

Dr. Prabhakar Pandey

Principles of exercise

Objective

- Knowledge about exercise training
- Basics of exercise training principles
- Clinical application of principles

Exercise training

- Exercise is the systematic, planned performance of bodily movements, postures or physical activities intended to provide a means to:-
 - Remediate or prevent impairments
 - Improve, restore or enhance physical function
 - Prevent or reduce health related risk factors
 - Optimize overall health status, fitness or sense of well being
- Training is a systematic process in which athletes improve their fitness to meet the demands of their sport/activity

Principles of training

Principles of training

- I-Individuality
- S-Specificity
- P- Periodization
- O-Overload
- R-Reversibility

Individuality training

- All are not created with same capacity to adapt to exercise
- Many factors contribute to individual variation
- Variations occur in cellular , metabolic , neural , endocrine, genetic level and previous training
- Appropriate physiologic measurements and performance test evaluate the capacity of energy transfer system

- Stair sprint test measure power capacity , maximum oxygen consumption measures long term energy system
- Any training program must take special need and abilities of patient into consideration
- Lance Edward Armstrong



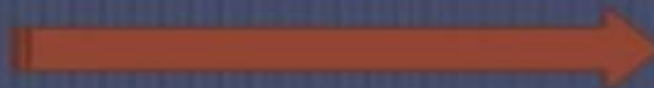
Specificity training

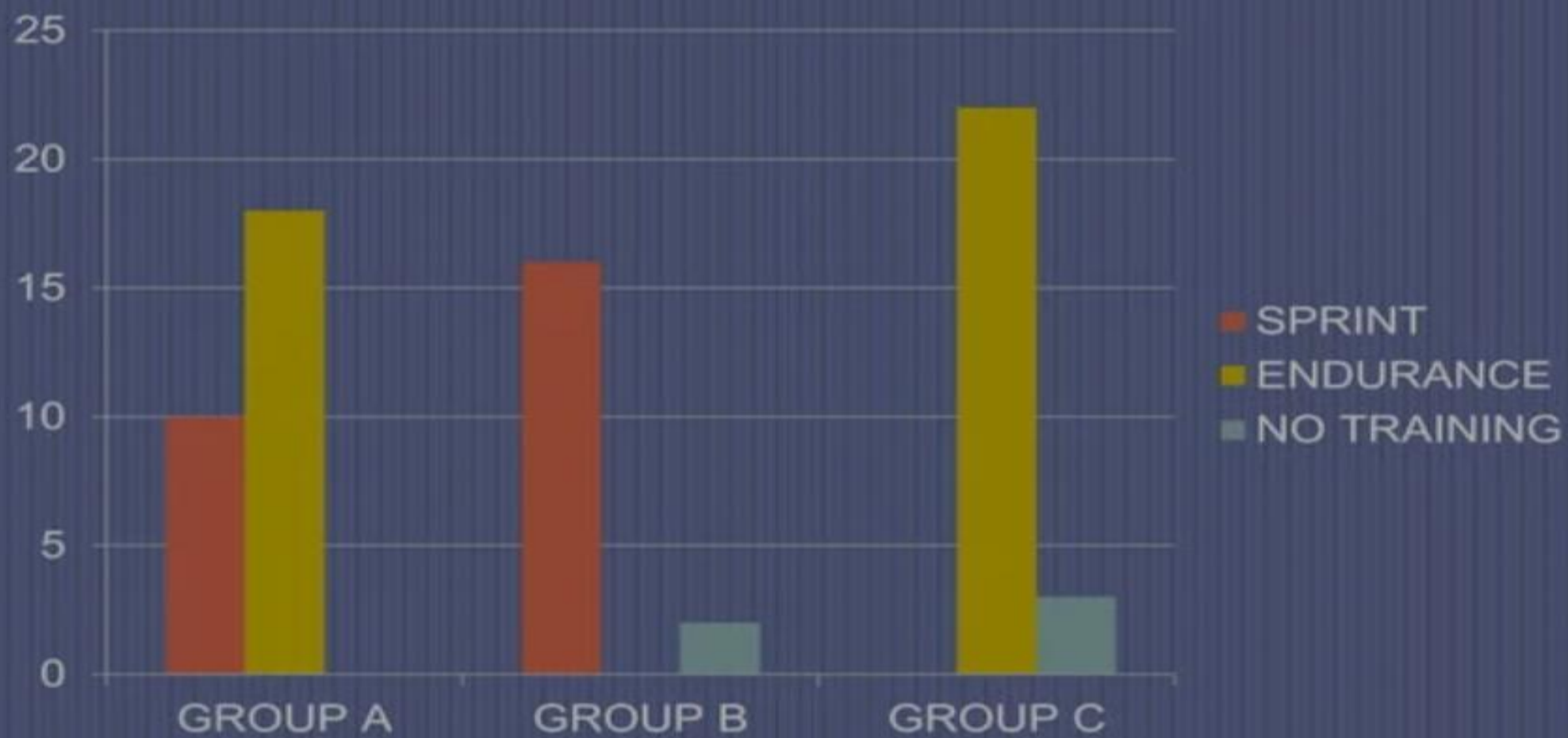
- Specific adaptation to imposed demands (SAID) principle
- Exercise training should be specific to particular sports/activity
- Physiologic adaptation depend on nature of training imposed
- Specific training \longrightarrow specific adaptation \longrightarrow specific effect

