

SBG STUDY

7

Test and Measurement in Sports

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INTRODUCTION

Test and measurement is necessary for successful programme of physical education. Measurement and evaluation techniques are applied to judge the progress of the programme in physical education. Measurement and evaluation is the technique which gives information about fitness level of an individual. The measurement progress is directly applied on an individual and its main objectives are measurement of consecutive learning body fitness and psychomotor sports skill. If we do not measure our fitness even after taking part in the fitness programme, we remain in dark. **According to Leonardo Da Vinci** - "If you are enamoured of practice without scientific ways, you are just like a pilot who goes into a ship without radar and compass and does not know his destination." Measurement is a process in which our level of fitness and performance, personality traits and skill of different techniques are measured with the help of standard test.



7.1 COMPUTATION OF FAT PERCENTAGE - SLAUGHTER-LOHMAN FORMULA

This formula is also known as slaughter-Lohman children skinfold formula. This is named after the authors of the original research study. This skinfold equation, as indicated by the name are used to predict body fat in children 8-18 years of age. Each formula was developed from the results of underwater weighing and skinfold data taken from several hundred individuals over a wide range of age, body structure, body composition and exercise habits.

Slaughter-Lohman formula

For calculating fat percentage, we need the skinfold measurement of triceps and calf (back portion of lower leg). This is done by using a skinfold caliper.

1. **For measuring triceps skinfold:** Measure vertically on back of the arm in midway between top of shoulder point and elbow.
2. **For measuring calf skinfold:** Measure inside of the right lower leg at the greatest calf girth.



Triceps



Calf

This formula is different for boys and girls are given as:

Boys: % Body Fat = $0.735 (\text{Triceps} + \text{Calf}) + 1.0$

Girls: % Body Fat = $0.610 (\text{Triceps} + \text{Calf}) + 5.1$

Procedure for estimating body composition by measuring skinfolds with skinfold calipers:

1. Take all measurements on the right side of the body.
2. Identify, measure, and mark the skinfold site.
3. Grasp the skinfold firmly with the tips of the thumb and index finger of the left hand.
4. Lift the pinch. Keep the fold elevated while taking the measurement with the skinfold calipers.
5. Place the jaws of the skinfold caliper perpendicular to the fold, approximately 2 cm below the thumb and index finger and halfway between the crest and the base of the fold.
6. Release the caliper jaw pressure slowly and record measurement 2 seconds after the pressure is released.
7. Open the jaws of the caliper to remove it from the site.
8. Close the jaws slowly to prevent damage or loss of calibration.
9. A minimum of two measurements should be taken at each site, with at least 15 seconds between measurements to allow the fat to return to its normal thickness. If values vary from each other by more than 10%, take additional measurements.

Tips for Measuring Skinfolds of Children:

1. Prior to body composition testing, inform the parents so they will understand the purpose and procedures of this assessment.
2. Instruct students regarding concepts and procedures for measuring body composition.
3. Maintain records of these measures over time to assess the interaction effects of growth, maturation, diet, and physical activity on body composition changes.
4. Measure only standardized sites and follow established procedures.
5. If you feel it is necessary, ask a teacher, nurse, or the child's parent to be present during body composition testing.
6. Ensure confidentiality by sharing test results only with the child and the parents.
7. Provide personal feedback and "group" interpretations of the results.

8. Do not use body composition test results for grading purposes.
9. Be sure to make the assessment the body composition a positive experience for each child. Do not label, criticize, or ridicule children during any phase of this assessment.

7.2 MEASUREMENT OF MUSCULAR STRENGTH: KRAUS WEBER TEST

Kraus-Weber Test was developed by Dr. Hans Kraus and Dr. Sonja Weber in a posture clinic of England in the 1950s. It was developed for the diagnosis and treatment of low back pain.

The Kraus-Weber (K-W) is the test of Minimum Muscular Fitness. This test consists of six components. It measures several large muscle groups for flexibility and strength. The scoring of each item ranges from 0 to 10. The higher the degree of test rating, the greater is the muscular function of the body as a whole.

The Kraus-Weber Test is done as follows:

Kraus-Weber Test No. 1 (Straight Leg Sit-up)

Purpose: This test measures the strength of the abdominal and psoas muscles.

Procedure: The individual lies flat on his back with his hands behind the neck and legs kept straight. The examiner holds his feet to keep them on the ground. The individual has to perform one sit-up.

Scoring: If the individual performs one complete sit-up, 10 points are awarded. If he is not able to lift his shoulders from the ground, his score remains zero.



Test 1: Straight leg test

Kraus-Weber Test No. 2 (Bent knee Sit-up)

Purpose: This test measures the strength of the abdominal muscles.

Procedure: The individual lies flat on the back and the knees are bent with ankles close to the buttocks. The examiner holds his feet to keep them on the ground. The individual performs one complete sit-up.

Scoring: If the individual performs one complete sit up, 10 points are awarded. If is not able to lift his shoulders from the ground, his score remains zero.



