

HSC P.D./H./P.E.

Option 2: Improving Performance

- *Why is training important?*
 - Improve skill.
 - Decrease risk of injury.
 - Increase fitness components.
 - Prepare athlete physically & mentally.
 - Increase energy production.
 - Develop stress tolerance.
 - Sustain high performance.
 - Nutritional analysis.

- Before designing a training program, it is important to decide which type of training best suits the demands of the sport that need to be considered.

- *Types of training:*
 - Aerobic.
 - Strength.
 - Flexibility.
 - Skills.

Endurance Power Speed

Aerobic	Strength	Flexibility	Skill
<ul style="list-style-type: none"> - Continuous. - Interval. - Circuit. - Fartlek. 	<ul style="list-style-type: none"> - Resistance. - Isometric. - Isotonic. - Isokinetic. - Plyometrics. - Complex training. 	Types: <ul style="list-style-type: none"> - Static. - Dynamic. Methods: <ul style="list-style-type: none"> - Static. - Ballistic. - PNF. - Combination. 	<ul style="list-style-type: none"> - Part. - Whole. - Massed. - Distributed. - Drills/routines. - Games. - Varied.

- *Not everyone responds to different types of training the same way. Why?*

Genetic	Environment
<ul style="list-style-type: none"> - Somatotype. - Lung Capacity. - Flexibility. - Conceptual ability. - Gender. - Age. - Muscle fibre composition. 	<ul style="list-style-type: none"> - Facilities / location. - Coaching / assistance. - Family. - Social environment. - Socioeconomic status. - Personality / attitude. - Opportunities. - Sporting culture. - Climate. - Motivation / goals.

- **Strength training:**
 - *Goal:*
 - Increase force exerted by a muscle group.
 - Shorten time taken for muscle to contract.
 - Increase fitness components.
 - Increase performance.
 - Increase strength of contraction.
 - Look good.
 - Lose weight / general health.
 - Rehabilitation.
 - *Different forms:*
 - Resistance (weights).
 - Plyometrics.
 - Callisthenics.
 - * **Type chosen depends on;**
 - Equipment.
 - Cost.
 - Location.
 - Components requiring development.
 - **For strength training program to be most effective:**
 - Must be exercise specific.
 - Employs overload principle.
 - Uses progressive resistance.

- Types of resistance training:
 - Isotonic:
 - Muscle length changes.
 - Isometric (1950s):
 - Muscle length remains the same.
 - Isokinetic (last 20yrs):
 - Muscle shortens & lengthens with constant resistance.
- *Overload*:
 - Applications to resistance training:
 - Increase reps.
 - Increase sets.
 - Increase load.
 - Increase frequency.
 - Decrease rests.
 - Alter speed.

Not recommended
for dynamic sports

Maximum strength
gains

Overload Technique	Method
<i>Blitzing</i>	Bombarding specific muscle group with a range of exercises until muscle group completely fatigued. Variety of exercises.
<i>Cheating</i>	Advanced weight trainers. Assistance from other muscles to lift weight through sticking point.
<i>Pyramiding</i>	Resistance increased with each set until peak is reached. Number of reps decreased. Muscle worked to fatigue.
<i>Reverse pyramiding</i>	Resistance progressively decreased. Muscle worked to fatigue.
<i>Forced repetitions</i>	Spotter used to assist in lifting heavy weight through sticking point. Muscle worked through full range.
<i>Super sets</i>	2+ exercises applied to muscle group without rest in between.
<i>Negative repetitions</i>	Advanced weight training. Spotters help to control heavy weight as it is lowered. Strengthen eccentric contraction.

- **Guidelines for resistance training:**

- For Strength:

- Allow 48hrs for muscle repair.
- No weight >80% 1-RM.
- 3-6 sets.
- <6 reps.
- 3-4 exercises for each body part.
- Variety of exercises.
- >3 minutes rest.

- Lean Body Mass:

- Moderate weight (70% 1-RM).
- High reps (8-15).
- 4-5 sets.
- Isolation exercises.
- Advanced overload techniques.
- Work each muscle group @ different angles.
- Slow pace.

- For endurance:

- Light / moderate load.
- High reps (>15).
- 3-5 sets.
- Rest 20-60 seconds.
- Monitor h.r.

