CHAPTER: THREE

METHODOLOGY

The procedural method with specific training process directed towards condition has been planned and performed in this chapter methodology.

After establishing the hypothesis in relation to the objectives the next steps is to develop the procedural method in the training institution model. This indicates the specific operations based on the hypothesis that will accomplish the desired objectives must be planed and performed. Hypothesis based on the best information available should be used to direct the procedure. Methodology is one by which programmed are initiated and carried out.

This Chapter deals with the subjects of the present study the criterion measures, design of the study, procedure, tools and the collecting data have been described, this is the study falling under the category of experimented research in the field of physical education. In this study, the researcher made an attempts to evaluate the effect of plyometric training and speed-strength training on football shooting ability, ball velocity during service and take-off height during spiking in volleyball.

3.1 Subjects

Twenty male Football players and twenty two male volleyball players were engaged from different coaching stations for the study. Each subject belonged to a group of comprising at least three years of

Figure 1, Subject of Plyometric Training Group (Soccer)
training age. The subjects were between the ages of 16 and 19 years. They were divided into two equal groups namely; Plyometric training group and Speed-Strength training group. Therefore experimental groups each comprising to 10 subjects.

3.2 Criterion Measures

1. Age

2. Height

3. Weight

4. Motor Fitness (Marie Corps)
   (i) Bent-knee sit-up
   (ii) Pull-up
   (iii) Three mile Run

5. Speed-strength Test (MJQ)
   (i) 30m Sprint
(ii) 3 -Jump

(iii) Standing Broad Jump

(iv) Overhead Shot Throw

6. Performance:

(i) Ball velocity of service in Volleyball

(ii) Two-foot take-off for spiking

(iii) Ball Velocity of Shooting in soccer

3.3 PROCEDURES:

Measurement of personal data: Equipment used: measuring sheet, tape and lever type laboratory weighing machine.

3.3.1 Age: The date of birth of the subjects was collected from the institutional record. The age of each subject was calculated to the nearest year.

3.3.2 Body weight: The each subject was asked to stand erect at the center of the weighing machine with bare foot and wearing minimum costume only. The weight was read and recorded to the nearest 0.5 kg.

3.3.3 Standing Height: Each subject was asked to stand erect without shoes against a marked scale fixed on a wall keeping the heels buttocks and back touching the same line of the wall. The subject was instructed to keep the heels together, head erect and to take and hold a full breath while measurement was taken. A stiff hard board was held horizontally slightly pressing on the top of the head and touching the scale (marked on the wall). The subject was asked to step out and the reading indicated by the hard board was read on the scale and recorded to the nearest centimeter.
3.3.4 Speed-Strength Exercise protocol:

3.3.4.1. Back Squat:

- Stand with feet shoulder width apart, trunk flexed forward slightly with back straight in a natural position.
- A load will be put on the both shoulder the weight of the load will be 90% of body of the subjects.
- Lower body with thighs are paralleled to the ground.

**Duration:** 2 sets X 2 – 3 repetitions.

Rest 3 – 4 minutes between sets and 4 – 6 minutes after second sets.

3.3.4.2. Drop Jumps:

- Stand on the box with your toes close to the front edge.
- Step from the box and drop to land on then balls of both feet.
- Try to anticipate the landing and spring up as quickly as you can.
- Keep the feet touch down time on the ground to the shortest time possible.

**Duration:**

- 2 Sets using 10 boxes or 3 Sets using 7 boxes.
- Rest 2 – 3 minutes between sets.
- Height of the boxes need to be established to the individual need.

3.3.4.3. Jump Ups:

- Stand with feet shoulder with apart in a neutral position.
• Arms should be placed on the hip or stretched forward.

• Jump vertically as high as possible.

**Duration:**

- Perform as many repetitions in 10 seconds without any load.

5 – 10 sets are advised with full recovery.

**3.3.4.4. Bench Press:**

- Lie on your back with your feet flat on the floor if your feet don’t reach the floor use a stable board to accommodate size group the barbell with a wider than shoulder width grip, wrapping thumbs around the bar, hold the barbell at arm’s length above your upper chest area.

