CHAPTER III

METHODOLOGY
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In this chapter, selection of subjects, selection of variables, selection of tests, reliability of instruments, competency of tester, reliability of data, pilot study to construct practice schedule of asanas, orientation of subjects, administration of tests, collection of data, schedule for practice of asanas, experimental design and statistical procedure used are explained.

SELECTION OF SUBJECTS

Twenty-four trained intercollegiate Volleyball players were selected at random from the colleges affiliated to Madurai Kamaraj University, Madurai. From the selected players, twelve players were randomly assigned as subjects for control group and the other twelve players for experimental group. The experimental group underwent twelve weeks practice of selected asanas whereas the control group did not undergo any type of training. The age, height and weight of the selected subjects ranged from eighteen to twenty five years, 1.62 to 1.81 meters and 55 to 73 kilograms respectively. Their means were 20 years and eight months, 1.72 meters and 65 kilograms respectively.
A qualified physician assured that the subjects did not have any malfunction in their endocrine system. A copy of the fitness certificate of the subjects is given in the appendix- V. Subjects of the study volunteered to participate with a written consent and they were free to withdraw their consent in case they felt discomfort during the period of training. A form for written consent is shown in the appendix - VI. However, there were no dropouts in the study. All the subjects had similar academic work and regular activities in accordance with the requirements of the college curriculum. The subjects were not involved in any other activity except the intramural competitions that could not be avoided.

RATIONALE USED IN THE SELECTION OF SUBJECTS

To give due credence to the purpose of the present investigation, six main players from each of the four teams were selected. From the selected players, twelve players were randomly assigned as subjects for control group and the other twelve players for experimental group. The six players chosen for this study were mainly involved in play for more time than other players in that particular team. It was felt that these subjects were sufficient, taking into consideration of the number and nature of variables, nature and duration of training, testing procedures, time factor and practical difficulties of the investigator to collect the data and processing them. Above all, such subjects were adequate to draw meaningful conclusions and generalisations.
SELECTION OF VARIABLES

Most of the available data refer to blood levels of various hormones rather than rates of secretion. An increase of blood concentration during exercise may indicate an increased rate of hormone secretion by an endocrine gland. Plasma cortisol was increased due to heavy, prolonged or exhausting exercises (Shephard, 1982).

Resting plasma cortisol concentrations are not greatly affected by aging that increases heart rate, systemic blood pressure and associated catecholamine secretion with stressful exercise or cold exposure. They are greater in the elderly than in the younger person (Shephard, 1982).

Cortisol is the main glucocorticoid, comprising more than 30% of the total plasma 17-hydroxycorticoids. 15-30 μg of cortisol is secreted per day by the adrenal cortex in an adult and 60-70% of this is secreted between midnight and morning 8 o’clock. Because of the diurnal variation, normal plasma cortisol values in the same person may be 25 μg per dl at 7 to 8 A.M and 6 to 10μg per dl after 4 P.M. (Rapael, 1976).

If there is a stress imposed on the person, the ACTH (Adrenocorticotropic Hormone) secretion is elevated and so the cortisol secretion is elevated, no matter what is the hour of the day. Further, inspite of the high plasma cortisol level, the ACTH continues to remain high in stress (Chaudhuri, 1991).

It is amazing that almost any type of stress, whether it be physical or neurogenic, will cause an immediate and marked increase in ACTH secretion,
followed within minutes by greatly increased adrenocortical secretion of cortisol (Guyton, 1971).

Athletes who sweat heavily during long periods of exercise need to be concerned with loss of electrolytes, especially sodium (Bruce, 1986).

Epithelial cells of the renal tubules, sweat glands and glands of the alimentary system have enzymatically-controlled mechanisms for transporting electrolytes across cell membranes. The electrolyte 'pumps' respond to mineralocorticoids by concerning sodium and chloride and by wasting bodily potassium. A good example of such a system is found in the distal tubule of the mammalian nephron. The processes are accelerated by mineralocorticoids. Absence of mineralocorticoid activity may result in luteal wastage of sodium and retention of potassium. Sufficient mineralocorticoid helps the body to achieve electrolyte homeostasis (Williams, 1981).

The principal steroid with mineralocorticoid activity is aldosterone. Cortisol, the major glucocorticoid in non-rodent species, is said to have "weak mineralocorticoid activity", which is of some importance because cortisol is secreted very much more abundantly than aldosterone. Another way to state this is that a small fraction of the mineralocorticoid response in the body is due to cortisol rather than aldosterone.