- Power & Speed:

- Develop anaerobic system.
- Pressure on ATP-PC / lactic acid systems.
- Heavy load (70 – 90% 1-RM).
- 6-12 reps.
- 3-6 sets.
- Fast / explosive.
- 3-5 minutes.

* Longer recovery = greater speed produced.

- **Plyometrics:**
 - Type of exercise which muscle is lengthened using eccentric contraction, rapidly followed by concentric contraction.
 - Convert strength gains to power.
 - Develops elastic recoil → more force produced.
 - Anaerobic sports (power & speed).
 - Develop stronger contraction.

 - eg. Hopping, bounding, jumping, medicine ball.

- **Anaerobic Training for Endurance (non-resistance):**
 - Places demand on oxygen supply to muscles.
 - Effects:
 - Hypertrophy (more ATP/PC stores).
 - Decreased resting heart rate.
 - Increased r.b.c. count (more haemoglobin).
 - Increased stroke volume.
 - Increased O₂ uptake.
 - Store more fuel.
 - Use fat more.

 - * Must follow F.I.T.T. principle.
 - * Must pre-screen.

- **Resistance Training for Endurance:**
 - Recruits use of slow twitch fibres.
 - Effects:
 - Increased mitochondria.
 - Increased capillaries → more blood delivered & removed.
 - Improved enzyme activity.

Area	Effect	How This Improves Training
<i>Fuel storage & utilisation</i>	Increased haemoglobin.	More O ₂ carried to working muscles.
	Increased myoglobin.	More O ₂ delivered from cell membrane to mitochondria.
	Increased ability to use fats.	Reserve fuel used earlier in endurance event.
	Increased storage of ATP & CP.	Immediate fuel storage increased by up to 25%.
	Increased glycogen storage.	Fuel for lactic acid & aerobic system increased.
	Increased ability to use glucose.	Increased enzyme activity enable faster breakdown of glycogen.
<i>O₂ transport system @ rest</i>	Increased heart size.	Particularly in size of left ventricle, more blood available.
	Decreased H.R.	Sign of increased heart efficiency, supplies blood with less b.p.m.
	Increased S.V.	More blood available per stroke (beat).
	Increased C.O.	More blood available to tissues.
<i>O₂ transport system @ maximal exercise</i>	Increased O ₂ uptake.	Increased ability of muscles to extract & utilise O ₂ delivered in the blood.
	Increased C.O.	More blood available to tissues.
	Increased S.V.	More blood available per stroke.
<i>Respiration</i>	Increased efficiency.	More O ₂ extracted from air to alveoli & delivered to muscles.
<i>Other</i>	Hypertrophy.	More strength produced.
	Decreased body fat.	Less excess to carry in endurance events.
	Increased strength & power.	Faster, stronger contractions.
	Increased muscle elasticity.	Increased power, less likelihood if injury.
	Increased mitochondria.	More sites for fuel to be burnt.

- **Flexibility Training:**
 - Increasing range of movement of a joint or body part.
 - Static.
 - Ballistic.
 - PNF.

 - Combination is most effective.

 - Increase length of muscles, ligaments & tendons.
 - Range of movement about a joint.
 - Genetic.
 - 2-5x per week.
 - 15-30 minutes per session.
 - Hold 10-30 seconds.
 - 2-3 reps.
 - Balance (left – right).
 - Increased range of movement by 10% each rep.

 - Stretch reflex (controlled by CNS) aids in preventing from over stretching.
 - Slow, controlled stretch is best.

- **Contra-indicated Exercises:**
 - Potential to cause harm.
 - Not recommended for amateurs.
 - Hyperextension.
 - Excessive twisting.
 - Joint impingement.
 - Compression of a joint.
 - Pinched nerves.
 - Disc compression.
 - Overstretched ligaments.
 - Squeezed arteries.
 - Lower back strain.

- **Skill & Improvement:**

- Should be related to sport.
- Stage of learning should be accounted for.
- Age.
- Gender.
- Number of people.
- Equipment.
- Motivation level.
- Individual skill development.
- Minor games.
- Phase practice.
- Functional practice.
 - Position specific.
- Small games.

*Use clear, concise, accurate demonstrations.

*Provide accurate, frequent, appropriate feedback.

