
Chapter-VII

TEST & MEASUREMENT IN SPORTS

Key Points :

- Measurement of Muscular strength-Kraus-Weber test
- Motor Fitness Test-AAPHER
- Measurement of Cardio-Vascular Fitness-Harvard Step Test/Rock Port Test
- Measurement of flexibility-Sit & Reach Test
- **Rikli Jones-Senior Citizen Fitness Test**
 1. Chair stand test for lower body strength
 2. Arm curl test for upper body flexibility
 3. Chair sit & reach test for lower body flexibility
 4. Back-scratch test for lower body flexibility
 5. Eight foot up & go test for agility
 6. Six minute walk test for aerobic endurance

7.1 Measurement:- Measurement refers to the process of administering a test to obtain a quantitative data. It can also be said that the measurement aids evaluation process in which various tools and techniques are used in the collection of data.

“Measurement is a process by which the level of performance, fitness, ability, Knowledge, personality and skills are measured with the help of various standard Tests”.

Importance of Measurement in Physical Education & Sports.

- To know about the progress
- Individual centered training program
- Helps in selection of athletes
- To study the development of athletes
- Motivation of an athlete
- To predict in advance the performance potentials
- To prepare norms and standards
- To measure current fitness status
- To achieve goals and objectives of the activity
- To conduct research

7.2 Measurement of Muscular strength-Kraus-weber test:-

The six items of the Kraus-Weber Muscular Strength Test:

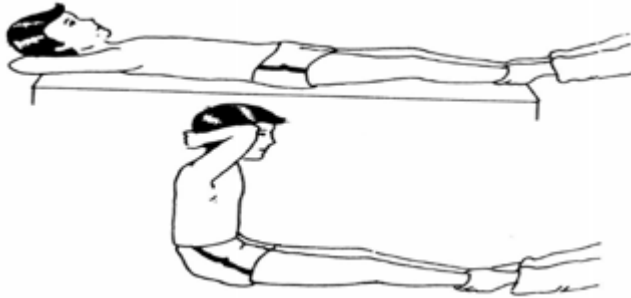
1. Strength of abdominal plus psoas muscles
 2. Strength of abdominal minus psoas muscles
 3. Strength of psoas and lower abdominal muscles
 4. Strength of upper back muscles
 5. Strength of lower back muscles
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6. Floor touch test

Hans Kraus had devised these tests after Fifteen Years of close study of individual cases. A battery by six tests was prepared. The purpose of the tests was the measure Minimum muscle power necessary for healthy living. Because this is a Minimum Test, one should be able to perform all six parts.

The tests are as follows:

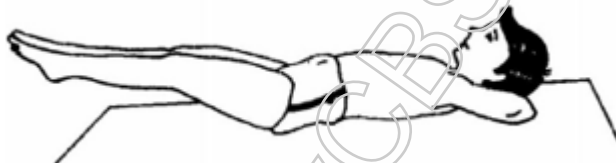
1. **Position** : Lie down on back, legs straight, feet held down, hands behind neck. The examiner holds down the feet and the student rolls to a sitting position.



2. **Position** : Lie down on back, Knees bent, Feet held down, Hands behind back.



3. **Position** : Lie on back, hands behind neck.



Action : Lift both legs up 8 to 10 inches from floor hold for a count of 10 seconds.

4. **Position** Lie face down. Place small pillows under hips. Lower body held down, hands behind neck.



5. **Position** : Lie face down, Place small pillow under hips, Upper body held down, head resting on hands.

Action : Lift upper body off floor and hold for a count of 10 seconds.



6. Position : Stand feet together, knees straight.

Action : Bend slowly forward and see how close you can come and touch the floor. If you can touch, measure distance from finger to floor. If you can touch, hold for count of three, If you can't touch, measure distance from finger to floor.

The above tests are considered useful and preferable from the point of view of equipment as well as time.



