What's My Score? Evaluation in Physical & Health Education

Chapter 6

Objectives

- Calculate means and standard deviations using a graphic display calculator or computer program
- Understand what the standard deviation and coefficient of variation tell us about the distribution of data
- Understand what t-tests tell us between two sets of data
- Understand what a correlation is
- Outline the importance of specificity, accuracy, reliability and validity in a fitness test

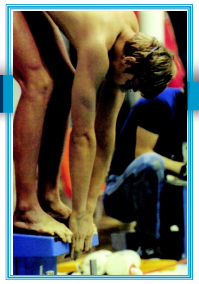
Objectives cont.

- Discuss the importance of good study design in experiments
- Outline the importance of the PAR-Q
- Evaluate the advantages and disadvantages of field, laboratory, sub-maximal and maximal tests when examining human performance
- Describe the components of fitness
- Outline why and how fitness is assessed

Objectives cont.

- Introduce the principles of training programme design
- Suggest ways of monitoring exercise intensity

Introduction

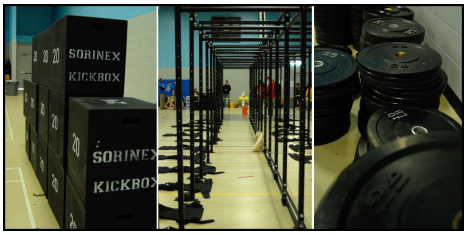


How do we measure athletic performance?

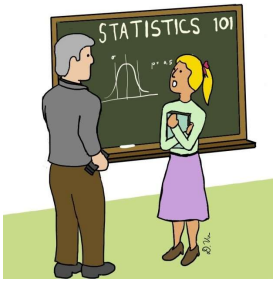
What ways can we use to gather data?



How can we design different fitness tests?



How do we interpret this data?



How do we use this information to compare athletes,…

develop training strategies, …

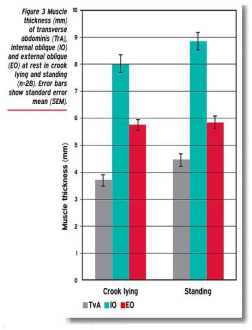
and measure improvement.


Statistical Analysis

Why are there different statistical measurements?

- The knowledge that any individual measurement you make in a lab will lack perfect precision often leads a researcher to choose to take multiple measurements at some independent variable level.
- Though no one of these measurements are likely to be more precise than any other, this group of values, it is hoped, will *cluster* about the true value you are trying to measure.

This distribution of data values is often represented by showing a single data point, representing the *mean* value of the data, and *error bars* to represent the overall *distribution* of the data.

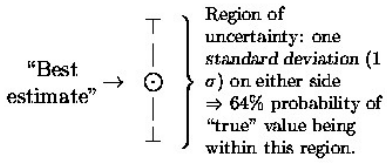


Mean

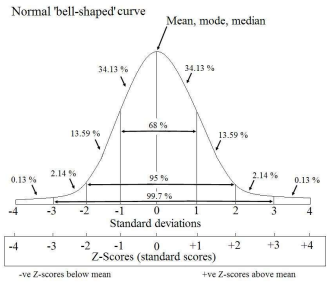
- The mean, or average, of a group of values describes a middle point, or central tendency, about which data points vary.
- The mean is a way of summarizing a group of data and stating a best guess at what the true value of the dependent variable value is for that independent variable level.

Error Bars

- The error bars shown in a line graph represent a description of how confident you are that the mean represents the true value.
- The more the original data values range above and below the mean, the wider the error bars and less confident you are in a particular value.
- See figures 6.1 and 6.2 page 139



Standard Deviation



Calculating the mean and standard deviation of a set of values

- Ensure you are referencing a sample standard deviation (not the population) when reporting results
- You do not need to know the formulas. You are expected to use the statistics function of a scientific calculator

What is Standard Deviation?

- **Standard deviation** is a simple measure of the variability or dispersion of a data set.
- A low standard deviation indicates that the data points tend to be very close to the same value (the mean).
- A high standard deviation indicates that the data are "spread out" over a large range of values.