For example, if you're training for a weightlifting competition, it's no use going swimming every day



You need to concentrate on strength training for your arms and legs

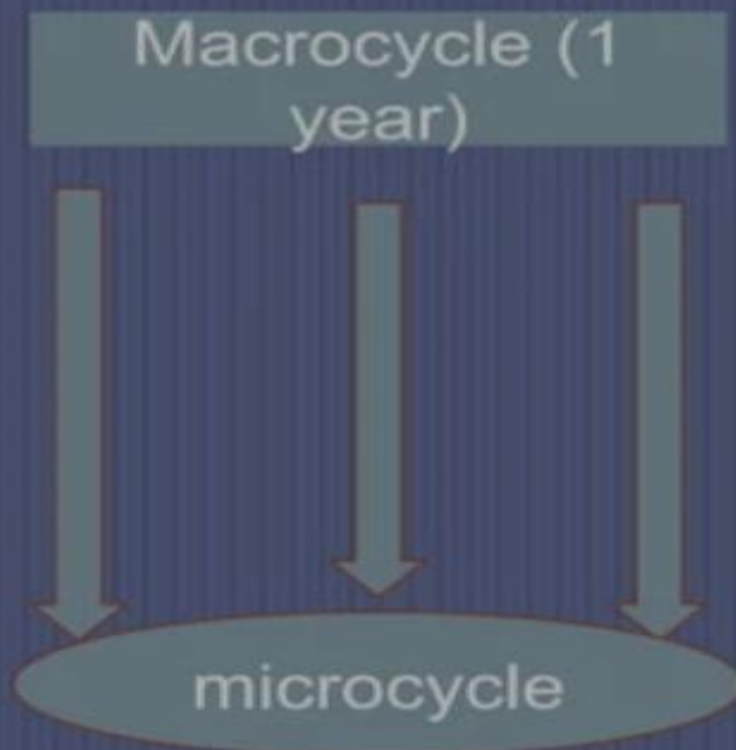


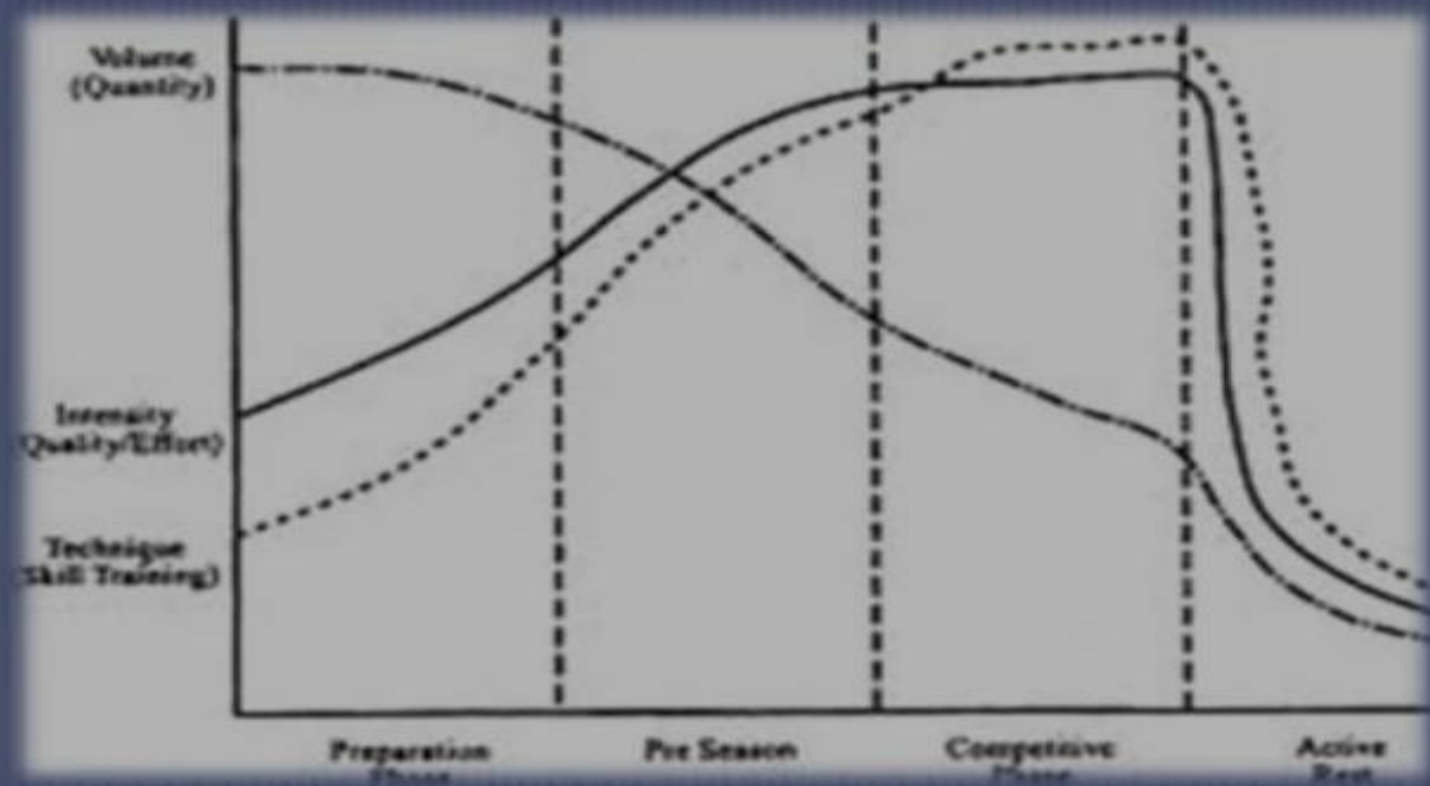


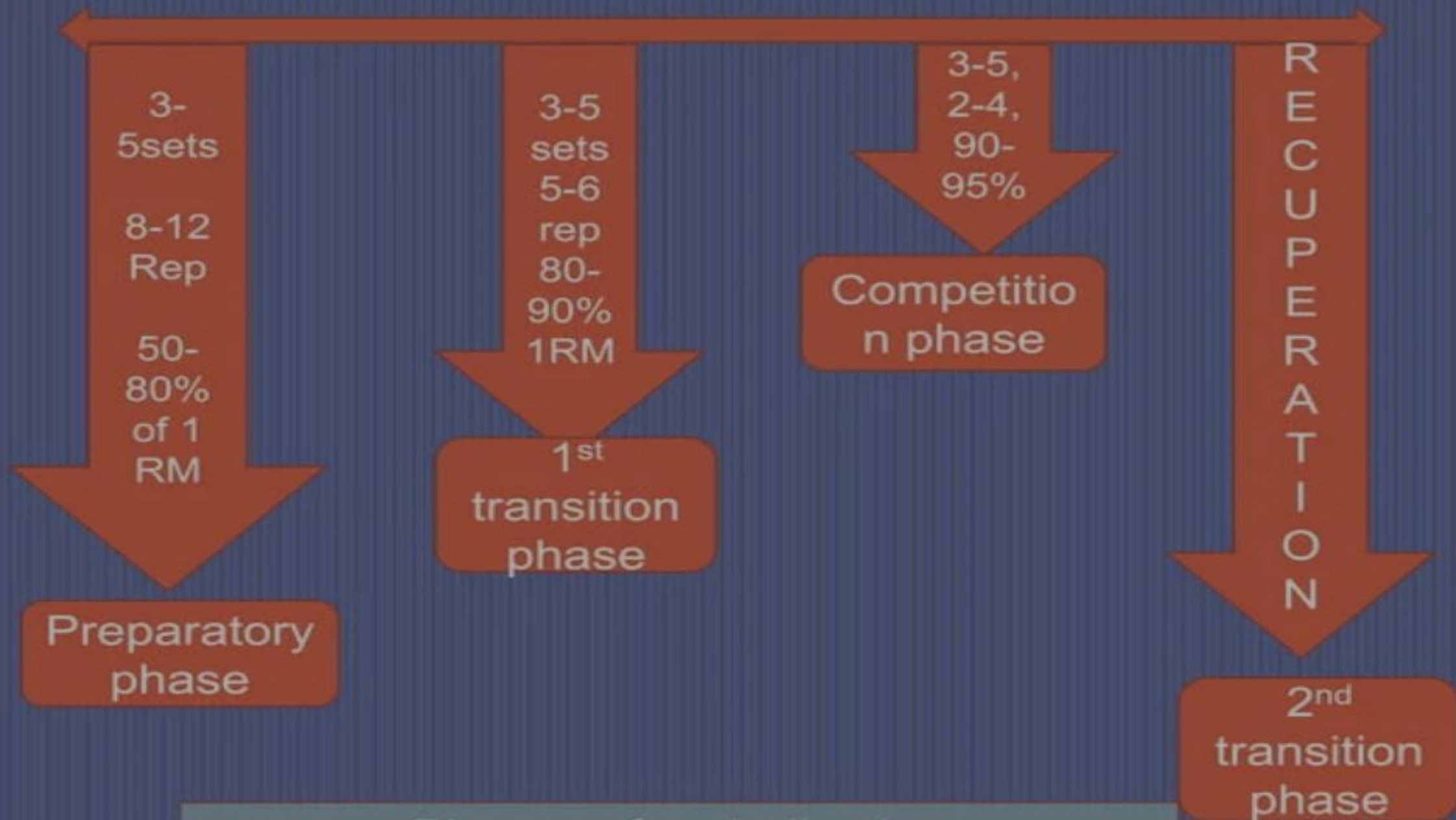
Periodization

- Introduced in 1972 by Russian scientist Leonid Matveyer
- Vary intensity and volume to ensure peak performance

Progressively decrease training volume and increase intensity







Phases of periodization

- The Linear Model is characterized by high initial training volume and low intensity. As training progresses, volume decreases and intensity increases in order to maximize strength, power, or both
- The Undulating (Non-Linear) Model enables variation in intensity and volume within each 7-10 day cycle by rotating different protocols to train various components of the neuromuscular system (e.g. strength, power, local muscular endurance).