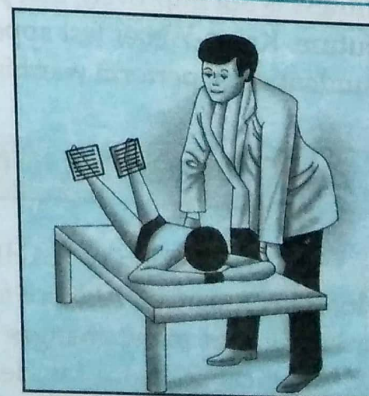
Test 2: Bent knee

Kraus-Weber Test No. 3 (Raising Legs)

Purpose: This test measures the strength of the psoas and lower back.

Procedure: The individual lies flat on the back with the hands behind the neck. The legs straight are lifted 10 inches off the ground. One has to hold this position for 10 seconds.

Scoring: If the individual holds his legs for 10 seconds, he scores 10 points. Anything held less than 10 seconds is scored accordingly, e.g. 5 seconds is recorded as 5 points and so on.



Test 3: Raising leg

Kraus-Weber Test No. 4 (Raising Upper Body)

Purpose: This test measures the strength of upper back muscles.

Procedure: The individual lies on the stomach with a pillow under the lower abdomen and groin. The examiner holds the feet down. The individual has to lift head, shoulder, and chest off the floor and hold this position for 10 seconds.

Scoring: If the individual holds the position for 10 seconds, he scores 10 points. Anything held less than 10 seconds is scored accordingly, e.g. 5 seconds is recorded as 5 points and so on.



Test 4: Raising upper body

Kraus-Weber Test No. 5 (Raising Lower Body)

Purpose: This test measures the strength of lower back muscles.

Procedure: The individual lies on the stomach with a pillow under the lower abdomen and groin. The examiner holds the chest down. With knees straight, the individual lifts legs off the ground and tries to hold this position for 10 seconds.

Scoring: If the individual holds the positions for 10 seconds, he scores 10 points. Anything held less than 10 seconds is scored accordingly, e.g. 5 seconds is recorded as 5 points and so on.



Test 5: Raising lower body

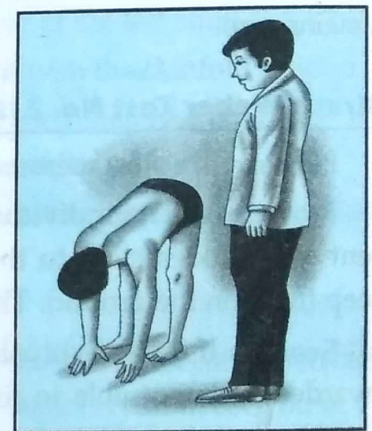
Kraus-Weber Test No. 6 (Floor Touching)

Purpose: This test measures the strength of back and hamstring.

Procedure: The individual stands erect, barefooted, and with feet together. The knees are straight. The individual bends over slowly and touches the floor with the fingertips. One has to hold this position for 3 seconds.

Scoring: If the fingertips remain at a distance of 10 or more inches from the floor, the individual is graded as fail while the individual who is able to touch the floor and hold the touch position for three seconds is given a scoring of 10 points.

Evaluation of test: A physically fit person can easily clear all six tests. Failure in one or more tests indicates lack of physical fitness. If fitness is not improved, that person may come across health problem in future. Kraus-Weber test appears to be simple but sometimes it puts great strain on some muscles, thus student must perform warming-up before doing these tests.



Test 6: Floor touching

7.3

MOTOR FITNESS TEST - AAHPER TEST

The first version of AAHPER physical fitness test was published in 1958 and that time AAHPER stood for American Alliance for Health, Physical Education and Recreation. Then it was revised in 1965 and after that many changes in the test battery were made in 1975 and now it is known AAHPERD i.e. American Alliance for Health, Physical Education, Recreation and Dance. American organisation developed a physical fitness test for measuring physical fitness. It is one of the oldest professional

organisations in USA. It was started to measure the physical fitness in USA. school children. Now this test is used by whole world to measure physical fitness of an individual.

Administration of AAPERD Fitness Test: The students should warm up before they participate in the test. All the students should be medically fit. This test has following six items (test battery) to access physical fitness of an individual, which has to be performed in two days.

Test Items:

- (i) Pull-ups for boys, flexed arm hang for girls
- (ii) Bent-knee sit-ups
- (iii) Shuttle-run
- (iv) Standing long/broad jump
- (v) 50-yard dash
- (vi) 600-yard run or walk

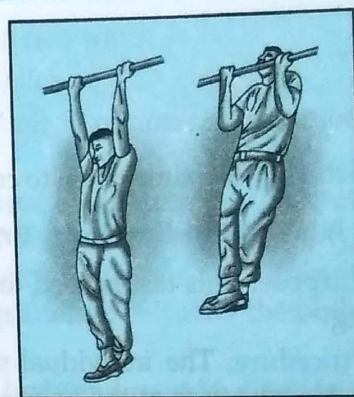
Test Administration

Test No. 1: Pull-ups for boys

Purpose: This test is used to measure the strength and endurance of shoulder and arm.