Standard Deviation of average height of adult men in Canada

- For example, the average height for adult men in the Canada is about 70 inches, with a standard deviation of around 3 inches.
- This means that most men (about 68%, assuming a normal distribution) have a height within 3 inches of the mean (67 inches – 73 inches)
- This also means that almost all men (about 95%) have a height within 6 inches of the mean (64 inches – 76 inches).
- See normal distribution curve

- If the standard deviation were zero, then all men would be exactly 70 inches high.
- If the standard deviation were 20 inches, then men would have much more variable heights, with a typical range of about 50 to 90 inches.

How do you calculate Standard Deviation?

- x = one value in your set of data
- avg (x) = the mean (average) of all values x in your set of data
- n = the number of values x in your set of data
- For each value x, subtract the overall avg (x) from x, then multiply that result by itself (otherwise known as determining the square of that value).

- Sum up all those squared values. Then divide **that** result by (n-1).
- Find the square root of that last number. **That's** the standard deviation of your set of data.
- Remember you do not have to memorize the formula, you just need to understand what the values tell you.

What does Standard Deviation tell us?

- A small standard deviation indicates that the data is clustered closely around the mean value.
- Conversely, a large standard deviation indicates a wider spread around the mean.

Coefficient of Variation

- The coefficient of variation is useful because the standard deviation of data must always be understood in the context of the mean of the data. The coefficient of variation is a dimensionless number.
- Coefficient of variation is the standard deviation expressed as a percentage.

- When the SD and mean come from repeated measurements of a single subject, the resulting coefficient of variation is an important measure of reliability.
- Gives you the relationship of the Standard Deviation to the Mean
- Pg 140 and Table 6.2 pg 141

- This form of within-subject variation is particularly valuable for sport scientists interested in the variability an individual athlete's performance from competition to competition or from field test to field test. The coefficient of variation of an individual athlete's performance is typically a few per cent.

- For example, if the coefficient of variation for a runner performing a 10,000-m time trial is 2.0%, a runner who does the test in 30 minutes has a typical variation from test to test of 0.6 minutes.

T-Test

- The t-test can be used to measure whether there is a significant difference between the means of two populations.
- For example if you measure the weight of the inhabitants on two islands the t-test formula will work out whether there is a significant difference based on the difference between the means and the degree of variation among them.

- A table of critical t values is used to determine the probability that the difference is simply random chance.
- For the difference to be significant the probablity (p-value) needs to be less than 5% ($p < 0.05$)

Independent T-Test (Unpaired)

- The most frequently used t test determines whether two sample means differ reliably from each other.
  - Do two groups training at different levels of intensity differ from each other on a measure of cardiorespiratory endurance?

Dependent T-Test (Paired)

- The two group of scores are related in some way.
  - Two groups of subjects are matched on one or more characteristics OR
  - One group of subjects is tested twice on the same variable.

- Two tailed t test: it is assumed that the difference between the means could favour either mean.
- One tailed test: can do only one direction.

Correlation

- **Correlation** (co-relation) is a term which is used to define the extent of relatedness or relationship between two variables.
- Are the two variables related in such a way that random chance cannot account for the relationship?

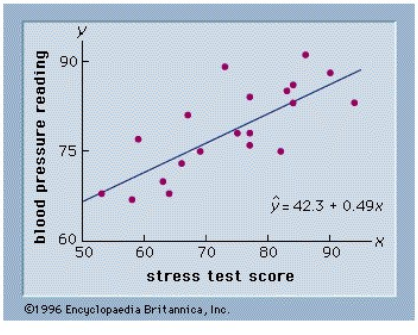
- It should be noted that just because you can mathematically determine how related two variables are one cannot use correlation to validate a cause and effect relationship between the two variables.
- Therefore correlation is not sufficient for validity of the relationship. This concept is loosely phrased "**correlation does not imply causation**."

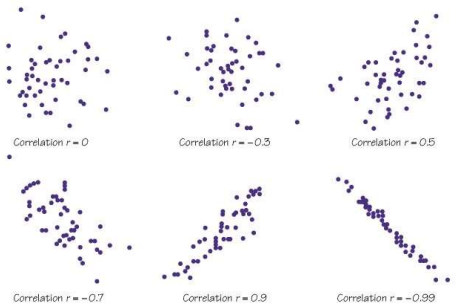
- They can indicate only how or to what extent variables are associated with each other. The correlation coefficient measures only the degree of linear association between two variables.
- The correlation will be either positive or negative

- **Pearson product-moment correlation coefficient (r)** is the correlation between two variables (X and Y)
- This calculation provides a measure of the linear relationship between the two variables. Does X and Y increase or decrease together or is it relationship due to random chance.