- Slowly lower the barbell to the middle of your chest. In the bottom position the forearm should be perpendicular to the floor, pause brightly, then press the barbell to the standing position during the movement the upper arms should be about 45 to 60 degree from the torso and the hips should remain on the bench.

**Duration:**

- 80 - 90% if IRM loading was applied

- 2 - 5 repetition was recommended

- Complete recovery was given between the repetition

**3.3.4.5. Squat Jump:**

- Standing with feet just outside of shoulders and heads behind head.

- Sit back and down into squat position, keeping knees
behind toes.

• Immediate jump vertically by extending through hips
• Pull toes to shins in mid-air to prepare for landing
• Land in squat position and immediately repeat the same movement

3.3.4.6. Box Jumps:

• Assume a deep squat position with your feet shoulder width apart at the end of the new boxes.
• Keep your hands on your hips or behind your head.
• Jump on to the box, landing softly in a squat position on the balls of the feet.
• Maintaining the squat position, jump off the box onto the ground, landing softly in a squat position on the balls of the feet.
• Jump onto the next box as so on.
• Keep the feet touch down time on the ground to the shortest time possible.
• Assume a deep squat position with your feet shoulder width apart at the end of the new boxes.

Loading procedure:

• One to three sets using 6 to 8 boxes.
• Allow a full recovery between each set.
• The height of the box should be in the region of 30 to 80 cm.
• Quality of the box jumping is for more important than quantity.
3.3.5 Plyometric Training

While adapting the method of plyometric training, the loading structure was applied as suggested by Milic et al (2008) which showed the range of variation of intensity began from 70% onward. The output of the same was a significant improvement of explosive strength of the leg muscles. Thus, the selection of the training method is deemed to rational.

3.3.5.1. Bounds:

- Jog into the start of the exercise Push off with your left foot and bring the leg forward, with the knee bent and the thigh parallel to the ground.
- At the same time, reach forward with your right arm. As the left leg comes through, the right leg extends back and remains extended for the duration of the push-off.
- Hold this extended stride for a brief time then land on your left foot.
- The right leg then drives through to a forward bent position, the left arm reaches forward, and the left leg extends backward.
- Make each stride long, and try to cover as much distance as possible.
- You should land on the sole of the foot (flat footed), allowing energy to be stored by the elastic components of the leg muscles, and immediately take off again.
- Keep the foot touch down time to the shortest time possible.

**Loading Procedure**

- One to three sets over 30 to 40 meters.
- Allow a full recovery between each set.
- Quality of bounding is far more important than quantity.
3.3.5.2. Hurdle Hopping

- Jump forward over the barriers with your feet together
- The movement should come from your hips and knees
- Keep your body vertical and straight, and do not let your knees move apart or to either side
- Tuck both knees to your chest
- Use a double arm swing to maintain balance and gain height
- You should land on the balls of the feet, allowing energy to be stored by the elastic components of the leg muscles, and immediately take off again
- Keep the feet touch down time between hurdles to the shortest time possible

**Loading Procedure**

- One to three sets using 6 to 8 hurdles
- Allow a full recovery between each set
- Hurdles should set up in a row, spaced according to ability
- The height of the hurdles should be in the region of 12 and 36 inches high.
- Quality of hurdle hopping is far more important than quantity.

3.3.5.3. Single Leg Hopping

- Stand on one leg
- Push off with the leg you are standing on and jump forward, landing on the same leg.
- Use a forceful swing of the opposite leg to increase the length of the jump but aim primarily for height off each jump.
• You should land on the ball of the foot, allowing energy to be stored by the elastic components of the leg muscles and immediately take off again.

• Keep the foot touch down time to the shortest time possible.

• Try to keep your body vertical and straight.

• Perform this drill on both legs

• Beginners will use a straighter leg action where as advanced athletes should try to pull the heel toward the buttocks during the jump

**Loading Procedure**

• One to three sets over 30 to 40 meters

• Allow a full recovery between each set

• Quality of bounding is far more important than quantity

**3.3.5.4. Box Jumps**

• Assume a deep squat position with your feet shoulder width apart at the end of the row of boxes

• Keep your hands on your hips or behind your head

• Jump onto the box, landing softly in a squat position on the balls of the feet

• Maintaining the squat position, jump off the box onto the ground, landing softly in a squat position on the balls of the feet

• Jump onto the next box and so on

• Keep the feet touch down time on the ground to the shortest time possible

**Loading Procedure**

• One to three sets using 6 to 8 boxes

• Allow a full recovery between each set
• The height of the box should be in the region of 30-80 cm.