*Analyse & correct technique & performance.

*Incorrect feedback should be corrected.

- **Types of practice methods:**

- Massed vs. Distributed.

- *Massed best for:*

- Elite athletes.
- Motivated players.
- Older athletes / performers.

- *Distributed best for:*

- Children.
- Low motivation.
- Low competition.
- Beginners.

*Generally use a combination of both.

- Part vs. Whole.

- *Part best for:*
 - Beginners (cognitive stage).
 - Complex skills.
- *Whole best for:*
 - Experienced performers.
 - Fast skills.
 - Simple skills.

*Best when using a combination.

- Mental vs. Physical.

- * Physical should be done before mental.
- *Mental best for:*
 - Advanced performers.
 - Older performers.
- *Physical best for:*
 - Children.
- * Variety of practice drills → motivation.

- How does competition affect performance?

Planning

Organisation

Commitment

- **Phases of competition:**

- Post season (transition) (off-season).
- Pre season (preparation).
- In season (competition).

*Subtle & important differences in training (& resulting performances) exist in each stage.

- *Post season aims to:*

- 1 week complete rest.
- Remaining active rest.
- Prevent weight gains.
 - Diet modifications due to decreased work load.
- Maintain aerobic fitness (aerobic training).
- Improve / maintain strength.
- Maintain skill level.
- Rehab, repair, operations.
 - Physically & mentally.
- Develop weaknesses.
- Change in environment: cross training.

- *Pre season (8-12 weeks prior to competition) aims to:*

- High training volume, moderate intensity.
 - Long training sessions.
- Target appropriate energy system/s.
- General fitness components.
- Specific components.
- Increase intensity of work.
- Sport specific skill training.
- May continue resistance training.
- Variety (non related activities).

- *In season aims to:*
 - Maintain fitness, strength & skills.
 - Game-like skills & strategies (away from drills).
 - Develop tactics, strategies.
 - Introduce opposition.
 - Always increasing training volume & intensity.
 - Develop reserves, subs & lower level players.

- Planning the training year:
 - **Peaking:**
 - Phase of training where optimal performance is reached to meet demands of competition.
 - *eg.* Reaching optimal performance for finals.
 - State of excellent health.
 - Heightened recovery rate from training.
 - Body systems operating at optimum.
 - Technical adjustments completed.
 - Superior neuromuscular coordination.
 - High self confidence & esteem.
 - Mentally strong.
 - Mentally alert.
 - **Tapering:**
 - Period of reduced training prior to competition.
 - Guidelines:
 - Individual sport / lasting <1 hour = 1 week.
 - Team sport / >1 hour = +1 week.
 - **Dietary considerations:**
 - *Pre-game meal:*
 - 3 to 4 hours prior to event (large meal).
 - 1 to 2 hours prior to event (small snack).
 - Complex CHOs.
 - Avoid high fat & protein.
 - Avoid high amounts of simple sugars.
 - Adequate hydration up to ½ an hour prior to event.
 - Liquid meals good substitute for solid foods.
 - Stick to usual diet, new foods may cause upset.
 - *During competition:*
 - May require CHO supplementation during event, prevent glycogen depletion, hypoglycaemia.
 - Liquid glucose.
 - Regular fluid intake, drink before thirst.

- *Post performance:*
 - Replace glycogen stores.
 - 1g CHO for every Kg body weight every 20mins for an hr.
 - Small amount of protein.
 - Replace 150% fluid loss.
- *Dietary supplements:*
 - Vitamins & minerals most popular.
 - No dramatic performance enhancements.
 - Provide platform for optimal performance.
 - An attempt to balance diet.

Suggested Fluid Intake Before, During & Following Competition			
Before	During	What To Drink	Following
- At least 500mL 30mins prior to competition.	- 250mL every 15mins. - Don't wait to get thirsty. - Drink more in hot weather. - Replace 80% fluid loss while still exercising.	- Water if event lasts <1hr. - Diluted CHO/electrolyte drink if event lasts >1hr. - No higher than 8% CHO solution. - Non-carbonated. - Cold fluid; empties faster. - No alcohol/caffeine. - Good taste.	- Use water followed by CHO drinks. - Replenish regularly. - Body weight returns to normal. - Replace 80% while still exercising.