Procedure: This test is administered on a horizontal bar. The bar should be adjusted according to the height of the individual. The bar is held with palm. The individual is advised to raise body so that the chin reaches above the level of bar. This is to measure the number of pull ups performed without taking rest.

Scoring: Score is awarded for each correct and complete pull-up. The type of grip should be also recorded with results.



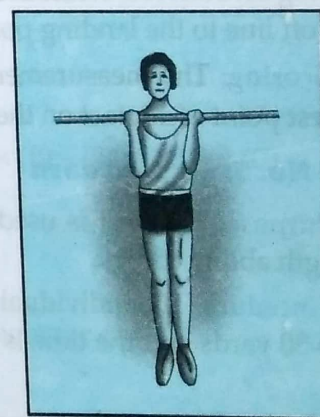
Pull ups

Flexed arm hang for girls

Purpose: This test is used to measure the strength and endurance of shoulder and arm.

Procedure: The test is administered on a horizontal bar. The bar should be adjusted according to the height of the individual. The bar is held with overhand grip. The individual is lifted off the ground until her chin reaches above the level of bar. She has to hold the bar in the same position for maximum time.

Scoring: The total time is recorded in seconds. The type of grip should be also recorded with the results.



Flexed arm hang

Test No. 2: Bent-knee sit-ups

Purpose: This test is used to measure the strength and endurance of abdominal and hip muscles.

Procedure: The individual should lie down on back with bent knees. Feet are held by partner on the floor; fingers should be interlocked and put behind the head. To perform sit-ups, elbows must touch the knees. The maximum number bent knee sit-ups to be performed within 60 seconds is noted.



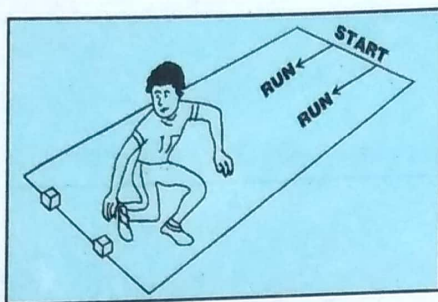
Sit-ups

Scoring: The total number of correctly completed sit-ups in 60 seconds.

Test No. 3: Shuttle run

Purpose: This test is used to measure speed and agility (coordinative ability).

Procedure: Two lines which are parallel to each other are marked 10 yard apart. Two wooden blocks and picks are kept on opposite side of the start line. On start the individual runs towards wooden blocks and picks one of them. Then he/she places the block on the line from where the test started. He/she continues to run and similarly lift other block and place at starting line. The time is recorded in second to complete a trial.



Shuttle run

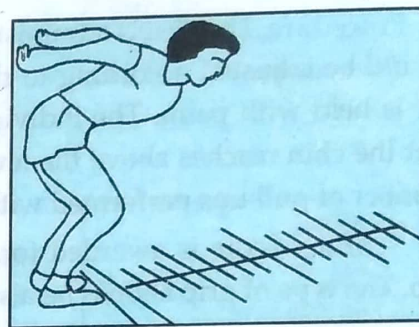
Scoring: The time taken to complete the trial is taken as score.

Test No. 4: Standing long/Broad jump

Purpose: This test is used to measure the explosive power of the leg.

Procedure: The individual stands on marked line with feet close. He/she dips at the knee and swings arms before jumping, landing on both feet without falling backwards. The distance from take off line to the landing point is measured in feet and inches.

Scoring: The measurement is taken from take-off line to the nearest point of contact on the landing.



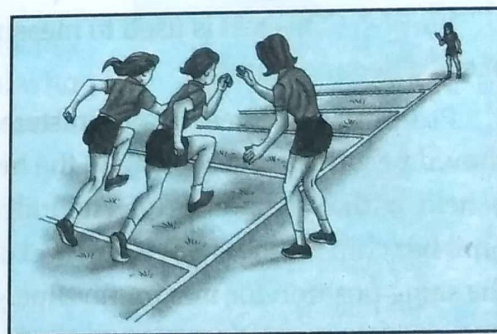
Standing jump

Test No. 5: 50-yard dash

Purpose: This test is used to measure speed and explosive strength ability of legs.

Procedure: The individual has to run with maximum speed up to 50 yards and the time is recorded in second to complete a trial.

Scoring: The timing starts at the starter's signal, and finishes when the chest crosses the finish line, is recorded in seconds.



50-yard dash

Test No. 6: 600-yard run

Purpose: This test is used to measure cardiovascular endurance.

Procedure: The individual has to run or walk 600 yards in shortest time. The time is recorded in minutes and seconds.

Scoring: The timing starts at the starter's signal, and finishes when the chest crosses the finish line, is recorded in minutes and seconds.

Evaluation of Test: According to the norms provided by AAHPERD fitness test table (based on age) is taken after completing all the test items, the recorded scores of tests are converted into percentile scores.

The percentile scores of the individual help evaluate and compare the performance with other groups of same age.

This test faced a lot of criticism from practioners. Therefore, in 1988 AAHPERD introduced the 'Physical Best Test'. This test is designed to measure physical performance of the body.