- The correlation coefficient will be a value between +1.000 and -1.000.
- The closer the number is to 0 the less likely there is a linear relationship with a value of 0 is there is no linear relationship between X and Y.

- The closer the number is to 1 the more likely there is a linear relationship between X and Y with a value of 1.0 indicating a perfect linear relationship. The sign (+ or -) indicates the direction of the relationship. A plus (+) sign tells you that as X increase so does Y. A minus (-) sign tells you as X increases, Y decreases or as X decrease, Y increases.





Greens in Regulation and Putts Per Round

Player	GIR (X)	X^2	Putts (Y)	Y^2	XY
Singh	68.45	4685.4	29.47	868.5	2017.3
Mickelson	65.81	4331.0	28.74	826.0	1891.4
Garcia	67.06	4498.4	29.61	876.8	1985.9
Perry	67.47	4552.2	29.25	855.6	1973.6
Kim	65.78	4327.0	28.85	832.3	1897.8
Villegas	64.60	4173.2	28.97	839.3	1871.5
Harrington	60.67	3680.8	28.04	786.2	1701.3
Cink	66.94	4481.0	29.16	850.3	1952.1
Leonard	66.61	4436.9	28.85	832.3	1921.7
Allenby	70.40	4956.2	30.07	904.20	2116.9

Number of Paired Scores	10
Sum of Greens Hit in Regulation	663.8
Sum of Putts Per Round	291.0
Sum of Greens Hit in Regulation Squared	44121.98
Sum of Putts Per Round Squared	8471.44
Sum of Greens Hit x Putts Per Round	19329.4

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

- r = 0.925

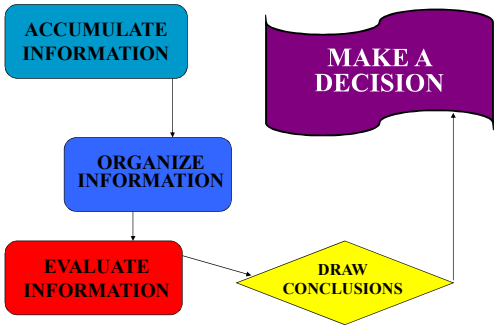
R	0.925
R^2	0.855

- **Coefficient of determination (r^2)** is the proportion of the variance of one variable which is predictable from the other variable. In other words this helps determine (in percentage) how much the variation of Y is based on the variation of X. Is the variation in Y related to the linear relationship between X and Y.

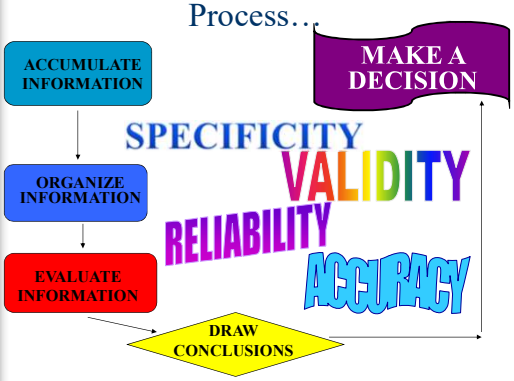
Example

- "If your r = 0.922, then r2 = 0.850, which means that 85% of the total variation in y can be explained by the linear relationship between X and Y (as described by the regression equation).
- The other 15% of the total amount of variation in Y remains unexplained."

Study Design



Factors to be Considered in the Process…



Research Task

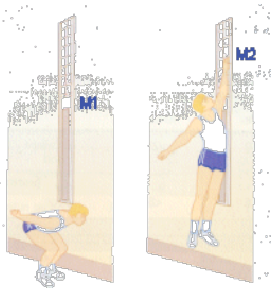
- Define the following terms and use examples from fitness testing to demonstrate how they can be applied and their importance in scientific research:
- Specificity
- Accuracy
- Reliability
- Validity

Specificity

- Tests need to be specific to what we are trying to test.
- Tests should provide the athlete and coach with information concerning the athletes ability to perform in a specific sport or skill.