The mineralocorticoid receptor binds both aldosterone and cortisol with equal affinity. Moreover, the same DNA sequence serves as a hormone response
element for the activated (steroid-bound) forms of both mineralocorticoid and glucocorticoid receptors.

Asanas, as these exercises are called, may be best translated, as postures. It is interesting to note that, as against western exercise, a posture, once the position is assumed, is held for a long time. Apart from the general development that is claimed to follow from these postures, some of them are said to have specific therapeutic value (Behnam, 1938).

The yoga theory about the endocrine glands and their profound effect on body, mind and soul, was not accepted as scientific until endocrinology was ‘born’ in the west, which was as late as May 1899. Even then it was a long time before it was discovered that the ductless glands were responsible for the nutrition of the body and its growth, for our sex life, for blood circulation and other important functions including the working of the mind (Indradevi, 1990).

Hence, the investigator selected plasma aldosterone and plasma epinephrine as dependent variables for this study.

Elevation of adrenal cortex hormones is considered helpful in doing a movement explosively and effectively to give better performance. The investigator selected a group of asanas to examine their influence on plasma aldosterone and plasma epinephrine.
SELECTION OF TESTS

Aldosterone

Aldosterone synthesis is primarily regulated by the renin-angiotensin system. This system forms a volume-feedback loop whose level of activity can be suppressed or enhanced by sodium balance and/or circulating intravascular volume. Renin, an enzyme produced in the juxtaglomerular apparatus of the kidney, catalyzes the conversion of angiotensinogen (an inactive precursor peptide) to angiotensin I. Angiotensin I undergoes further enzymatic conversion by angiotensin-converting enzyme (ACE) to produce angiotensin II which acts via the angiotension (AT) AT2 receptor to stimulate the release of aldosterone from the zona glomerulosa of the adrenal gland. The renin-angiotensin II system is also locally expressed in the zona glomerulosa of the adrenal cortex and regulates aldosterone production in a paracrine fashion. Aldosterone production is positively and directly stimulated by potassium balance. Adrenocorticotropic hormone (ACTH) will also transiently stimulate aldosterone production but prolonged ACTH infusion over 24 hours leads to a return of aldosterone levels to baseline. Aldosterone production can also be modulated by additional factors including dopamine and atrial natriuretic peptide (ANP). The action of angiotensin II on aldosterone secretion results in a negative-feedback relationship. For example, high sodium intake results in extracellular volume expansion and a decrease in aldosterone production by suppression of the renin-angiotensin system. This feedback loop functions to control two critical systems in the human body: 1)
sodium homeostasis, and 2) regulation of arterial pressure. The regulation of arterial pressure by the renin-angiotensin-aldosterone system (RAAS) is complex, resulting from direct and indirect actions of angiotensin II and aldosterone on 1) constriction of vascular smooth muscle; 2) release of norepinephrine from the peripheral sympathetic nerve endings and epinephrine from the adrenal medulla; 3) release of vasopressin; and 4) volume expansion.

**Epinephrine**

Epinephrine, norepinephrine, brain natriuretic peptide, angiotensin 2, aldosterone, endothelin, and estrogen have systemic effects (e.g. on the sympathetic nervous system) as well as cellular effects on endothelial cells and vascular smooth muscle cells besides other actions. Epinephrine stimulates α, β1 and β2 receptors in vascular smooth muscle cells. It increases systolic blood pressure, ventricular contractility, and heart rate, and it causes vasoconstriction in the arterioles of the skin, mucosa, and splanchnic areas. However it causes dose-dependent vasodilation in skeletal muscle arterioles as a first-line response to stress. Endothelial cells emerge to be target cells as well. Coactivation of the sympathetic nervous system may lead to indistinguishable coeffects together with norepinephrine. In addition to well characterized effects on the heart (chronotropicity, inotropicity), epinephrine has a certain anti-oxidant potential by increasing both the intra- and extracellular superoxide dismutase as a major oxidant-stress defense. Although hydrogen peroxide, the product of the reaction catalyzed by superoxide dismutase, is considered a reactive oxygen species, it is
readily disposed by both catalase and reduced glutathion. The explanation for the beneficial effect of inducing superoxide dismutase by epinephrine in circumstances like vigorous exercise is that hydrogen peroxide induces eNOS, the endothelial isoform of nitric oxide synthase. Thus, epinephrine triggers a response directed to oxidative stress by inducing eNOS. Epinephrine increases C-reactive protein (CRP) in a dose-dependent manner, probably via a receptor mechanism.