This test includes the following items:

Test Items

- (i) 1½ mile Run/Walk or 12 min. Run
- (ii) Skinfold measurement
- (iii) Sit-ups
- (iv) Pull-ups for boys and flexed arm hang for girls
- (v) Sit and reach test.

Test Administration

1. **1½ mile walk/run or 12 min. run:** This test can be administered in two ways:
 - (i) Students are asked to run 1½ mile. There timing is taken by stopwatch.
 - (ii) If the above method is not suitable then students are asked to run for 12 minutes. In this method their distance is noted down.
2. **Skin fold Measurement (Body Fat):** In this test calipers skin is used to measure the thickness of fat of various parts of the body. After measuring the thickness of different parts of the body, the measurements are put in an equation to calculate the body density. Equations are different for girls and boys. After calculating body density, it is put in the equation to calculate the body fat percentage.

Note: All the measurement must be done on the right side of the body and must be noted in mm.

Boys' measurement: The following three body parts are measurement for boys:

- (a) Abdominal Skin Fold (A)
- (b) Chest Skin Fold (B)
- (c) Arm Skin Fold (C)

Equation for body density = $1.1017 - (0.000282) \times (A) - (0.000736) \times (B) - (0.000883) \times (C)$

Equation for Fat percentage:

$$\text{Fat percentage} = \left(\frac{4.570}{\text{Body density}} - 4.142 \right) \times 100$$

Girl's measurements: The following two body parts are measurement for girls:

- (a) Arm Skin Fold (A)
- (b) Iliac Skin Fold (B)

Equation for body density = $1.0764 - (0.00081) \times (A) - (0.00088) \times (B)$

Equation for Fat percentage:

$$\text{Fat percentage} = \left(\frac{4.570}{\text{Body Density}} - 4.142 \right) \times 100$$

Example: Suppose that an individual's Arm Skin Fold is 20 mm and Iliac Skin Fold is 16 mm. Now, compute these values:

Body density = $1.0764 - (0.00081) \times (20 \text{ mm}) - (0.00088) \times (16 \text{ mm}) = 1.0491 \text{ gm/cc}$.

$$\text{Fat percentage} = \left(\frac{4.570}{1.0461} - 4.142 \right) \times 100 = 22.7\%$$

3. **Sit-ups:** (Procedures are explained above as test item 2).

4. Pull-ups for boys and Flexed-arm Hang for Girls (Procedures are explained above as test item 1)
5. **Sit-and-reach Test:** This test is used for measuring flexibility. After proper warming up, student sit with their legs extended in front of them. The distance of the feet should be according to the width of shoulders. From this position they reach forward with their palms facing downward flexing at their waist. The purpose is to reach as forward as possible. Note down the distance they cover beyond their toes in centimeters.

7.4

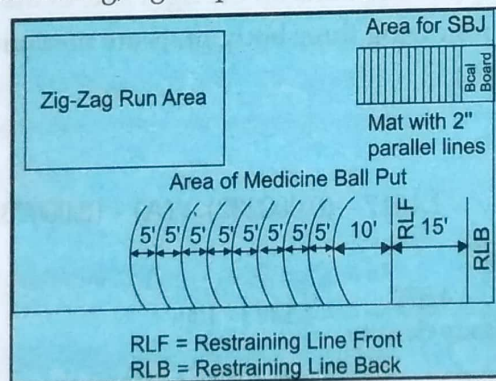
GENERAL MOTOR FITNESS-BARROW THREE ITEM GENERAL MOTOR ABILITY

This is one of the most popular motor ability test given by Dr. Harold M. Barrow in 1954. He selected 29 test items for the construction of test battery. After testing 29 items, he studied multiple correlation coefficients of various combinations of test items with the total performance score and found that, there are two test batteries, one with six test items and other with three test items, which are highly correlated with 29 items. Therefore, instead of measuring 29 items, most frequently Barrow 3 item motor ability test is used. This test battery has the following three test items:

1. SBJ (Standing Broad Jump)
2. Zig-zag Run
3. Medicine Ball Put

Equipment required: Stopwatch, medicine ball (3 kg for boys and 1 kg for girls), measuring tape, five obstacles, 5 by 12 feet tumbling mat marked with a take-off line having parallel lines.

Test administration: The three items may either be conducted in an athletic field area or in a gymnasium. In case of the indoor testing, figure provides a guide to space requirements.



Barrow three item test plan

Test item (i) Standing Broad Jump: This test item measures primarily the explosive power of the legs. The subject is given demonstration about the area of jump. The performer stands behind a line marked on the ground, takeoff line with feet slightly apart. A two foot non-slip floor for take-off and soft landing area is used, with swinging of the arms and bending of the knees to provide forward drive. The performer attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed.