Wingate test for aerobic power

Sergeant Jump Test



Accuracy

- We must make sure that the instruments with which we measure the fitness component are accurate
- Make sure equipment is working properly

Reliability

- An integral part of validity is reliability, which pertains to the consistency, or repeatability of a measure.
- Reliability is the “degree to which a measure would produce the same result from one occasion to another” (Clark-Carter 2000).
- Ex. Want to be sure that improvement is due practice and not because there is something wrong with reliability of the test.

- A valid test is reliable. It yields the same results on successive trials
- Scores from a test can be reliable but not valid (weighing someone repeatedly on a broken scale)

Validity

- Is the degree to which a test or instrument measures what it is intended to be measuring
- The soundness of the interpretation of scores from a test, the most important consideration in measurement
- A test can not be considered valid if it is not reliable

Designing Sport and Exercise Science Experiments

Causality

- Cause and effect
- If this happens then this should be the result

Control Groups

- A control group in a scientific experiment is a group separated from the rest of the experiment where the independent variable being tested cannot influence the results.
- This isolates the independent variable's effects on the experiment and can help rule out alternate explanations of the experimental results.

Randomisation

- Randomly allocating individuals to the groups

Placebos

- A placebo tastes like the real thing that is being given to the control group but is in fact a harmless substance which will not affect performance

Blinding

- Making all participants think they are receiving the substance which is being tested (regardless of whether or not they are receiving placebo).
- This eliminates they being influenced because the think/don't think their performance should improve/not improve

Double-Blinding

- An experiment in which neither the participants nor the experimenters know who has been given the placebo

A Weak Experimental Design

Pre-Test → Treatment (caffeine ingestion) → Post-Test

Experimental design using a control group

Experimental Group	Pre-Test	→	Treatment (caffeine ingestion)	→ Post-Test
Control Group	Pre-Test	→	No Treatment	→ Post-Test

Experimental design using a control group with a placebo

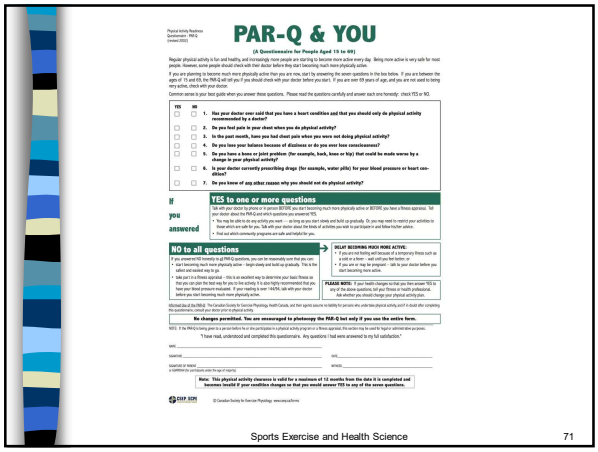
Experimental Group	Pre-Test	→	Treatment (caffeine ingestion)	→ Post-Test
Control Group	Pre-Test	→	Treatment (placebo ingestion)	→ Post-Test

Importance of study design in the context of sport and exercise

- Written Report:
  - Design a sample sports science experiment demonstrating the use of these experimental techniques. (500 typed words)

PAR-Q

- Types of tests used require individuals o undertake physical activity, often strenuous
- Need to make sure test will not put their health, or their life at risk.
- Have participants fill out the PAR-Q form



PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
☐	☐	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
☐	☐	2. Do you feel pain in your chest when you do physical activity?
☐	☐	3. In the past month, have you had chest pain when you were not doing physical activity?
☐	☐	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
☐	☐	5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?
☐	☐	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
☐	☐	7. Do you know of any other reason why you should not do physical activity?

If you answered **YES** to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

If you answered **NO** to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- If you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- If you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

a witness for participants under the age of majority

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

CSEP SCPE

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Research

- Evaluate the advantages and disadvantages of field, laboratory, sub-maximal and maximal tests of human performance
  - Using the internet see if you can find examples of field and laboratory tests that claim to test the same things. Also can you find sub-maximal and maximal tests that claim to measure the same things. Which do you prefer?