**RELIABILITY OF INSTRUMENTS**

All the instruments were in good condition and workable, purchased in reputed companies. The calibrations were tested and found to be accurate enough to serve the purpose of the study.

**COMPETENCY OF TESTER**

The operation of semi auto analyser and flame photometer was done under the supervision of an experienced microbiologist. The investigator learned the procedure and methods to prepare the solutions and operate the instrument for testing plasma aldosterone and epinephrine. The competency of tester was evaluated together with the reliability of the tests. The plasma aldosterone and epinephrine levels of ten players were estimated twice under identical conditions for determining the competency of the tester. The scores thus obtained were analysed by using intraclass correlation.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma aldosterone</td>
<td>0.99*</td>
</tr>
<tr>
<td>Plasma epinephrine</td>
<td>0.95*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level of significance

The table value required for significance at 0.01 level of confidence is 0.76.

**RELIABILITY OF DATA**

The reliability of data was ensured by establishing the reliability of instruments, competency of tester, reliability of the test and subject reliability.
PILOT STUDY TO CONSTRUCT PRACTICE SCHEDULE OF ASANAS

To construct the practice schedule of asanas, ten trained Volleyball players were selected at random from the selected subjects and they underwent practice of asanas under the keen observation of the experts and the investigator. The asanas selected for this study under the practice schedule have been recommended to influence the adrenal cortex hormones (Yogeshwar, 1982). Based on the response and interest of the subjects during the pilot study, training schedule was constructed. However, the individual differences were considered. The following basic principles of asanas were followed while constructing the practice schedule.

Principles of asanas

1. Practice of asanas without the backing of yama and niyama is mere acrobatics.
2. Before starting to practice asana, the bladder should be emptied and the bowels evacuated.
3. Taking a bath or a shower bath before and after practicing asanas refreshes the body and mind.
4. The best time to practice is either early in the morning or late in the evening.
5. Do not practice asanas after being out in the hot sun for several hours.
6. Asanas should be done in a clean airy place, free from insects and noise.

7. Do not do them on the bare floor or on an uneven place, but on a folded blanket laid on a level floor.

8. No undue strain should be felt in the facial muscle, ears and eyes or in breathing during the practice.

9. In the beginning, keep the eyes open. You can keep your eyes closed only when you are perfect in a particular asana.

10. During the practice of asanas, it is the body, alone which should be active while the brain should remain passive, watchful and alert.

11. In all the asanas, the breathing should be done through the nostrils only and not through the mouth.

12. After completing the practice of asanas always lie down in Savasana for at least 10 to 15 minutes, as this will remove fatigue (Iyengar, 1982).

**ORIENTATION OF THE SUBJECTS**

The investigator clearly explained the selected variables in the study and the purpose of training schedule to the subjects. Before the commencement of the training programmes, a week was spent to teach the asanas postures for the experimental group. Four ‘one hour’ sessions were spent on alternate days to have thorough knowledge of practicing asanas.
Though the control group did not undergo any training, they were also given a thorough knowledge about the test items followed in this study.

**ADMINISTRATION OF TESTS**

Blood samples were allowed to clot for 1 hour at room temperature and were then centrifuged in order to obtain the plasma. Plasma was taken from each sample and they were stored at -20°C within 2 hours after collection.

**DETERMINATION OF PLASMA ALDOSTERONE AND EPINEPHRINE**

**Testing aldosterone**

Blood is drawn from a vein, usually from the inside of the elbow or the back of the hand. The puncture site is cleaned with antiseptic. An elastic band is placed around the upper arm to apply pressure and cause the vein to swell with blood.

A needle is inserted into the vein, and the blood is collected in an air-tight vial or a syringe. During the procedure, the band is removed to restore circulation. Once the blood has been collected, the needle is removed, and the puncture site is covered to stop any bleeding.

The area is cleansed with antiseptic and punctured with a sharp needle or a lancet. The blood may be collected in a pipette (small glass tube), on a slide, onto a test strip, or into a small container. A bandage may be applied to the puncture site if there is any bleeding.
**How the test will feel**

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

Aldosterone is a hormone released by the adrenal glands. It is part of the complex mechanism used by the body to regulate blood pressure. Aldosterone is the main sodium-retaining hormone from the adrenal gland. It increases the reabsorption of sodium and water along with the excretion of potassium in the distal tubules of the kidneys. This action raises blood pressure.