- Periodization reduce overtraining and staleness effect so athlete achieve peak performance at competition
- It produces greater improvement in muscular strength and body mass
- Incorporated in training regimens of novice and champion athlete involved in long term resistance training

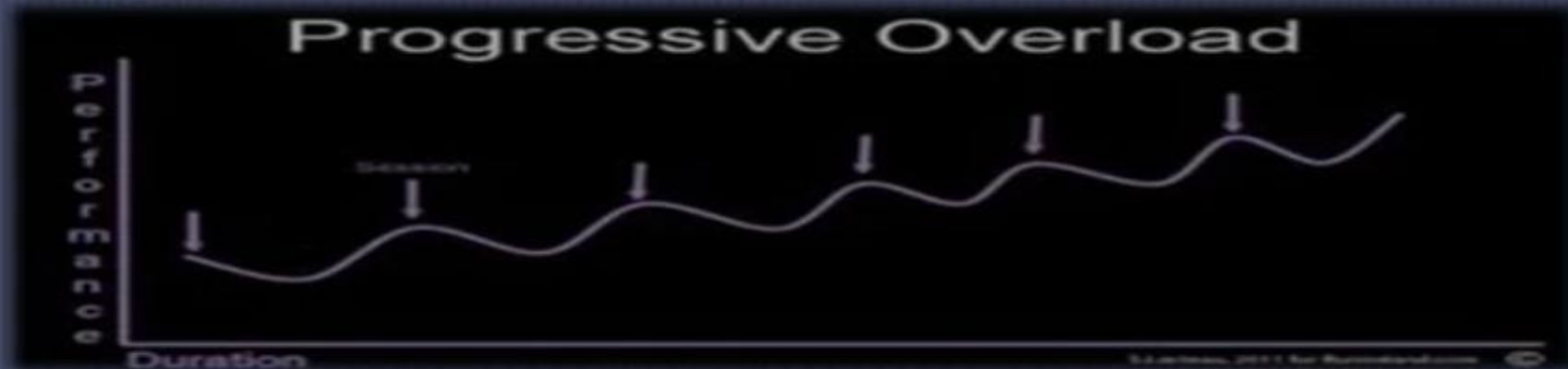
Overload training/ Progressive overload

- Fitness can only be improved by training more than you normally do
- Overload include manipulation of: frequency , intensity, duration, exercise mode.
- Eg; to gain strength muscle must overload beyond the point they are normally loaded
- This is also termed as progressive resistance training

Progression

Progression means gradually increasing the amount of exercise you do

- increasing the frequency, intensity and duration of fitness sessions ,important factor for effective performance
- In terms of type of training, progression should be based on the principle of moving from easy activities to difficult ones



- There are four ways to achieve overload in an exercise programme. They can easily be remembered using the mnemonic, FITT.
 - Frequency – how often you train
 - Intensity – how hard you train.
 - Time – how long you train for.
 - Type – the kind of training you do



FITT: frequency

- The National Institute for Health and Clinical Excellence suggests that to maintain health, you should do 30 minutes of moderate exercise 5 times a week.
- However, if you wish to become an intermediate or elite competitor in any sport, you will need to train much more frequently!
- Elite rowers often train twice a day!



FITT: intensity – energy systems

- Aerobic respiration – means respiration 'with oxygen'. When exercise is not too fast and at a constant, steady rate, heart can keep the muscles fully supplied with oxygen.