- "We want to try to prove without a shadow of a doubt the relationship between physical fitness and health, not just physical fitness and ability to perform." Kenneth H. Cooper, designer of the Cooper test

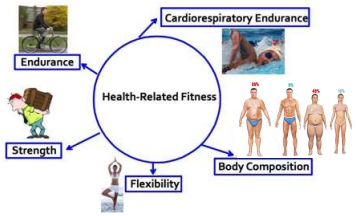
- "The doctor of the future will give no medicine, but will instruct in the care of the human frame, in diet, and in the cause and prevention of disease" Thomas Alva Edison (1847-1931)

Components of Fitness

- Physical fitness is a complex and challenging term. It relates to an individuals physical ability to perform a specific activity

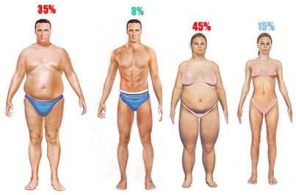
Health Related Fitness

- An individual's physical ability to maintain health and perform activities of daily living. Primarily associated with disease prevention and functional health.



Body Composition

- The proportion of an individual's total body mass that is made up of fat and fat-free mass.



- Body fat mass (FM) includes essential fat found in the tissues and organs and stored fat, which is essentially an energy reserve.
- Fat free mass (FFM) refers to what makes up the rest of the total body mass, including muscle, water and bone.

Body fat % can be measured by:

1. Calipers
2. Body fat scales
3. Water displacement tank

Norms for Percent Body Fat

Rating	Males		Females	
	18-25	26-35	18-25	26-35
Very Lean	4-7	8-12	13-17	13-18
Lean	8-10	13-15	18-20	19-21
Leaner than average	11-13	16-18	21-23	22-23
Average	14-16	19-21	24-25	24-26
Fatter than average	18-20	22-24	26-28	27-30
Fat	22-26	25-28	29-31	31-35
Overfat	28-37	30-37	33-43	36-48

- High levels of body fat are associated with many pathological disorders and so maintenance or attainment of low body fat mass is important.
- Anorexia – fat mass is too low
- Sarcopenia – muscle mass is too low

Cardio-Respiratory Fitness (aerobic capacity)

- The ability to take in, deliver and use oxygen for use by the aerobic or oxidative energy system.
- The ability to work continuously for extended periods of time.

Cardiorespiratory Endurance

- The ability to produce energy through an improved delivery of oxygen to working muscles
- The major function of the cardiorespiratory system is to provide oxygen to tissues
- Needed for exertion over longer periods of time

- Low levels of cardio-respiratory fitness are associated with many diseases and a shorter lifespan.
- With heart disease for example only very low intensities of physical activity can be tolerated before anaerobic energy systems need to be relied on and these are less sustainable.
- The result is that even simple physical tasks become unachievable and this worsens the physical deconditioning.
- In contrast, very high levels of cardio-respiratory fitness are observed in endurance trained athletes.

Cardio-respiratory fitness can be tested by:

- Beep test
- Cooper's 12 minute run
- Harvard Step Test

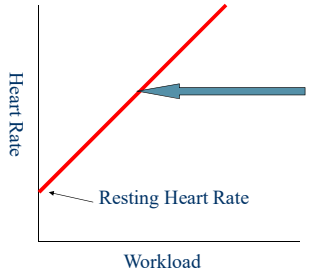
Aerobic Power

- The maximal rate at which the body can take up, transport, and utilize oxygen
- Expressed as maximal oxygen uptake or VO_2max

VO_2max

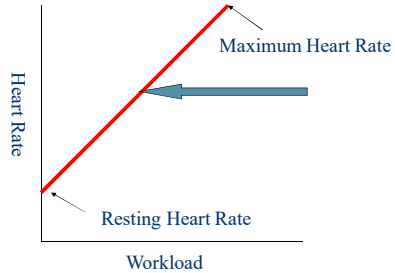
- VO_2max is measured as the maximal value of oxygen consumption recorded during a progressive exercise test to exhaustion

Prediction of VO_2max



- Predictions based on the linear relationship between heart rate and workload can be made over a given workload range

Prediction of VO_2max



- With increasing workload, heart rate increases to a maximum that corresponds to a maximal oxygen consumption (VO_2max)