7.3 Motor Fitness Test-AAPHER(American Alliance for Physical Health Education & recreation

Test Items	Parts of Body-Physical Fitness Components
1. Pull up (boys)	1. Muscular strength or endurance of arm & shoulder
2. Flexed arm hang (girls)	2. Muscular strength or endurance of arm & shoulder
3. Bent Knee-sit-ups (boys & girls)	3. Muscular strength and endurance (trunk)
4. Shuttle run (boys & girls)	4. Speed and Agility
5. Standing broad jump (boys & girls)	5. Explosive strength of legs
6. 50yard dash	6. Speed of lower extremities'- explosive strength
7. 600 yard or 9 minute run& walk	7. Cardio-vascular endurance
8. Soft ball throw	8. Explosive strength of Arms & shoulder

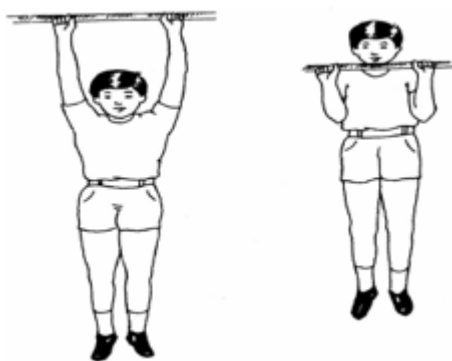
The Aapher—Youth Physical Tests were created in 1957. During the years 1957- 58 these tests were applied to 8500 School Children of classes 5 to 8 in the United States of America. On the basis of this study standard rooms were created. Studies were conducted on 2200 College level students in 1960 and percentile rooms were created, Similarly Percentile rooms were created on the basis of studies belonging to 50

institutions. New percentile rooms were created again in 1965 on the basis of age. This study included 9200 boys and girls in the 10 to 17 years age group.

1. Pull Ups Boys is an activity meant only for boys:

Equipment: A metal or wooden bar approximately 1½ inches in diameter is preferred. A doorway gym bar can be used and if no regular equipment is available, a piece of pipe or even rungs of a ladder can serve the purpose.

Description: The bar should be high enough so that the pupil can hang with his arms and legs fully extended and feet free from the floor. He should use the overhand grasp. After coming in hanging position, the pupil raises his body by his arms until his chin can be placed over the bar. Then he lowers his body to a full hang as in starting position. The exercises is repeated as many times as possible.



Rules

- (i) Each Student will be allowed one trial.
- (ii) The body must not swing during the execution of the movement.
- (iii) The knees must not be raised and the kicking of legs is not permitted.

Scoring: Record the number of completed Pull Ups.

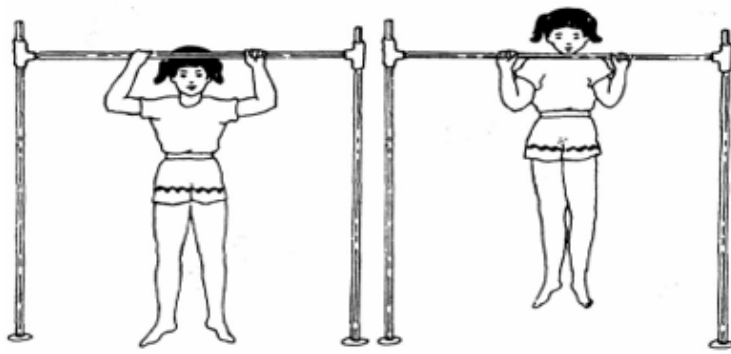
2. Flexed Arm Hang: This activity is meant only for girls.

Equipment: A horizontal bar is used. The diameter of the rod ought to be 1½ inches. A stop watch is needed to record time.

Description: The height of the bar should be adjusted so it is approximately equal to the pupil's standing height. The pupil should use an overhand grasp. With the assistance of two spotters, one in front and one in back of Pupil the Pupil raises her body off the floor to a position where the Chin is above the bar, the elbows are flexed and the Chest is close to the bar. The Pupil holds this position as long as possible.