• Quality of box jumping is far more important than quantity

3.3.5.5. Depth Jumps

• Stand on the box with your toes close to the front edge

• Step from the box and drop to land on then balls of both feet

• Try to anticipate the landing and spring up as quickly as you can

• Keep the feet touch down time on the ground to the shortest time possible

Loading Procedure

• One to three sets using 6 to 8 boxes

• Allow a full recovery between each set

• The height of the box should be in the region of 30-80 cm

• Quality of depth jumping is far more important than quantity

3.3.5.6. Tuck Jumps

• Begin in a standing position

• Jump up, grabbing both knees as they come up your chest

• Return to the starting position landing on the balls of the feet

• Try to anticipate the landing and spring up as quickly as you can

• Keep the feet touch down time on the ground to the shortest time possible
**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 5 to 10 repetitions/set
- Quality of Tuck Jumps is far more important than quantity

**3.3.5.7. Two Legged Hops or Bunny Hops**

- Stand with your feet shoulder width apart
- Lower into a squat position and jump as far forward as possible
- Land on the balls of both feet
- Try to keep your body vertical and straight, and do not let your knees move apart or to either side. Try to anticipate the landing and spring up as quickly as you can.
- Keep the feet touch down time on the ground to the shortest time possible
- Use quick double arm swings and keep landings short

**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 5 to 10 repetitions/set

**3.3.5.8. Chest Pass**

- This drill requires a partner
- Stand facing each other with your feet shoulder width apart and your knees slightly bent
Begin by holding the medicine ball with both hands at chest level, elbows pointing out.

Pass the ball to your partner, pushing it off your chest and ending with your arms straight.

Your partner catches the ball, allows the ball to come to the chest before passing it back to you.

Try to anticipate the catch and return the ball as quickly as you can.

Keep the catch time to the shortest time possible.

**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of Chest Passes is far more important than quantity

**3.3.5.9. Incline Push up depth jump**

- Two mats, three to four inches high, placed shoulder width apart
- A box high enough to elevate your feet above your shoulders when in a push-up position
- Face the floor as if you were going to do a push-up, with your feet on the box and your hands between the mats
- Push off from the ground with your hands and land with one hand on each mat
- Push off the mats with both hands and catch yourself in the starting position
- Keep the catch time to the shortest time possible
**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of Push Ups is far more important than quantity

**3.3.5.10. Power Drop**

- This drill requires a partner
- Lie supine on the ground with your arms outstretched
- Your partner stands on the box holding the medicine ball at arm's length
- Your partner drops the medicine ball into your hands
- Catch the ball with elbows bent
- Allow the ball to come towards your chest
- Extend the arms to propel the ball back to the partner on the box
- Keep the catch time to the shortest time possible

**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of the vertical toss is far more important than quantity

**3.3.5.11. Incline Chest Pass**

- Work with a partner and sit facing each other
- Lean back at a 45 degree angle, keeping your
abdominals tight

- Begin by holding the medicine ball with both hands at chest level, elbows pointing out
- Pass the ball to your partner, pushing it off your chest and ending with your arms straight
- Your partner catches the ball, allows the ball to come to the chest before passing it back to you
- Try to anticipate the catch and return the ball as quickly as you can
- Keep the catch time to the shortest time possible

**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of Chest Passes is far more important than quantity

### 3.3.5.12. Vertical Toss

- This drill requires a partner
- Sit in front of the box with your back to it, legs spread apart and straight.
- The other person stands on the box holding the medicine ball over you.
- Your partner drops the medicine ball into your hands.
- Catch the ball with elbows bent and toss it back over your head to the partner on the box.
- Keep the catch time to the shortest time possible

![Figure 21, Subjects are performing Vertical Toss](image-url)
**Loading Procedure:**

- 1 to 3 sets
- Allow a full recovery between each set
- 10 to 20 repetitions/set
- Quality of the vertical toss is far more important than quantity

### 3.3.6. Motor Fitness:

#### 3.3.6.1. Bent Knee – Sit up

**Equipment used:** A thin mat, stopwatch and score sheet.

**Procedure:** The subject assumes a supine position, knees bent to an angle less than 90 degrees, and hands clasped behind the neck. The feet are held down by a partner. To perform the test, the pupil brings his hand and elbows forward in a cart up motion touching elbows to knees. In returning to the supine position, the elbows should touch the floor each time.