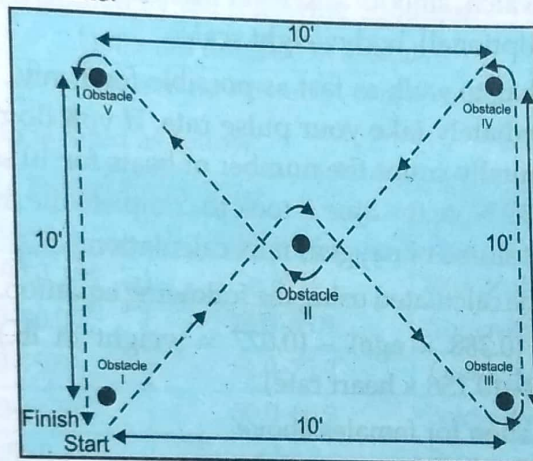
Scoring and evaluation: The measurement is taken from take-off line to the nearest point of contact on the landing (back of the heels). Record the longest distance jumped, the best of three attempts. The table below gives a rating scale for the standing long jump test for adults, based on personal experiences.



Standing Long Jump Equipment

Rating	Males		Females	
	(cm)	(feet, inches)	(cm)	(Feet, inches)
Excellent	> 250	> 8' 2.5"	> 200	> 6' 6.5'
Very good	241-250	7' 11" - 8' 2.5"	191-200	6' 3" - 6' 6.5'
Above average	231-240	7' 7" - 7' 10.5"	181-190	5' 11.5" - 6' 2.5"
Average	221-230	7' 3" - 7' 6.5"	171-180	5' 7.5" - 5' 11"
Below average	211-220	6' 11" - 7' 2.5"	161-170	5' 3.5" - 5' 7"
Poor	191-210	6' 3" - 6' 10.5"	141-160	4' 7.5" - 5' 2.5"
Very poor	< 191	6' 3"	< 141	< 4' 7.5"

Test item (ii) Zig-zag Run: This test item measures primarily agility and secondarily the speed. The subject is given demonstration about the course of zig-zag running as is illustrated in Figure. Then he/she is instructed to take the standing start position on the signal ready and to start running on the signal 'go' and that three laps are to be run and fast run is to be continued even after the finish line so as to slow down only after crossing the finish line.



Course of zig-zag run

The subject is specifically informed that the obstacles are neither to be grasped while going around them and nor to be misplaced in any way. If anybody fouls, then whole run is to be repeated.

After the signal ready? go, the subject begins the zig-zag run, the timer starts the stopwatch. As soon as the runner crosses the finish point (F) after the third round, the timer stops the watch.

Scoring and Evaluation: The final score is the time taken to run the three rounds of figure-of-eight. This time is to be evaluated with the help of norms of local population. If the norms are not available, then the comparative ranking of the persons tested may be assigned.

Test item (iii) Medicine Ball Put: This test measures primarily arm and shoulder girdle strength and secondarily power, agility, arm and shoulder girdle coordination, speed and balance.

Test Administration: Before starting the test, the subjects are given the following instructions. "The medicine ball is not to be thrown but to put as will be demonstrated. The subject is to stand between the two restraining line (see Figure) and the ball is to be put straight down the course. Each subject is to take three trials; fouls count a trial. However, in case of three continuous or more fouls the subject will be asked to re-attempt until he makes a fair put".

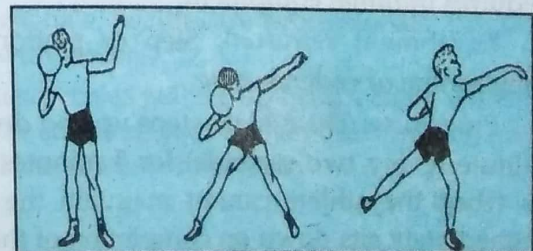


Illustration of medicine ball put

After giving above instructions, the event is explained by giving a live demonstration. Then a subject is asked to take a position in the throwing area and put the medicine ball as explained and demonstrated. He is given three trials.

Scoring and Evaluation: The maximum distance out of three trials of putting the medicine ball is the final score which is evaluated with the help of norms if available on the local population or the comparative rankings are assigned to the subjects tested. If the number of subjects is large enough, the Mean, Standard deviation, etc. are also computed and the norms are developed and used.

7.5

MEASUREMENT OF CARDIOVASCULAR FITNESS – HARVARD STEP TEST/ ROCKPORT TEST

The Harvard step test was developed by Brouha et al. (1943). It is a common aerobic fitness test for those of low fitness level. There is a very similar 1 mile walk test used for the Fitness Gram Program.

Purpose: To check the development of person's maximum cardio-respiratory ability, *i.e.* volume of oxygen.

Equipment required: Stopwatch, smooth and level marked 1 mile track, paper and pencil, heart rate monitor (optional), bodyweight scales.

Procedure: In this test one has to walk as fast as possible for 1 mile. After you have completed the mile, immediately take your pulse rate. If you do not have a heart rate monitor, you can manually count the number of beats for 10 seconds, and then multiply that by 6 to get your minute heart rate. Note the time it took to complete the mile. You will also need to know your body weight for the VO_2 (volume of oxygen) max calculation.

Scoring: A VO_{2max} score can be calculated using the following equation.