Rules:

- (1) The Stopwatch to started as soon as the Subject takes the hanging position.
 - (2) The watch is stopped when:
 - (i) Pupil's Chin touches the bar
 - (ii) Pupil's head hits backward to keep Chin above the bar.
 - (iii) Pupil's Chin falls below the level of the bar.
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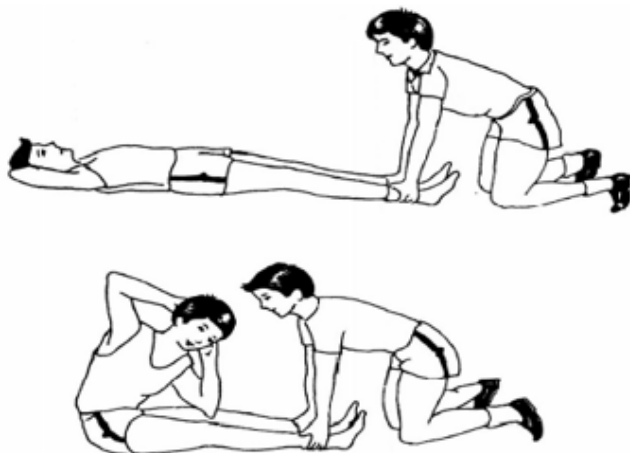


3. Sit-Ups (Flexed Leg), Boys and Girls

Scoring: The length of time the subject holds the hanging position will be recorded in seconds. Sit-ups (flexed leg)

Equipment: Clean floor, Mat or Dry Turf and Stop-Watch.

Description: The Pupil lies on his back with his knees bent, feet on the floor and heels not more than 12 inches from the buttocks. The angle at the knees should be less than 90 degrees. The Pupil puts his hands in the back of his neck with fingers clasped and places his elbows squarely on the mat, floor and turf. His feet are held by his partner to keep them in touch with surface. The Pupil heightens his abdominal muscles and brings his head to knees. This action constitutes one sit up. The number of correctly extended Sit ups performed in 60 seconds shall be the score.



Rules:

- (1) No rest is permitted between sit ups.
- (2) Keep the fingers clasped behind his neck.
 - (a) Keep the fingers clasped behind his neck.
 - (b) Bring both elbows forward in starting to sit up without pushing off the floor with an elbow.
 - (c) Return to starting position with elbows flat on the surface before sitting up again.

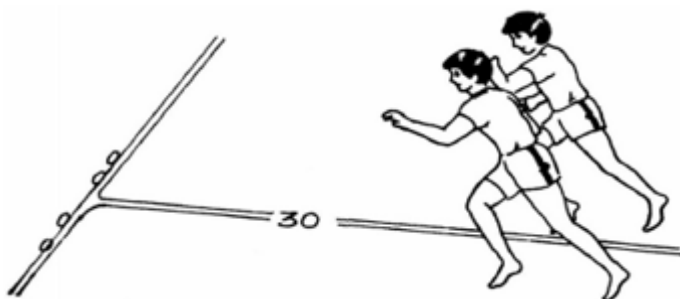
Scoring: Only the Sit ups a pupil is able to do in 60 Seconds are recorded.

4. Shuttle Run (Boys and Girls):

Equipment: Two blocks of wood, 2 inches x 2 inches x 4 inches and a stopwatch. Pupils must wear sneakers or run bare footed.

Description: Two parallel lines are marked on the floor 30 feet apart. The width of a regulation Volleyball Court serves as a suitable area. Place the blocks of wood behind one of the lines.

The pupil starts from behind one of the lines. On the signal "Ready" or "Go" the pupils runs to the blocks, picks one up runs back to the starting line and places the block behind the line. He then runs back and picks up the second block which he carries back across the Starting Line.