**Scoring:** Number of correctly executed sit ups performed in 60 seconds.

#### 3.3.6.2. Pull Ups

**Equipment used:** pull up bar and score sheet.

**Procedure:** The subject hangs from the bar by his hands with forward hand grip and chains himself as many times as he can. In executing the movement, he should pull himself up until his chain is even with his hands then lower himself until his arms are straight. He should not permit to kick, jerk or use a kip motion.

**Scoring:** Number of correctly he executes at a stretch.
3.3.6.3. Three mile run:

**Equipment used:** Flat surface, stopwatch, clapper and score sheet.

**Procedure:** Complete a three mile measured course on a flat surface as rapidly as possible.

**Scoring:** Score was recorded by time (min & s) elapsed in covering the distance of three miles.

3.3.7. Sports Performance:

3.3.7.1. Volleyball Service

The subjects were asked to perform Tennis service from the behind the end line of the court and to send the ball to the opponent’s court over the net. It was emphasized that the ball must be land within the opponent’s court. He was also asked to strike the ball as hard as possible and was allowed 5 trials each. The total action was recorded by sony video camera (Model No. HDR-P J340E) to analysis the sequential movement of the ball.

**Scoring:** The best trial out of five was recorded in terms of minimum time elapsed in landing within the target court from a successful tennis service. The velocity of the ball was determined by Kinovea Software device through computation of the recorded time per frame. The time recorded in the ms from the end of impact with ball to the movement of the touch with the ground. Velocity of the ball was determined by the following formula:

\[ v = \frac{s}{t} \]

Where \( v \) = velocity, \( s \) = displacement and \( t \) = time elapsed
3.3.7.2. Take Off Height:

Each subject was asked to spike the ball to the opponents court over and close to the net from the attack-area. He should be supplied the ball by set upper. He was also asked to spike the ball as hard as possible for five times. During spiking he must lift his CG as high as possible with extended knee. The ball landed within the opponent court. The performance of each spiking of the subjects was recorded by videography by professional photographer. Each subject was allowed five trials.

**Scoring:** The vertical height of the two foot take-off was measured by Kinovea Software from the recorded video. The take-off height was determined by the lowest part of the sole of extended leg while the subject attains the optimum height from the ground. The distance between the surface and the optimum height of the bottom of the sole. The computerized value of the height accordingly was recorded in cm.

3.3.7.3. Football Shooting:

The subjects were asked to shoot the ball from the centre of 18 yards line of the penalty area. They were asked to shoot right into the goal and to shoot as heard as possible. Five successful shoots were selected among all the shots (about 10 trials) for consideration. The whole action including the movement of the ball all through was video graphed by Sony Digital Camera (model: HDR-J340E) from a convenient focus. So that the movement iof the ball from one and the other could be distinctly recorded. Another camera was on the straight line of the intercepting paints of both the uprights of the goal post on the goal line. Each player took successive ten shots with convenient interval in between eight standards footballs were used for the purpose, comprising the average weight of 426±27g.

**Scoring:** Five successful shots in terms of speed were segregated from among the shooting trials of each subject. This was done according to the videography record.
Kinovea biomechanical software was applied in order to analyze the movement of the ball against time. Best performance of each subject was selected and the elapsed between release of the ball from kicking foot and the ball crossing the goal line was recorded. To compute the velocity of the ball by the following formula was applied:

\[ v = \frac{s}{t} \]

Where \( v \) = velocity, \( s \) = displacement and \( t \) = time elapsed

The time recorded from Kinovea device was in ms (mili second) for the convenience of presentation the ms was converted to second. The distant was fixed at 18 yards. 18 yards was converted to meter. Thus, the unit of velocity, as expressed in this study was considered as m/s.

### 3.3.8 Speed-strength (MJQ):

#### 3.3.8.1 Three Jumps:

**Equipment used**: Jumping Pit, Measuring Tape and Score Sheet.

Feet together, hop three times and land in a long jump pit. Measure from your starting position to the closest disturbance of the sand where you landed.