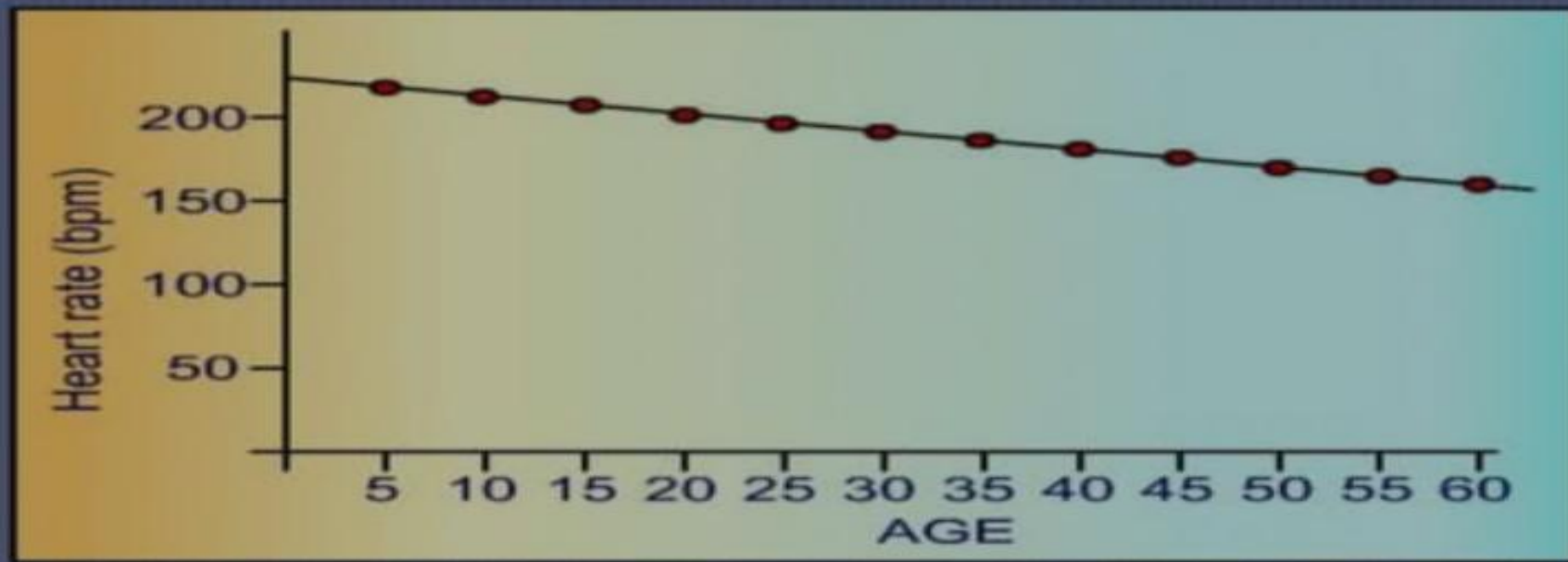
- Anaerobic respiration – means respiration ‘without oxygen’. If the exercise is fast or intense and done in short bursts, the heart cannot supply oxygen to the muscles as fast as the cells are using it

A good way to measure intensity is to monitor a performer’s heart rate. The harder you work, the faster your heart beats

Heart rate can indicate which energy system is being used

- Order to train the correct energy system, you need to calculate your maximum heart rate (MHR).

maximum heart rate = $220 - \text{age}$



- If a performer wishes to train their aerobic system, they should train at between 60% and 80% of their maximum.
- If a performer wishes to train their anaerobic system, they should train at between 80% and 90% of their maximum.

- Karvonen equation.
- First, calculate the MHR. Women subtract their age from 220 and men subtract one-half their age from 205.
- The second step is to determine the resting heart rate (RHR).
- Third, calculate the HRR. The HRR is MHR minus RHR. Lastly, the THR is the product of training intensity (TI), generally 60% to 80%, multiplied by the HRR then adding the RHR

$$\text{THR} = (\text{MHR} - \text{RHR}) \times \% \text{TI} + \text{RHR}$$

- For example, what is the THR for a 40 year old male with a RHR of 60 who is to exercise between 70% and 80% TI?
- His MHR is 205 minus 40 divided by 2, which equates to 185 beats per minute (BPM). Thus his HRR is 185 (MHR) minus 60 (RHR) which is 125BPM
- Seventy percent TI equals 0.7 (TI) multiplied by 125 (HRR) plus 60 (RHR).
- This figure calculates to 147.5 BPM. Eighty percent TI when calculated using the same formula yields 160 BPM. Thus this individual would have a THR ranging from 148 to 160 BPM.