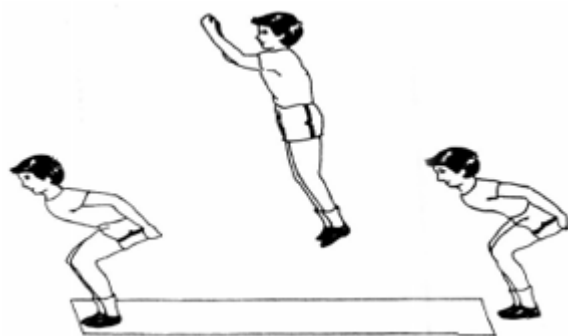
Rules: Allow two trials with some rest between.

Scoring: Record the time of the better of the two trials.

5. Standing Broad (Long) Jump:

Equipment: Mat, Floor or Outdoor Jumping pit and Tape Measure.

Description: Pupil stands with the feet several inches apart and the toes just behind the take off line. Preparatory to jumping, the pupil swings the arms backward and bends the knees. The jump is accomplished by simultaneously get bending the knees and swinging forward the arms.



Rules:

(1) Allow three trials.

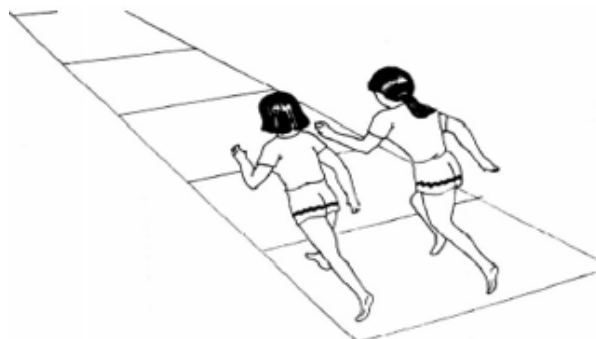
(2) Measure from the take off line to the feet or other part of the body that touches the floor nearest the take off line.

Scoring: Record the best of the three trials.

6. 50 Yards Run (Boys and Girls):

Equipment: Two stop watches or one with a split second times.

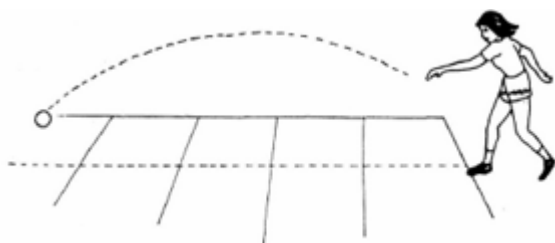
Description: It is preferable to administer this test to two pupils at a time. The starter will use the commands: "Ready" and "Go" the race comes to an end at the "Finishing Line", Rules, the stop watch is kept on from the word "Go" to the finishing line, a time is recorded to the one tenth of a second.



7. Soft-Ball Throw (Boys and Girls):

Equipment: Soft Ball 12, Measure Tape.

Description: Game is played in a football field on a field of similar size. Lines are drawn at a distance of five yards each. The pupil who throws the ball can throw from a distance of 6 feet.



Rules:

- (1) It is necessary to have the ball in one hand.
- (2) Three chances are given to each player.

Scoring: Best of the three throws is counted.

8. 600 Yards Run or Walk (Boys and Girls)

Equipment:

- 1. A Track 2. A Stop Watch

Description: Pupils take their positions at the standing start. The race starts with command words: "Ready" and "Go". As many as Six Pupils can participate at a time.

Rules: Walking is permitted but the object is to cover the distance in shortest possible time.

Scoring: Record in Minutes and Seconds.