- **Training programs & the training session:**

- The training session:
- Overview.
- Warm up.
- Skill instruction.
- Skill practice.
- Conditioning.
- Warm down.
- Evaluation.

Element	Activities	Benefits
<i>Overview</i>	<ul style="list-style-type: none"> - Provide overview of session. - What is expected. - Discussion of performance, injuries, suggestions. 	<ul style="list-style-type: none"> - Ensures intensions of coach & expectations. - Gathering players where issues can be addressed.
<i>Warm up</i>	<ul style="list-style-type: none"> - Gross motor skills. - Stretching. - Callisthenics. - Skill rehearsal. 	<ul style="list-style-type: none"> - Physically & mentally prepare for exercise. - Lower risk of injury.
<i>Skill instruction</i>	<ul style="list-style-type: none"> - Delivery of knowledge by coach. - Guidelines on how to perform skill. - Practice in drills. - Instruction on other aspects. - Effective: <ul style="list-style-type: none"> - Brief. - Well timed. - Specific. - Constructive. - Clear. - Informative. - Demonstratable. 	<ul style="list-style-type: none"> - Correct technical errors. - Teach correct technique.
<i>Skill practice</i>	<ul style="list-style-type: none"> - Target fundamentals. - Individual needs. - Gradual increase pressure. - Skills, drills, routines, movements. 	<ul style="list-style-type: none"> - Develop fundamental skills. - Develop cognitive abilities. - Develop temporal patterning,
<i>Conditioning</i>	<ul style="list-style-type: none"> - Fitness training skills. - Types of aerobic training. - Regular testing. 	<ul style="list-style-type: none"> - Develop fitness components. - Allows player to perform longer.
<i>Warm down</i>	<ul style="list-style-type: none"> - Gross motor skills. - Stretching. 	<ul style="list-style-type: none"> - Remove lactate. - Prevent venous pooling.
<i>Evaluation</i>	<ul style="list-style-type: none"> - Performance appraisal. - Feedback for players & coaches. - Prep. for future. 	<ul style="list-style-type: none"> - Receive feedback.

- **The training program:**
 - Training programs sometimes constructed over 1 year in advance.
 - *Macro cycles:*
 - Long training periods (approx. 4 weeks).
 - *Micro cycles:*
 - Short training periods (approx 7 days).
 - *Periodisation:*
 - Division of training cycles into cycles.
 - *Optimising performance:*
 - Peaking at intended time.
 - Appropriate training loads & recovery.
 - Individualised training.
 - Develop training program around data & performance.
 - Set goals.
 - Frequent testing.
 - Gather statistics.
 - Psychological techniques.
 - Equipment needs.
 - Positive interaction between team members.

- **Environmental Considerations.**

- Climate.
- Pollution.
- Altitude.
 - Acclimatisation:
 - Adapting to the environment.

- **Altitude:**

- As altitude increases barometric air pressure decreases; air less dense.
- Affects performance when >1500m.
- Mainly affects aerobic performance.
- Little to no effect on anaerobic performance.
- Hypoxia: lack of O₂.
- Atmospheric pressure decreases, lower O₂ uptake.

- Lower humidity.
 - Greater ability to thermoregulate.
- Air temp⁰C lower.

- Advantages:
 - Athletes train @ high altitude to increase aerobic capacity.
- Disadvantages:
 - Changes gradual, last for 2 weeks.

- Immediate responses:
 - Respiration rates increase.
 - Ventilation rate increases.
 - Hyperventilation (about 1 week).
 - C.O. levels increase.
 - H.R. increases.
- Physiological adaptations:
 - R.B.C. increases (erythropoietin).
 - Re-establish acid/base balance in body fluids.
 - Muscle tissues adapt to use O₂ more efficiently.

- Acclimatisation:
 - Phase 1:
 - Increase in lung ventilation (deeper breathing).
 - Phase 2:
 - Erythropoietin production due to lower partial pressure.
 - Phase 3:
 - Capillarisation.
- Elevation >2700m = 7-10 days acclimatisation.
 - Altitude sickness occurs above this height.
- Elevation >4000m = 21 days acclimatisation.