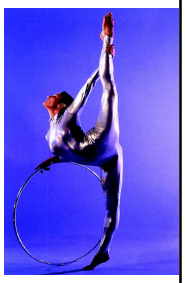
Beep Test

BEEP TEST MALES	poor	fair	average	good	very good	excellent
12 - 13 yrs	3/4	5/2	6/5	7/6	8/9	10/9
14 - 15 yrs	4/7	6/2	7/5	8/10	9/9	12/2
16 - 17 yrs	5/1	6/9	8/3	9/10	11/4	13/7
18 - 25 yrs	5/2	7/2	8/6	10/2	11/6	13/10
26 - 35 yrs	5/2	6/6	7/10	8/10	10/7	12/9
36 - 45 yrs	3/8	5/4	6/5	7/8	8/10	11/3
46 - 55 yrs	3/6	4/7	5/6	6/7	7/8	9/5
56 - 65 yrs	2/7	3/7	4/9	5/7	6/9	8/4
> 65 yrs	2/2	2/6	3/8	4/9	6/2	7/2

BEEP TEST FEMALES	poor	fair	average	good	very good	excellent
12 - 13 yrs	2/6	3/6	5/2	6/2	7/5	9/3
14 - 15 yrs	3/4	5/3	6/5	7/6	8/8	10/7
16 - 17 yrs	4/2	5/7	7/2	8/5	9/8	11/11
18 - 25 yrs	4/5	5/8	7/3	8/7	10/2	12/7
26 - 35 yrs	3/8	5/3	6/6	7/8	9/5	11/5
36 - 45 yrs	2/7-	3/8-	5/4	6/3	7/5	9/5
46 - 55 yrs	2/5	3/6	4/5	5/4	6/3	8/1
56 - 65 yrs	2/2	2/7	3/6	4/5	5/7	7/2
> 65 yrs	1/5	2/2	2/7	3/5	4/4	5/7

Flexibility

- The ability to move through the full range of movement around a joint.
- It is determined by the elasticity of ligaments and tendons to stretch, ligament condition, joint mechanics and the strength and opposition of surrounding muscles (including antagonists) and the shape of articulating bones.

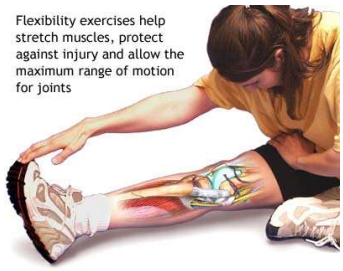


Flexibility

- Flexibility is affected by:
  - Age
  - Sex
  - Inactivity
- The benefits of flexibility include:
  - Good joint health
  - Slowed joint deterioration
  - Improved quality of life
- Flexibility may prevent back pain and injuries

Sit and Reach Test

The aim of the sit and reach test is to highlight tightness in the lower back and/or hamstring muscles.



Hamstring Looseness Test

Performance Level	Position Reached
Excellent	Palms touch the floor
Above Average	Knuckles touch the floor
Average	Fingertips touch the floor
Below Average	Fingertips touch the feet
Needs Improvement	Fingertips touch the ankles or higher

Muscular Endurance

- Is the ability of a particular muscle group to keep working at the desired level of effort for as long as the situation demands (fatigue resistant). It is often controlled by the body's tolerance of the increasing levels of lactic acid which the activity creates. It is of high importance in:
  - The arms in a 200m swim.
  - The legs in a marathon
  - The arms, abdominals and quadriceps in a 2000m rowing race.

Muscular Endurance examples

Upper body – push ups
Lower body - marathon

Norms for the YMCA 1-Minute Sit-Up Test (no. of reps.)

Performance Level	Age and Sex			
	13 Males	14 Males	15+ Males	13+ Females
Excellent	≥98	≥ 99	≥ 103	≥ 93
Above Average	87-97	90-100	92-102	83-92
Average	73-86	76-89	79-91	71-82
Below Average	55-72	58-75	61-80	54-70
Needs Improvement	≤54	≤ 57	≤ 60	≤ 53

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Norms for the Push-Ups Test

Performance Level	No. of Push-Ups	
	Males (15-29)	Females (15-29)
Excellent	50+	45+
Above Average	40-49	30-44
Average	30-39	20-29
Below Average	20-29	10-19
Needs Improvement	0-19	0-9

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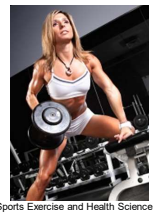
Muscular Strength

- Relates to the ability of the body to apply a force. The recognized definition of strength is, the maximum force that can be developed in a muscle or group of muscles in a single maximal contraction.