Frequently, blood aldosterone levels are combined with other blood tests (plasma renin activity) or provocative tests (captopril test, intravenous saline infusion test or ACTH infusion test) in order to diagnosis over- or under-production of the hormone.

**Table 2**

<table>
<thead>
<tr>
<th>Aldosterone</th>
<th>Lying down:</th>
<th>2 to 16 nanograms per liter (ng/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing up:</td>
<td>5 to 41 ng/dl</td>
</tr>
</tbody>
</table>

Normal value ranges may vary slightly among different laboratories.

Note: ng/dl = nanograms per deciliter

**Testing Epinephrine**

A test for catecholamines measures the amount of epinephrine, norepinephrine, and dopamine produced by nerve tissue (including the brain) and
the inner part of the adrenal glands. The test for epinephrine was done on a sample of blood taken from a vein.

The adrenal glands produce large amounts of catecholamines as a reaction to stress. The main catecholamines are epinephrine (adrenaline), norepinephrine (noradrenaline), and dopamine. They break down into the compounds vanillylmandelic acid (VMA) and metanephrine, which are passed in the urine.

When released into the blood, catecholamines increase heart rate, blood pressure, breathing rate, muscle strength, and mental alertness. They also reduce the amount of blood going to the skin and increase blood flow to the major organs (such as the brain, heart, and kidneys).

Certain rare tumors (such as a pheochromocytoma) can increase the amount of catecholamines in the blood, resulting in high blood pressure.

Normal values may vary widely from lab to lab.
Table 3

Catecholamine in blood

<table>
<thead>
<tr>
<th>Epinephrine</th>
<th>Lying down:</th>
<th>Less than 50 nanograms per liter (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing up:</td>
<td>Less than 95 ng/L</td>
</tr>
</tbody>
</table>

Note: ng/L = nanograms per liter

High values

High levels may also be seen with any significant stress, such as burns, a whole-body infection (sepsis), illness, surgery, and traumatic injury.

Low values

- Lower-than-normal blood catecholamine values are rarely important clinically. If values are low, most health professionals do not pursue further testing.
- Normally, the amount of catecholamines in a blood sample taken while a person is lying down is lower than in a sample taken while the person is standing up. If the amount while lying down is within the normal range and does not increase after standing up for 30 minutes, a problem with the autonomic nervous system may be present. This may be associated with long-term diabetes or certain neurologic conditions (such as Shy-Drager syndrome).
- No further testing is needed if urine catecholamine levels are at or near the undetectable range.
What Affects the Test
Factors that can interfere with your test and the accuracy of the results include:

- Strenuous physical exercise or extreme physical or emotional stress.
- Recent surgery, injury, or illness.
- Many medications. These include ephedrine, aspirin, levodopa, nitroglycerin, tricyclic antidepressants, tetracycline, theophylline, clonidine, methyldopa, guanethidine, bromocriptine, cimetidine, reserpine, and many blood pressure medications.
- Nicotine, alcohol (ethanol) or cocaine.
- Nonprescription cough, cold, or sinus medications.
- Eating or drinking foods containing caffeine.
- Failing to collect exactly 24 hours of urine during a catecholamines urine test.
- Having a test using radioactive tracer or contrast material, especially iodine, within 1 week of the catecholamine test (Nissl, 2004).

COLLECTION OF THE DATA
Blood samples were collected from experimental group and control group one week before competition during rest. In order to find out the influence of asanas on plasma aldosterone and epinephrine, blood samples were drawn from the subjects. Then the blood samples were also collected just five minutes prior to competition and immediately after competition before and after the
experimentation. The blood samples were collected from the non-dominant forearm vein of the subjects by a qualified lab-technician. All blood samples were collected from the subjects prior to which they refrained from exercise, alcoholic drinks and any other strenuous physical activity, which may elevate the secretion of adrenal cortex hormones for twenty-four hours. The blood samples from each subject were drawn using separate disposable, highly sterilised syringe to avoid possible HIV (AIDS) infection. A qualified lab-technician was assigned to collect blood samples to gain faith from the subjects.

The subjects from the experimental group were treated with the practice of asanas for twelve weeks both in morning and in evening, as mentioned in Table 4. The asanas were practiced between 6 a.m. and 7 a.m. and between 5.30 p.m. and 6.30 p.m. for five days in a week. The practice was given under the watchful eyes of the investigator. Attendance was calculated for the experimental group by dividing the total number of training sessions by the number of sessions present. It was 90% for the experimental group. The control group did not undergo any type of training.

