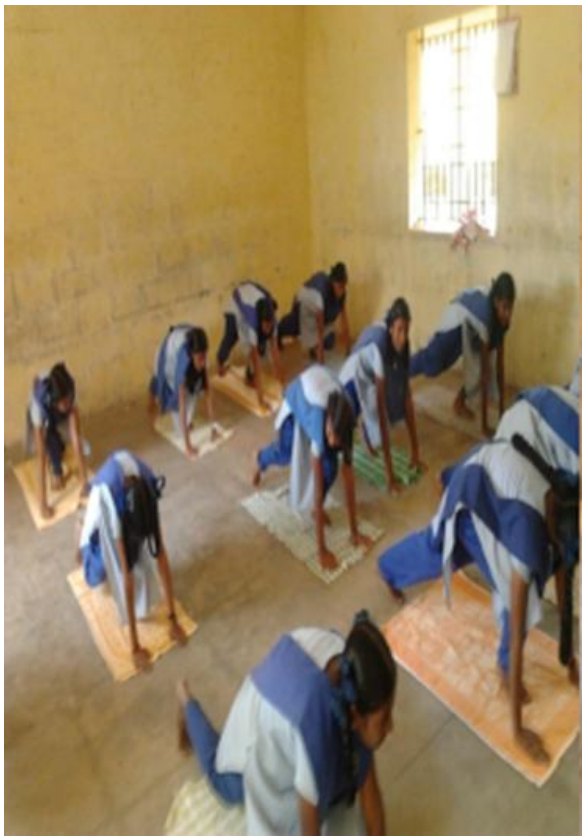
APPENDICES

SURYANAMASKAR PRACTICES





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