7.4 Measurement of Cardio-Vascular Fitness-Harward Step Test/Rock Port Test

1. Harward Step Test-Aerobic Fitness (Recovery time)

$100 \times (\text{Total test time in seconds (the time for which the athlete was able to do the stepping up and down)})$
 $2 \times (\text{the total number of heartbeats for all the three time intervals})$
2. Rockport Fitness Test-One mile Walking test
 $\text{VO}_2\text{max} = 132.853 - (0.0769 \times \text{Weight}) - (0.3877 \times \text{Age}) + (6.315 \times \text{gender}) - (3.2649 \times \text{time}) - (0.1565 \times \text{Heart Rate})$

Harvard Step Test

Harvard Step Test: Brouha (1943) constructed a very simple and promising field test for measuring cardiovascular endurance of human beings by using easily available and inexpensive equipment.

Equipment: A stopwatch, 20-inch high bench, metronome or tape recorder (optional), stethoscope (optional).

Test Administration: The tester gives a demonstration of the stepping up style to be followed by the subjects during the test. If the metronome is available, it is set to a speed of 120 beats per minute. Depending upon the availability of 20-inch high bench area and pulse count testers, a group of 1 to 4 subjects may be asked to start the stepping up and down exercise in consonance with the sounds of metronome and by starting the stopwatch at the signal 'go'. If the metronome is not available, then the tester should do enough rehearsal of counting the pace up-up-down-down, 30 times a minute. The subject is given instructions that on the command 'up' or the first sound of the metronome, he/she should place one foot on the bench; on the second command 'up' or the second sound of the metronome, he/she should place both feet fully on the bench with the body erect straightening the legs and back.

Immediately after reaching the erect posture, she should step down one foot at a time as the tester gives command 'down-down' (third and fourth sounds of the metronome). The subject is instructed to repeat the stepping up and down exercise in the above manner for five minutes at the pace of 30 steps per minute. The subject is also asked to take off and step-down with the same foot each time. The tester starts the stopwatch simultaneously with the first take off by the subject/subjects and stops the watch after exactly five minutes by giving the 'stop' signal to the subjects who immediately sit down on the bench. In case, any subject stops the exercise or slows down the pace of the exercise due to fatigue or exhaustion, his or her duration of exercise performed at the correct pace is noted (in seconds) and is asked to stop and sit down Exactly one minute after the exercise, the tester starts counting the pulse rate and records the same for the duration from 1 to 1.5, 2 to 2.5 and 3 to 3.5 minutes.

Scoring: The pulse of all the 3 half minute counts recorded are added together and a fitness index is calculated by the following formula:

$$\text{Fitness Index (F.I.)} = \frac{\text{Duration of exercise period in seconds} \times 100}{2 \times \text{sum of three pulse counts after exercise}}$$

7.5 Measurement of flexibility-Sit & Reach Test

1. Test for absolute flexibility

2. Test of Relative flexibility

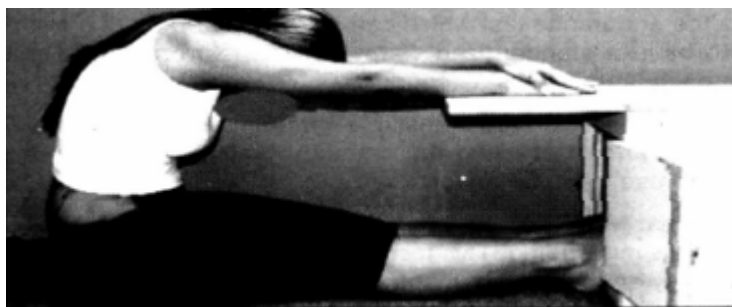
a. Measure of linear flexibility test

b. Rotary (Angular measure flexibility test)

I. Sit and Reach Test: This test is used to measure the flexibility of the back and leg (hamstring muscle) It is a kind of absolute and linear test of flexibility.

Equipment: A testing box or a flexomasure and a yardstick.

Procedure: The subject is asked to remove shoes and place his/her feet against the testing box while sitting on the floor with straight knees. Now the subject is asked to place one hand on top of the other so that the middle finger of both hands are together at the same length. The subject is instructed to lean forwards and place his/her hands over the measuring scale lying on the top of the box with its 10 inch mark coinciding with the front edge of the testing box. Then, the subject is asked to slide his/her hands along the measuring scale as far as possible without bouncing and to hold the farthest position for at least one second.