**SCHEDULE FOR THE PRACTICE OF ASANAS**

The bodily postures help to strengthen the body and stabilise the mind. That posture in which a man can remain longest without effort is for him the best. The very word *asana* means “easy, comfortable”, and so the postures should have their full effect. To gain its effects, it is necessary to remain in one posture motionless for a specific period. The asanas in the practice schedule and the
duration of practice, as prescribed by Kuvalayananda (1925), have been shown in Table 2 given below.

Table 4  
SCHEDULE OF ASANAS

<table>
<thead>
<tr>
<th>Name of the Asana</th>
<th>Duration of asana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savasana</td>
<td>15 minutes to 20 minutes</td>
</tr>
<tr>
<td>Sarvangasana</td>
<td>½ minute to 6 minutes</td>
</tr>
<tr>
<td>Matsyasana</td>
<td>¼ minute to 3 minutes</td>
</tr>
<tr>
<td>Halasana</td>
<td>1 minute to 4 minutes</td>
</tr>
<tr>
<td>Bhujangasana</td>
<td>10 seconds to 1 minute</td>
</tr>
<tr>
<td>Dhanurasana</td>
<td>10 seconds to 1 minute</td>
</tr>
<tr>
<td>Shalabasana</td>
<td>10 seconds to 1 minute</td>
</tr>
<tr>
<td>Savasana</td>
<td>15 minutes to 20 minutes</td>
</tr>
</tbody>
</table>

The procedure of practicing each asana, prescribed in the schedule, is given hereunder. Figure 4 to 10, showing the asana postures are copied from the book entitled “Lights on Yoga” written by Iyenkar.
**Savasana (Corpse Pose)**

'Sava' means a corpse. In this asana the subject has to imitate a corpse. Once life has departed, the body remains still and no movements are possible.

![Figure 4 Savasana](image)

**Procedure**

The subject lies flat on the back full length like a corpse. He keeps the hands a little away from the thighs, with the palms up. Then he closes the eyes and keeps the heels together and the toes apart. He concentrates on deep and fine exhalations, in which the nostrils do not feel the warmth of breath. He relaxes completely and breathes out slowly. He stays in the pose from 15 to 20 minutes.

**Sarvangasana (The Pan - Physical Pose)**

'Sarvanga' ('Sarva' - all, whole, entire, complete; 'anga' - limb or body) means the entire body or all the limbs. In this pose, the whole body benefits from the exercise, hence the name.
Procedure

The subject first lies supine on his seat with all his muscles completely relaxed and his mind thoroughly concentrated. Then he slowly raises his legs through the hipjoint till they make a right angle with the ground, all the while maintaining stiff knees, upto now he does not bring into action his arms and elbows which play only a passive part. But, here, he raises his whole body with weight on his arms, resumes the position as shown in figure -5. At this point, the player must see that his chest presses against his chin. Further, in order to complete the chin-lock, he bends his forearm through the elbows and with his hands press his trunk against the chin, until it well sets in the jugular notch. In this
practice, the posterior part of the neck lies close along the ground; the trunk and the legs are in a straight line and the mind is free on the thyroid.

*Matsyasana (The Fish Pose)*

‘*Matsya*’ means a fish. This posture is dedicated to *Matsya*, the Fish Incarnation of Vishnu, the source and maintainer of the universe and of all things.

![Figure 6 Matsyasana](image)

**Figure 6 Matsyasana**

**Procedure**

The subject first takes his seat with his legs fully stretched out. He then bends one of his legs, preferably the right in the knee joint and folding it upon itself, sets the same in the opposite hip joint, so as to allow the foot lie stretching at the root of the thigh with its sole upturned. The other leg is similarly folded and set in the opposite hip joint. Both the heels he adjusts in the adjacent portion of the abdomen. After this, the player lies supine on his seat. Then he is resting his weight on the elbows. He raises his trunk and head and throwing the latter backward with an arched spine, makes a bridge on his seat. Subsequently he makes hooks of his forefingers and with these lays hold of the opposite toes, which are now available on their wrong side.
Halasana (The Plough Pose)

'Hala' means a plough, the shape of which this posture resembles, hence the name.

Figure 7 Halasana

Procedure

It is a part of Sarvangasana and a continuation thereof. The subject releases the chin lock, lowers the trunk slightly, move the arms and legs over the head and rests the toes on the floor. He tightens the knees by pulling up the hamstring muscles at the back of the thighs and the trunk.
\textit{Bhujangasana} (The Cobra Pose)

'\textit{Bhujanga}' means a serpent. The pose resembles a serpent about to strike.