Females: $VO_2 = 139.168 - (0.388 \times \text{age}) - (0.077 \times \text{weight in lb.}) - (3.265 \times \text{walk time in minutes}) - (0.156 \times \text{heart rate})$.

Males: Add 6.318 to the equation for females above.

Target population: This test is suitable for both males and females of poor fitness who would not be able to complete a similar distance run test. The test is suitable for people of all ages, from the very young to the elderly.

Advantages: Minimal equipment and costs are required, and the test can be self-administered.

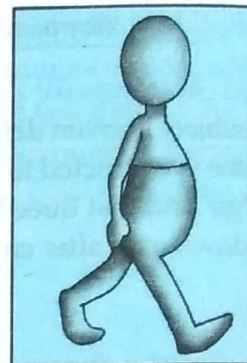
Disadvantages: This test is too easy for highly fit people. Also, since you must walk as fast as possible, the accuracy of this test depends on your pacing ability and level of motivation.

Harvard Step Test

The Harvard Step test is a test of aerobic fitness, developed by Brouha in 1943 in the Harvard Fatigue Laboratories. The feature of this test is that it is simple to conduct and requires minimal equipment.

Equipment required: Step or platform 20 inches / 50.8 cm high, stopwatch, metronome or cadence tape.

Procedure: The athlete steps up and down on the platform at a rate of 30 steps per minute (every two seconds) for 5 minutes or until exhaustion. Exhaustion is defined as when the athlete cannot maintain the stepping rate for 15 seconds. The athlete immediately sits down on completion of the test, and the total number of heart beats is counted between 1 to 1.5 minutes after finishing. This is the only measure required.



Scoring: The Fitness Index score is determined by the following equations:

$$= (100 \times \text{test duration in seconds}) \div (5.5 \times \text{pulse count between 1 and 1.5 minutes}).$$

Advantages: This test requires minimal equipment and costs, and can be self-administered.

Disadvantages: Biomechanical characteristics vary between individuals. For example, considering that the step height is standard, taller people are at an advantage as it will take less energy to step up onto the step. Body weight has also been shown to be a factor. Testing large groups with this test will be time consuming.

7.6 COMPUTATION OF FITNESS INDEX

The person who is taking the test should step up and down on a platform at a height of about 50 cm. The rate of 30 steps (one up and one down) per minute must be held up for five minutes or until exhaustion (a point at which stepping rate is not maintained for 15 second). The person immediately sits down on completion of the test, and the heartbeats are counted for 1 to 1.5 minutes, 2 to 2.5 minutes and 3 to 3.5 minutes.

The fitness index score is determined by the following equation:

$$\text{Fitness Index} = \frac{(100 \times \text{test duration in seconds})}{(5.5 \times \text{pulse count between 1 and 1.5 min.})}$$

The outcome of the equation is rated as follow:

Fitness Index Score		Rating
Male	Female	
> 90.0	> 86.0	Excellent
80.0–90.0	76.0–85.9	Above Average
65.0–79.9	61.0–75.9	Average
55.0–64.9	50.0–60.9	Below Average
< 55.0	< 50.0	Poor

7.7 RIKLI AND JONES – SENIOR CITIZEN FITNESS TEST

Fitness is very important for those in their senior years. Older adults need to have adequate strength, flexibility, and endurance to accomplish everyday tasks. Assessing these components of fitness can detect weaknesses which can be treated before causing serious functional limitations.

The Senior Fitness Test was developed as a part of the Lifespan Wellness Program at Fullerton University, by Dr. Roberta Rikli and Dr. Jessie Jones. As such, the test is sometimes known as the Fullerton Functional Test. It is a simple, easy-to-use, easy to understand and effective to measure aerobic fitness, strength and flexibility using minimal and inexpensive equipment.

The Senior Fitness Test Kit is suitable for fitness professionals, health care professionals, physical therapists, and therapeutic recreation specialists who work with seniors.

The individual fitness test items involve common activities such as getting up from a chair, walking, lifting, bending, and stretching. The tests were developed to be safe and enjoyable for older adults, while still meeting scientific standards for reliability and validity. Here is a list of the tests:

1. Chair-stand Test — testing lower body strength.
2. Arm-curl Test — testing upper body strength.
3. Chair-sit and Reach Test — lower body flexibility test.

4. Back Scratch Test — upper body flexibility test.
5. 8-Foot Up and Go Test — agility test.
6. Walk Test (6 minutes) or Step in Place Test (2 minutes) — The walk test is used to assess aerobic fitness unless the person uses orthopedic devices when walking or has difficulty balancing, in which case they do the step in place test.

1. Chair-stand Test

The chair-stand test is similar to a squat test to measure leg strength. This test is a part of the Senior Fitness Test Protocol, and is designed to test the functional fitness of seniors.

Purpose: This test assesses leg strength and endurance.

Equipment required: A straight back or folding chair without arm rests (seat 17 inches/44 cm high), stopwatch.