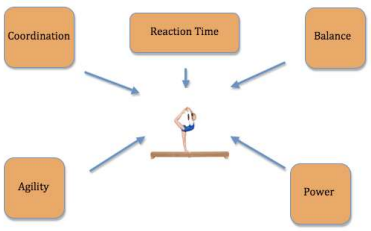

Hand Dynamometer Strength test

Grip Dynamometer

- An isometric strength test
- Grip dynamometer is used to measure the grip strength of the hand
- Hand grip strength is correlated with total body strength

Performance-related Physical Fitness (skill)

- An individual's physical ability to perform in a specific sport.



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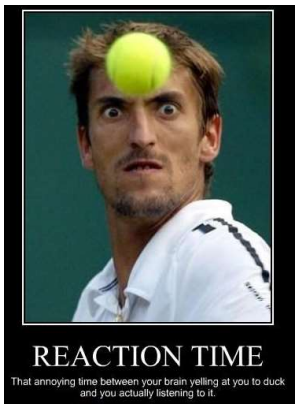
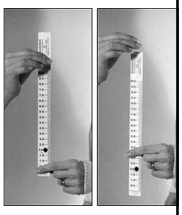
Reaction Time

- The time taken to initiate a response to a given stimulus.
- The reaction time reflects the combination of detecting sensory information, processing this information, sending a response and effecting this response.
- Reaction time can be simple tasks or highly complex tasks



Ruler Test

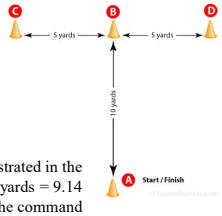
Reaction Time Chart	
DISTANCE ON RULER	REACTION TIME
5 centimeters	.10 seconds
10 centimeters	.14 seconds
15 centimeters	.18 seconds
20 centimeters	.20 seconds
25 centimeters	.23 seconds
30 centimeters	.25 seconds



Agility

- The ability to move and change direction and position of the body quickly and effectively while under control.
- Many factors affect agility: strength, power, speed, flexibility, balance, peripheral vision, anticipation and experience.

Agility T-Test



procedure: Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m). The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touches its base, this time with their left hand. Then shuffling sideways to the right to cone D and touching the base with the right hand. They then shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A.

Agility T-Test results

	Males (sec)	Females (sec)
Excellent	<9.5	<10.5
Good	9.5 to 10.5	10.5 to 11.5
Average	10.5 to 11.5	11.5 to 12.5
Poor	>11.5	>12.5

Balance

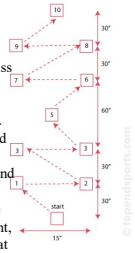
- The maintenance of the centre of mass over the base of support. This can be while the body is static or dynamic (moving).

Stork Stand - balance

Rating	Score (seconds)
Excellent	>50
Good	40-50
Average	25-39
Fair	10-24
Poor	<10

Modified Bass Test Dynamic Balance

purpose: to measure dynamic balance
equipment required: adequate floor space, sticky tape for marking floor, measuring tape, stopwatch.
procedure: The procedure described here is for the*Modified* Bass Test of Dynamic Balance test. The course is marked out as illustrated in the diagram to the right. The subject begins by standing stationary on the right foot on the starting point square. The subject then hops to the first tape mark with the left foot and immediately holds a static position for five seconds. After this time, he then hops to the second tape mark with the right food and holds a static position for another five seconds. This continues with alternate foot hopping and holding a static position for five seconds at each point until the course is completed. At each point, the sole of the foot must completely cover each tape mark so that it cannot be seen. A period of practice with the procedure and on the course should be allowed.



Speed

- The ability to put body parts into motion quickly, or the maximum rate that a person can move over a specific distance.

Power

- Is the combination of strength and speed. A powerful movement is achieved quickly as possible, while imparting as much strength as possible. It is of high importance in:
  - Field events
  - Tackling in rugby or football.
  - Spike in volleyball
  - Drive in golf

Co-Ordination

- The interaction of the motor and nervous systems and is the ability to perform motor tasks accurately and effectively.

To do:

- Does each of the following have a functional role for both health-related and performance-related fitness? Provide examples for each which illustrate why
  - Strength
  - Power
  - Muscular Endurance
  - Flexibility
  - Agility
  - Balance
  - Reaction Time

How fast a reaction time is physically possible?