**Scoring**: The distance to the nearest meter from take-off line to the closest heel position.

#### 3.3.8.2 Standing Long Jump:

**Equipment used**: Jumping Pit, Measuring Tape and Score Sheet.

Standing at the edge of a long jump pit. With toes slightly over the edge of the board, perform a standing long jump into the pit.

**Scoring**: Measure from the lip of the board to the closest disturbance of the sand where you landed.

*Figure 25, Subjects are performing Standing Long Jump*
The distance to the nearest meter from take-off line to the closest heel position.

3.3.8.3. Thirty Meter Sprint:

**Equipment used**: Stop Watch and Score Sheet

Using starting blocks (you may also have a partner place his or her foot behind your lead foot to simulate a block), start on the command of a timer at the finish line. The timer starts the watch when your back foot makes contact with the ground on the first step, and stops in when you break the finish line.

**Scoring**: The time was recorded in seconds to the nearest 100 of a second.

3.3.8.4. 16lb Overhead Shot:

**Equipment used**: 16lb shot, flat surface, measuring tape and score sheet.

Standing on top of a shot put stop board (your back to the pit), dip down (much line the preparatory crouch for a vertical jump), swing the shot between the legs, and then extend and throw the shot overhead backwards. It is not necessary to remain on the stop board.

**Scoring**: Measure from the lip of the stop board to the first point of impact. The distance to the nearest meter from take-off line to the closest heel position.

3.3.9. Treatment:

There were two different experimental samples: one sample was made for Speed-strength training and the other was marked for treatment was plyometric.

The Speed-strength was given series of exercises apart from warming up and cooling down.
Three days in a week training was given with progressive and adopting changing the loading procedure for 8 weeks.

The other plyometric group has also trained 3day/week for period of 8 weeks after initial test on all the selected variables. No experimental groups which might have some influence over the organism.

The days of the week as selected for the training were conveniently administrated and no interruption develop could affect the training process.

Final data all the variables were collected through the tests all ready conducted during initial reading.

3.4 Design of the Study:

Forty two male Players and Players with an age of 16 to 21 years volunteered for the study. The entire subjects will be equally divided into two groups, one group will be considered as Plyometric training group and other one will be considered as Speed-Strength training group.

An initial test was taken on both groups in terms of Footballer subjects. The shooting ability was evaluated by video graphic record.

After initial test on shooting ability the subjects of both group will be given plyometric training and Speed-Strength Training for development of leg power.

An initial test was also conducted on both the groups of Volleyball subjects. For volleyball players the test was ball velocity in Tennis Service and take-off height during spiking. The performance of volleyball for both groups were assessed by the videographic record. Initially the motor fitness was measured for all groups of Volleyball and Football to assess the fitness level of the subjects. Besides it the performance of speed-strength for both volleyball players were and football groups assessed was evaluated.
After completion of eight weeks duration the final tests on all the variable were taken and the date collected through different tests items for analysis.

3.5 Statistical Procedure:

The data gathered were duly analyzed through statistical procedure. The different statistical procedure used in this study and their relevant formulas are given below.

(i) Mean (M) = \( \frac{\sum x}{N} \)

\[ \sum x \] = the sum of the scores of the items.

N = the total number of items.

(ii) Standard Deviation (\( S_D \)) = \( \sqrt{\frac{\sum x^2}{N}} \)

\( x \) = deviation of each score from the mean

N = the total numbers of items.

(iii) Correlation (r) = \( \frac{\sum xy}{N \sigma_x \sigma_y} \)

Where, \( x \) = deviation of any x-score from the mean in the test x

\( Y \) = deviation of any y-score from the mean in the test y.

\( \sum xy \) = sum of all the products of deviation (each x deviation multiplied by its corresponding y deviation)

\( \sigma_x \) = Standard deviation of distribution of scores in test x

\( \sigma_y \) = Standard deviation of distribution of scores in test y

N = the total number of items.

(iv) t-ratio (t) = \( \frac{DM}{\sigma_{DM}} \)

DM = difference between means.

\( \sigma_{DM} \) = standard error of the difference between means.