Procedure: Place the chair against a wall, or otherwise stabilise it for safety. The subject sits in the middle of the seat, with their feet-shoulder width apart, flat on the floor. The arms are to be crossed at the wrists and held close to the chest. From the sitting position, the subject stands completely up, then completely back down, and this is repeated for 30 seconds. Count the total number of complete chair-stands (up and down equal's one stand). If the subject has completed a full stand from the sitting position when the time is elapsed, the final stand is counted in the total.

Scoring: The score is the number of completed chair-stands in 30 seconds. Below is a table showing the recommended ranges for this test based on age groups.

Men's Results

Age	Below average	Average	Above average
60–64	< 14	14 to 19	> 19
65–69	< 12	12 to 18	> 18
70–74	< 12	12 to 17	> 17
75–79	< 11	11 to 17	> 17
80–84	< 10	10 to 15	> 15
85–89	< 8	8 to 14	> 14
90–94	< 7	7 to 12	> 12

Women's Results

Age	Below average	Average	Above average
60–64	< 12	12 to 17	> 17
65–69	< 11	11 to 16	> 16
70–74	< 10	10 to 15	> 15
75–79	< 10	10 to 15	> 15
80–84	< 9	9 to 14	> 14
85–89	< 8	8 to 13	> 13
90–94	< 4	4 to 11	> 11

Advantages: The equipment is readily available around any home.

Comments: The arms may be used for assistance or for safety if needed.



2. Arm Curl (Bicep) Test

The Arm Curl test is a test of upper body strength, and is designed to test the functional fitness of seniors.

Purpose: This test measures upper body strength and endurance.

Equipment required: 5-pound weight (for women), 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 stronger 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. 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.



Scoring: The score is the total number of controlled arm curls performed in 30 seconds. Below is a table showing some recommended ranges for this test based on age groups.

Men's Results

Age	Below average	Average	Above average
60-64	< 16	16 to 22	> 22
65-69	< 15	15 to 21	> 21
70-74	< 14	14 to 21	> 21
75-79	< 13	13 to 19	> 19
80-84	< 13	13 to 19	> 19
85-89	< 11	11 to 17	> 17
90-94	< 10	10 to 14	> 14

Women's Results

Age	Below average	Average	Above average
60-64	< 13	13 to 19	> 19
65-69	< 12	12 to 18	> 18
70-74	< 12	12 to 17	> 17
75-79	< 11	11 to 17	> 17
80-84	< 10	10 to 16	> 16
85-89	< 10	10 to 15	> 15
90-94	< 8	8 to 13	> 13

Comments: It is important that the upper arm is stable throughout the test, and does not swing.

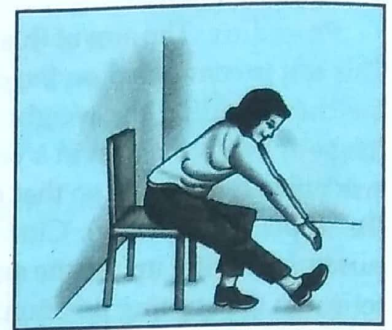
3. Chair Sit and Reach Test

The Chair Sit and Reach test is 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 lower body flexibility.

Equipment 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, and 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 2 seconds. The distance is measured between the tip of the fingertips and the toes. If the fingertips 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). Perform two trials.



Scoring: The score is recorded to the nearest 1/2 inch or 1 cm as the distance reached, either a negative or positive score. Record which leg was used for measurement. Below is a table showing the recommended ranges (in inches) for this test based on age groups.

Men's Results

Age	Below average	Average (inches)	Above average
60-64	< -2.5	-2.5 to 4.0	> 4.0
65-69	< -3.0	-3.0 to 3.0	> 3.0
70-74	< -3.5	-3.5 to 2.5	> 2.5
75-79	< -4.0	-4.0 to 2.0	> 2.0
80-84	< -5.5	-5.5 to 1.5	> 1.5
85-89	< -5.5	-5.5 to 0.5	> 0.5
90-94	< -6.5	-6.5 to -0.5	> -0.5

Women's Results

Age	Below average	Average (inches)	Above average
60-64	< -0.5	-0.5 to 5.0	> 5.0
65-69	< -0.5	-0.5 to 4.5	> 4.5
70-74	< -1.0	-1.0 to 4.0	> 4.0
75-79	< -1.5	-1.5 to 3.5	> 3.5
80-84	< -2.0	-2.0 to 3.0	> 3.0
85-89	< -2.5	-2.5 to 2.5	> 2.5
90-94	< -4.5	-4.5 to 1.0	> 1.0

Advantages: Does not require the subjects to get up and down from the floor as does the traditional test.

Disadvantages: Only one leg is usually measured, which will not show any differences between sides.

Comments: This test should not be done if you have severe Osteoporosis.

4. Back-scratch Test

The Back Scratch Test, or simply the Scratch Test, measures how close the hands can be brought together behind the back. This test is a part of the Senior Fitness Test Protocol, and is designed to test the functional fitness of seniors. Another shoulder flexibility test designed for testing the elderly is the Shoulder Circumduction Test.

Purpose: This test measures general shoulder range of motion.