- Research page 150

Outline and evaluate the following fitness tests for aerobic capacity

- Beep Test (Multistage fitness test)
- Cooper's 12 Minute Run
- Harvard Step Test
- Queen's or McArdle Step Test
  - Consider validity, reliability, and limitations
  - See examples pages 151 - 153

Outline and evaluate the following fitness tests for flexibility

- Sit and Reach
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for muscular endurance

- Maximum sit-ups
- Maximum push-ups
- Flexed Arm Hang
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for agility

- Illinois Agility Test
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for strength

- Hand grip dynomometer
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for speed

- 40 metre sprint
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for body composition

- Body mass index
- Anthropometry
- Underwater weighing
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for balance

- Stork stand
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for coordination

- Hand ball toss
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for reaction time

- Drop test
- Computer simulation
  - Consider validity, reliability, and limitations

Outline and evaluate the following fitness tests for power

- Vertical jump
- Standing broad jump
  - Consider validity, reliability, and limitations

Principles of training program design

Warm-up and Stretching Activities

- Increase body temperature
- Elevate heart rate and breathing rate
- Prepare cardio vascular system

Cardio-respiratory endurance training

- Walking
- Jogging
- Running
- Cycling
- Swimming
- Rowing
- Aerobic dancing

Cool-down and stretching activities

- Decreases intensity
- Engage in stretching activities
- Improves flexibility
- Lowers risk of muscle injuries

Flexibility activities

- Explain the difference between passive and dynamic stretching
- What is PNF stretching?

Resistance Training

- Builds muscle mass
- Increased muscle mass burns more calories
- Part of a balanced training program

Incorporating recreational activities and sports

- Enjoyable
- Relatively inexpensive
- Contribute to health and fitness
- Sustain life-long interest
- Involve whole family

Basic Principles of Training

Progression

- The human body responds to stress caused by physical work. This adaptation is sometimes known as a training effect. As the adaptation takes place the body becomes comfortable with the new workload. Subsequently progressive overload is required to cause further change. Otherwise a plateau in performance levels will result.

Smyth et.al 2000

Overload (frequency, intensity, type and time)

- Distance of the work
- Time of recovery periods
- Number of repetitions
- Number of sets
- **Number of sessions/week (Frequency)**
- **Amount of resistance/% MAX HR (Intensity)**
- **Type of activity (Type)**
- **Time of the work (Time)**

Smyth et.al 2000

Specificity

- Is the process of replicating the characteristics of physical activity in training to ensure it benefits performance. The 4 categories to consider are:
  1. Muscle group used
  2. Skills performed
  3. Fitness components used
  4. Predominant energy systems used

Smyth et.al 2000

Reversibility

- Also known as "regression" or detraining, explains why performance deteriorates when training ceases or the intensity of training decreases for extended periods of time. Quite simply, if you don't use it you lose it!
- Wesson et.al 2005

Reversibility

- Seven weeks of inactivity has been shown to have the following physiological effects:
  - Significant decreases in Max oxygen uptake have been recorded – up to 27%.
  - In particular, stroke volume and cardiac output can decrease by up to 30%.
  - Muscle mass and strength decrease. Particular if a limb has been immobilized due to injury/surgery. Wesson et.al 2005

Variety

- Is all about providing different activities, formats and drills in training while still addressing the aims of the training programme. Training can become boring, and the and the athlete may drop out of the programme if there is insufficient variety.

Smyth et.al 2000

Variety

- Changes to training activities and drills stimulate and challenge participants, who are therefore more likely to train at optimal levels.
  - Changing the training environment
  - Change the training activity
  - Introducing competition/games/group work

Smyth et.al 2000

To do:

- From your favorite sport select one fitness component and give an example of how each of the first three basic principles can be applied to this component

Research/practical task

- In groups of 2 or 3 outline the use of the following methods of monitoring exerciser intensity and a design a lab to test their validity and reliability
  - Training Heart Rate (% of max HR)
  - The Karvonen Heart Rate Method
  - Ratings of perceived exertion (Borg Scale)

Research/practical task cont.

- Distinguish between the following RPE scales
  - Borg
  - OMNI
  - CERT
  - Outline two reasons as to why it may be a more sensible approach to establish an exercise intensity THR zone rather than a single THR value