Score: Each subject is given three trials and the highest score nearest to an inch is recorded and 10 inches are subtracted from the recorded reading to obtain the flexibility score which is compared with the standards given in.

Table source: Based on personal experience.

Validity: This test only measures the flexibility of the lower back and hamstrings, and is a valid measure of this.

Reliability: The reliability of this test will depend on the amount of warm-up that is allowed, and whether the same procedures are followed each time the test is conducted. Most sit and reach testing norms are based on no previous warm-up, though the best results will be achieved after a warm up or if the test is preceded by a test such as the endurance test which can act as a warm up. If a warm up is used, it is important to have a standardized warm up and test order and repeat the same conditions for each time the test is conducted.

Advantages: The sit and reach test is a common test of flexibility, and is an easy and quick test to perform. If using the standard testing procedure, there is a lot of published data to use for comparison.

Disadvantages: Variations in arm, leg and trunk length can make comparisons between individuals misleading. This test is specific to the range of motion and muscle and joints of the lower back and hamstrings, and may not be relevant to other parts of the body.

7.6 Rikli Jones-Senior Citizen Fitness Test

Test Item	Parts of Body-Physical fitness Components
1. Chair stand test for lower body strength	1. Lower body strength, leg strength & Endurance
2. Arm curl test for upper body flexibility	2. The upper body strength, arm flexor, strength & endurance
3. Chair sit & reach test for lower body flexibility	3. The hemi string and lower back flexibility
4. Back-scratch test for lower body &Flexibility	4. The upper body flexibility of the body range of motion of the shoulders
5. Eight foot up & Go test for agility	5. The motor agility, speed & balance
6. Six minute walk test for aerobic endurance	6. Cardio-vascular endurance & recovery

(a) Chair Stand test for lower body strength

Purpose and Daily Benefit: The purpose of the Chair-Stand is to measure the strength of lower body of adults over 60 years of age. Lower body strength is important for activities such as getting out of a chair, on the bus, out of the car, and rising up from a kneeling position in the house or garden. The, strength of your lower body can directly affect the ease with which you perform the activities you do every day.

Equipment: Chair without arms, Stopwatch.

Procedure: Place the chair against a wall where it will be stable. Sit in the middle of the chair with your feet flat on the floor, shoulder width apart, back straight. Cross your arms at the wrist and place them against your chest. The test partner will tell you when to begin and will time you for 30 seconds, using the stopwatch. You will rise up to a full stand and sit again as many times as you can during the 30 second interval.

(a) Each time you stand during the test be sure you come to a full stand.

(b) When you sit, make sure you sit all the way down. Do not just touch your backside to the chair. You must fully sit between each stand.

(c) Do not push off your thighs, or off the seat of the chair with your hands to help you stand unless you have to.

(d) Keep your arms against your chest crossed and do not allow the arms to swing up as you rise.

(e) If you are on your way up to stand when time is called you will be given credit for that stand.



Scoring: The score is the number of completing correct chair stands in 30 minutes.

(b) Arm Curl test for upper body strength

Purpose: This test measures upper body strength and endurance.

Equipments Required: 4 pound weight (women, AAHPERD), 5 pound weight (women, SFT), 8 pound weight (for men). A chair without armrests, stopwatch.

Procedure: The aim of this test is to do as many arm curls as possible in 30 seconds. This test is conducted on the dominant arm side (or strongest side). The subject sits on the chair, holding the weight in the hand using a suitcase grip (palm facing towards the body) with the arm in a vertically down position beside the chair. Brace the upper arm against the body so that only the lower arm is moving (tester may assist to hold the upper arm steady). Curl the arm up through a full range of motion, gradually turning the palm up (flexion with supination). As the arm is lowered through the full range of motion, gradually return to the starting position. The arm must be fully bent and then fully straightened at the elbow. The protocol for the AAHPERD test describes the administrator's hand being placed on the biceps, and the lower arm must touch the tester's hand for a full bicep curl to be counted. Repeat this action as many times as possible within 30 seconds.