Equipment required: Ruler or a yardstick.

Procedure: This test is done in the standing position. Place one hand behind the head and back over the shoulder, and reach as far as possible down the middle of your back, your palm touching your body and the fingers directed downwards. Place the other arm behind your back, palm facing outward and fingers upward and reach up as far as possible attempting to touch or overlap the middle fingers of both hands. An assistant is required to direct the subject so that the fingers are aligned, and to measure the distance between the tips of the middle fingers. If the fingertips touch, then the score is zero. If they do not touch, measure the distance between the finger tips (a positive score), if they overlap measure by how much (a negative score). Practice two times, and then test two times. Stop the test if the subject experiences pain.



Scoring: Record the best score to the nearest centimeter or 1/2 inch. Below is a table showing the recommended ranges (in inches) for this test based on age groups:

Men's Results

Age	Below average	Average (inches)	Above average
60-64	> 6.5	6.5 to 0	< 0
65-69	> 7.5	7.5 to -1.0	< -1.0
70-74	> 8.0	8.0 to -1.0	< -1.0
75-79	> 9.0	9.0 to -2.0	< -2.0
80-84	> 9.5	9.5 to -2.0	< -2.0
85-89	> 10.0	10.0 to -3.0	< -3.0
90-94	> 10.5	10.5 to -4.0	< -4.0

Women's Results

Age	Below average	Average (inches)	Above average
60-64	> 3.0	3.0 to 1.5	< 1.5
65-69	> 3.5	3.5 to 1.5	< 1.5
70-74	> 4.0	4.0 to 1.0	< 1.0
75-79	> 5.0	5.0 to 0.5	< 0.5
80-84	> 5.5	5.5 to 0	< 0
85-89	> 7.0	7.0 to -1.0	< -1.0
90-94	> 8.0	8.0 to -1.0	< -1.0

Advantages: Minimal equipment required.

5. 8-Foot Up and Go Test

The '8-Foot Up and Go' is a coordination and agility test for the elderly, which is part of the Senior Fitness Test Protocol.

Purpose: This test measures speed, agility and balance while moving.

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

Procedure: Place the chair next to a wall (for safety) and the marker 8 feet in front 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. Perform two trials.

Scoring: Take the best time of the two trials to the nearest 1/10th second. Below is a table showing the recommended ranges in seconds for this test based on age groups:



Men's Results

Age	Below average	Average	Above average
60-64	> 5.6	5.6 to 3.8	< 3.8
65-69	> 5.7	5.7 to 4.3	< 4.3
70-74	> 6.0	6.0 to 4.2	< 4.2
75-79	> 7.2	7.2 to 4.6	< 4.6
80-84	> 7.6	7.6 to 5.2	< 5.2
85-89	> 8.9	8.9 to 5.3	< 5.3
90-94	> 10.0	10.0 to 6.2	< 6.2

Women's Results

Age	Below average	Average	Above average
60-64	> 6.0	6.0 to 4.4	< 4.4
65-69	> 6.4	6.4 to 4.8	< 4.8
70-74	> 7.1	7.1 to 4.9	< 4.9
75-79	> 7.4	7.4 to 5.2	< 5.2
80-84	> 8.7	8.7 to 5.7	< 5.7
85-89	> 9.6	9.6 to 6.2	< 6.2
90-94	> 11.5	11.5 to 7.3	< 7.3

Comments: For best results, practice the test once, and then perform it twice. A cane or walker may be used if that is the usual mode of walking. Push-off from the chair is allowed.

Minute Walk Test

The 6-Minute Walk Test is a part of the Senior Fitness Test Protocol, and is designed to test the functional fitness of seniors. It is an adaptation of the Cooper 12 minute run. For people who use orthopedic devices when walking, as well as people who have difficulty in balancing, there is an alternative 2 minute step in place test.

Purpose: This test measures aerobic fitness.

Equipment required: Measuring tape to mark out the track distances, stopwatch, chairs positioned for resting.

Procedure: The walking course is laid out in a 50-yard (45.72 m) rectangular area (dimensions 45 × 5 yards), with cones placed at regular intervals to indicate distance walked. The aim of this test is to walk as quickly as possible for six minutes to cover as much ground as possible. Subjects are set their own pace (a preliminary trial is useful to practice pacing), and are able to stop for a rest if they desire.



Scoring: Measure the distance walked in 6 minutes to the nearest meter. The following regression equations were determined.

Males: Walk Distance (meters) = $867 - (5.71 \text{ age, yrs}) + (1.03 \text{ height, cm})$

Females: Walk Distance (meters) = $525 - (2.86 \text{ age, yrs}) + (2.71 \text{ height, cm}) - (6.22 \text{ BMI})$

Advantages: Minimal equipment and costs involved.

Disadvantages: This test is too easy for the highly fit person. One of the other running tests would be better suited.

Comments: The test should be terminated if the examined person reports dizziness, nausea, excessive fatigue, pain, or if the examiner notices any other symptoms of concern. The examiners should be trained in recognising these symptoms and the necessary action plan should be in place in case of medical emergencies.