Training zones

- 80% to 90% of MHR – Training in the anaerobic zone increases strength and power.
 - As you approach 90% of the performer's maximum heart rate, training time will have to get shorter and it will take more time for the performer to recover.
 - This is because anaerobic exercise produces lactic acid, which builds up in the muscles. When there is too much lactic acid, the performer must stop.

- 60% to 80% of MHR – Training between these levels will improve a performer's stamina (or aerobic fitness) levels.
- Lactic acid is not produced during aerobic exercise. Performers can train aerobically for much longer periods.

Time

- To achieve improvements in aerobic fitness, you should aim to spend at least 20 minutes per session in the target zone
- However, time will vary greatly depending on the activity the performer is training for.
- If they are training for a marathon, they may need to spend several hours at a time in the aerobic zone.
- A sprinter, on the other hand, will need to spend relatively little time actually exercising – their sessions are likely to consist of many short, high intensity bursts with lengthy rests in-between

Type

- If you are training for a specific event or competition, then the type of exercise you do is very important.
- Overload can be achieved by changing the type of exercise – for example, you could lift the same weight but in a different way and using different muscles



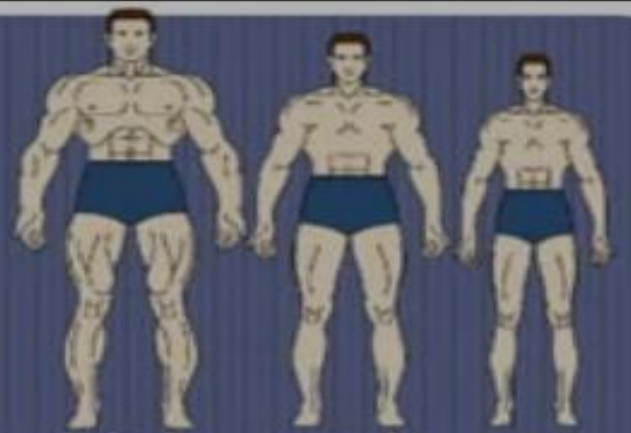
ACSM guidelines

variables	level
frequency	3-5 days per week
intensity	65 -90% max heart rate
duration	20-60 min
resistance training	Set of 8-12 ex under 50 years over 50 years- 10-15 or volitional fatigue
Flexibility training (stretches)	Static-10-30 sec, 4 repetitions , 2-3 times a week

Recommendations

Centre for disease control & prevention	30 min or more , short bout, all days a week
American heart association	Freq-3-4/week, 50% vo2 max, 30-60 min
American medical association guidelines for adolescent preventive service	Freq-3/week, 20-30 mins

Reversibility training



- Unfortunately, most of the adaptations which result from training are reversible
- Fitness will be lost if the training load is reduced (meaning overload is not achieved) or if a performer stops training, for example, if they are injured.
- We need to ensure that long periods of inactivity are avoided when possible

- Loss of physiologic and performance training adaptation occur rapidly when person terminates participation in regular exercise
- 1-2 week detraining decrease metabolic and exercise capacity
- Short term detraining time (<3 weeks) , long term detraining time (3-12 weeks)
- In elderly 4 months detraining cause complete loss of endurance

- Endurance can be lost in a third of the time it took to achieve! Strength declines more slowly, but lack of exercise will still cause muscles to wither (atrophy).
- Highly trained athlete remain transient and reversible
- Begin reconditioning prior to competitive session to maintain moderate level of exercise

SUMMARY

Definition

Principles of training with application

- Individuality

- Specificity

- Periodization

- Overload

- Reversibility



Thankyou