Scoring: The score is given for the total number of controlled arm curls performed in 30 seconds.

(c) Chair Sit and Reach test for Lower Body Flexibility

The Chair Sit and Reach test is a part of the Senior Fitness Test Protocol, and is designed to test the functional fitness of seniors. It is a variation of the traditional sit and reach flexibility test.

Purpose: This test measures flexibility of lower body.

Equipments Required: Ruler, straight back or folding chair, (about 17 inches/44 cm high)

Procedure: The subject sits on the edge of a chair (placed against a wall for safety). One foot must remain flat on the floor. The other leg is extended forward with the knee straight, heel on the floor, the ankle bent at 90°. Place one hand on top of the other with tips of the middle fingers even. Instruct the subject to inhale, and then as they exhale, reach forward towards the toes by bending at the hip. Keep the back straight and head up. Avoid bouncing or quick movements, and never stretch to the point of pain. Keep the knee straight, and hold the reach for seconds. The distance is measured between the tip of the *Chair sit & reach test for lower body flexibility* fingertips and the toes. If the finger tips touch the toes then the score is zero. If they do not touch, measure the distance between the fingers and the toes (a negative score), if they overlap, measure by how much (a positive score).



Scoring: Perform two trials. A score is recorded to the nearest inch or 1 cm as the distance reached, either a negative or positive score. Record with leg was used for measurement.

(d) Back Stretch for Upper Body Flexibility

Aim: The Back Scratch Test measure flexibility of your upper body. Upper body's flexibility affects your ability to reach for items that may be high on a shelf, change a light bulb, or do any activity that requires arm and/or shoulder movement. Maintaining flexibility in your upper body will assist you in continuing to live independently.

Equipment: Ruler

Procedure: Place your left arm straight up in the air above your left shoulder. Bend your left arm at the elbow to reach toward your back, with your fingers extended. Your elbow pointed toward the ceiling. Place your right hand behind your back with your palm out

and your fingers extended up. Reach up as far as possible and attempt to touch the fingers of your two hands together. Some people are not able to touch at all, while other's fingers may overlap. Take two practice stretches with each arm, determining which side is more flexible. You will be measuring and recording only your most flexible side. You are now ready to be measured. Perform the stretch as outlined above. Without shifting your hands your test partner will position your fingers so that they are pointing toward each other.



Scoring: The distance between the finger tips of one hand and the other is measured to the nearest half inch or centimeters. If your fingers overlap, the amount of the overlap will be measured. Fingertips just touching receive a score of "0". If your fingers do not touch, you receive a negative score of the distance between your fingers, measured to the nearest half inch or centimeters.

(e) Eight Foot Up and Go Test for Agility

Aim: The '8 Foot Up and Go' is a coordination and agility test for the elderly, which is a part of the Senior Fitness Test. This test measures speed, agility and balance while moving.

Equipments required: Stopwatch, straight back or folding chair (about 17 inches/44 cm high), one marker, measuring tape, area clear of obstacles.

Procedure: Place the chair next to a wall (for safety) and the marker 8 feet of the chair. Clear the path between the chair and the marker. The subject starts fully seated, hands resting on the knees and feet flat on the ground. On the command, "Go," timing is started and the subject stands and walks (no running) as quickly as possible (and safely) to and around the cone, returning to the chair to sit down. Timing stops as they sit down.



Purpose: To assess aerobic fitness or aerobic endurance which is important for walking distances, stair climbing, shopping and sightseeing etc.

Equipment: Stop watch. *

Rectangular ground measuring 20 x 5 yds.