- **Psychological preparation.**
 - Prepare athlete's mind for competition.
 - Sports psychologists:
 - Overcome competition pressures.
 - Improve performance.
 - Psychological assistance.
 - Educate players & coaches.
 - Set goals.
 - Mental rehearsal.
 - Concentration / focus.
 - Stress management.
 - Arousal control.
 - Motivational speakers may also be used.

 - Techniques:
 - Progressive muscular relaxation.
 - Mental rehearsal.
 - Centred breathing.
 - Floatation.
 - Meditation.
 - Sports massage.

- **Overtraining.**
 - Chronic psychological & physiological condition caused by training loads too demanding for athlete to manage.

 - *Result of:*
 - Poor planning of training program.
 - High dedication level.
 - Lack of variety can lead to overtraining, causing burnout.
 - High intensity / high volume of training when athlete is fatigued.
 - Requires longer regeneration & refreshment period.
 - Balance work & recovery times.
 - Testing errors.

 - *Characteristics:*
 - Lack of motivation.
 - Poor performance.
 - Increasing R.H.R.
 - Higher blood lactate levels.
 - Lower drive & motivation.

- *Physiological considerations:*
 - Environmental stress.
 - Lack of sleep.
 - Poor nutrition.
 - Excessive training volume & intensity.

 - Insomnia.
 - Decreased appetite.
 - Loss of muscle strength & coordination.
 - Elevated R.H.R.
 - Colds, allergic reactions.
 - Susceptible to infection.

- *Psychological considerations.*
 - Pressure to perform.
 - Psyching up too frequently.
 - Boredom.
 - Fear.
 - Lack of self confidence.
 - Anxiety.
 - Lack of encouragement.

 - Reduction or cessation of training.
 - Active rest.
 - Change in environment.
 - Change in routine.
 - Mini breaks.
 - Reduction in pressure.

*To avoid overtraining; tailor training program to individual's ability to tolerate stress.

- **Technology.**
 - Used to develop better technique & analysis of technique.
 - Video analysis.
 - Create better resistance (plyometrics, isokinetic training).
 - Clothing.
 - Improves performance.
 - Provides an edge over other performers.

Training innovations:

<i>Cycling</i>	<ul style="list-style-type: none"> - Streamlined helmets. - Lycra suits. - Carbon fibre wheels. - Carbon fibre frames.
<i>Recording data</i>	<ul style="list-style-type: none"> - Database software. - Statistical computerised data analysis.
<i>Training techniques (players & coaches)</i>	<ul style="list-style-type: none"> - Equipment. - Activities. - Methods.
<i>Clothing & protective equipment</i>	<ul style="list-style-type: none"> - Shark suits (swimming). - Headgear (football). - Fire retardant suits (motor racing).
<i>Performance analysis</i>	<ul style="list-style-type: none"> - Slow motion digital video cameras. <ul style="list-style-type: none"> - Improve technique. - Improve visualisation. - Biomechanical efficiency. - Develop / analyse strategies.
<i>Testing</i>	
<i>Computer software</i>	<ul style="list-style-type: none"> - Recording equipment. - Testing methods. - Data interpretation.
<i>Internet</i>	
<i>Nutrition</i>	<ul style="list-style-type: none"> - Databases. - Sharing of resources.
<i>H.R. monitors</i>	<ul style="list-style-type: none"> - Hydration. - Eating.
<i>Rehab</i>	<ul style="list-style-type: none"> - Monitor performance. - Return to play faster. - Reduces risk of re-injury. - Return to sport.

- **Gender differences.**
 - Little physiological differences occur between males & females below 9 years of age.
 - Females (after puberty):
 - Weaker.
 - Shorter.
 - More fatty tissue.
 - Less muscle.
 - Modifications **MAY** have to be made between genders in training programs.
- **Age considerations.**
 - Juniors (pre-puberty):
 - Monitor intensity.
 - Short attention span.
 - Hydration.
 - Frequent breaks.
 - Modified games, equipment.
 - Interchange.
 - Match size & skill.
 - Aged (+35y.o.):
 - Medical checkups.
 - Fitness testing.
 - Low intensity, smaller loads.
 - Increase flexibility training (*eg.* Water sessions).
 - Diet (balanced, Ca.)
 - High impact activities (walking, running).
 - Monitor Hb levels.