\textbf{Figure 8 \textit{Bhujangasana}}

\textbf{Procedure}

The subject first lies prone on his seat with his muscles thoroughly relaxed while getting ready for the cobra pose. The player touches the ground with his forehead and keeps his hands, one on each side of the chest, bending them in the elbows. The soles are made to look upward. The player raises his head and bends the neck backward as far as possible. The chin is completely thrown out. During this attempt, the player lifts the body up from the trunk until the pubis is in contact with the floor and stays in this position with the weight on the legs and palms. Then, he contracts the anus and the buttocks.
Dhanurasana (The Bow Pose)

'Dhanu' means a bow. The hands here are used like a bow-string to pull the head, trunk and legs up and the posture resembles a bent bow.

![Figure 9 Dhanurasana](image)

Procedure

The subject lies full length on the floor on the stomach, face downward. He exhales and bends the knees. Then he stretches the arms back and holds the left ankle with the left hand and the right ankle with the right hand. Now, he exhales completely, pulls the legs up by raising the knees above the floor, and simultaneously lifts the chest off the floor. The arms and hands act like a bowstring to tighten the body like a bent bow. The player lifts up the head and pulls it as far back as possible.
Shalabhasana (The Locust Pose)

'Shalabha' means a locust. The pose resembles that of a locust resting on the ground, hence the name.

Figure 10 Shalabhasana

Procedure

The subject lies full length on the floor on the stomach, face downwards. He stretches the arms back. He exhales, lifts the head, chest and legs off the floor simultaneously as high as possible. The hands should not be placed and the ribs should not rest on the floor. Only the abdominal front portion of the body rests on the floor and bears the weight of the body. Then, he contracts the buttocks and stretches the thighs, knees and ankles. He does not bear the weight of the body on the hands but stretches them back to exercise the upper portion of the back muscles. He stays in the position as long as he can with normal breathing. In the beginning, it is difficult to lift the chest and the legs off the floor, but this becomes easier as the abdominal muscles grow stronger.
The time for holding each asana in the final stage is slowly increased. Thus the concept of *asanjaya*, where one practices the asana with greater ease and maintains it comfortably and stably for a longer duration, could be achieved. In such type of effortless, easy and comfortable maintenance of the final stage, various muscles and joints are stretched smoothly without any resistance. This is known as passive stretching where the muscles and tendons are not stretched beyond their natural limits. When the big muscles of the extremities are undergoing a passive stretch, asanas work on the trunk areas and the smooth muscles of the visceral organs. The mild pressure in the internal organs results in stimulation of the autonomic nervous system as the walls of these organs undergo a mild stretching and relaxation, alternatively.

In most of the asanas, the abdominal area is influenced. During the maintenance phase of the asanas, the abdominal cavity undergoes pressure changes that are reflected on the visceral organs like stomach, lungs, colon, kidney, urinary bladder etc. If breathing is allowed to be continued while maintaining the asanas, there is an alternate positive and negative pressure on the viscera. These pressures and consequent stretching of the walls of the visceral organs stimulate visceroreceptors, which are sensitive to stretching. The alternate positive and negative pressure changes brought about in the abdominal and the pelvic region promote and preserve the health of the endocrine glands (Gore, 1991).
Hence, the investigator selected the above-mentioned group of asanas in which abdominal pressure is produced (Yogeshwar, 1982). These pressures may control the hyper or hypo secretion of human hormones in general and adrenal cortex activities in particular.

**EXPERIMENTAL DESIGN AND STATISTICAL PROCEDURE**

The experimental design used in this study was $2 \times 2 \times 3$ factorial design. The first factor indicates ‘groups’ of experimental and control. The second factor denotes ‘treatments’ namely practice of asanas to experimental group and no such practice to control group. The third factor indicates ‘competition’ during rest, five minutes prior to competition and immediately after competition.

This study comes under $2 \times 2 \times 3$ factorial design. The data pertaining to the variables in the study was examined by Factorial Analysis of Variance with repeated measures on the last two factors (ANOVA). If the main effects were found significant, Scheffé’s test was applied as a post-hoc test. If the interaction were found significant, simple effect test was applied. If the F-ratio for simple effect was found significant, Scheffé’s test was used as post-hoc test (Broota, 1992).