Concepts, methods and periodization in endurance training

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Specificity in training adaptation (bio motor ability)

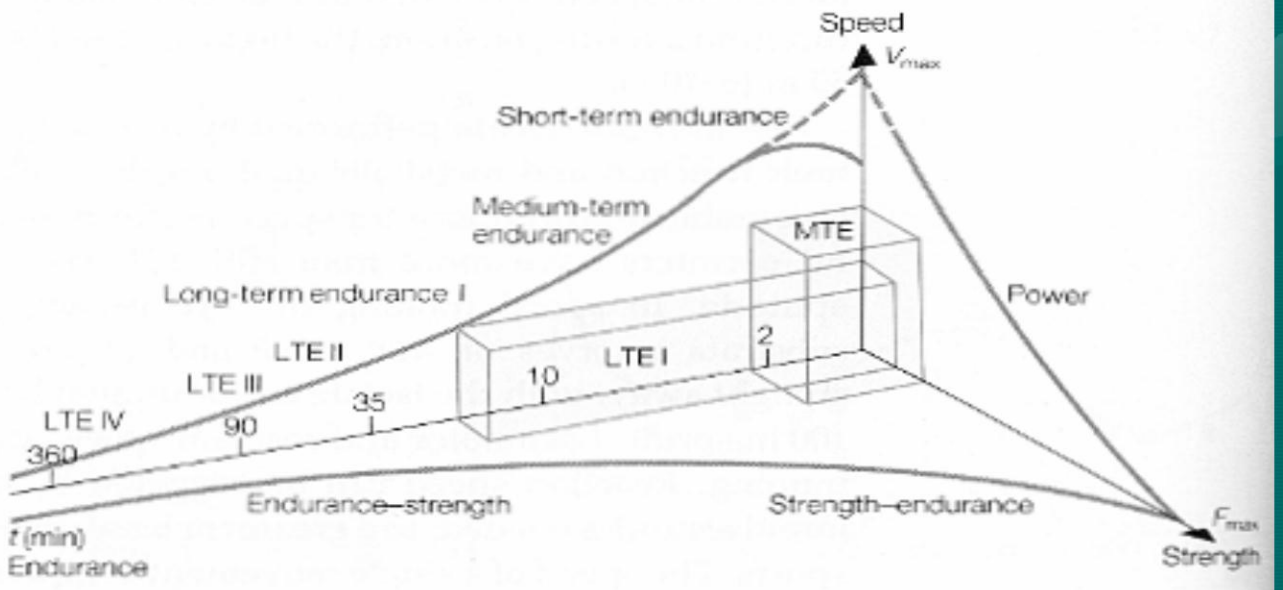
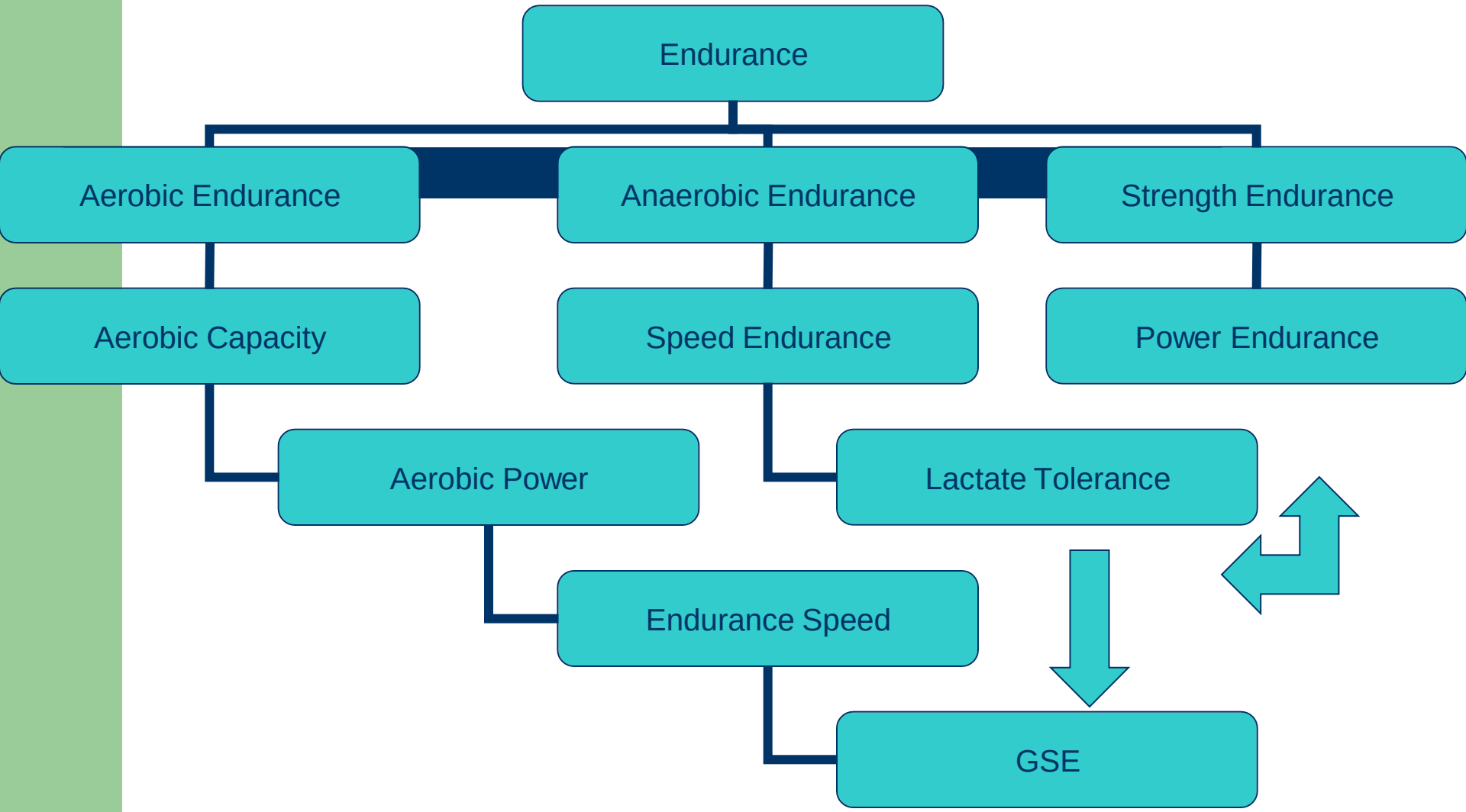
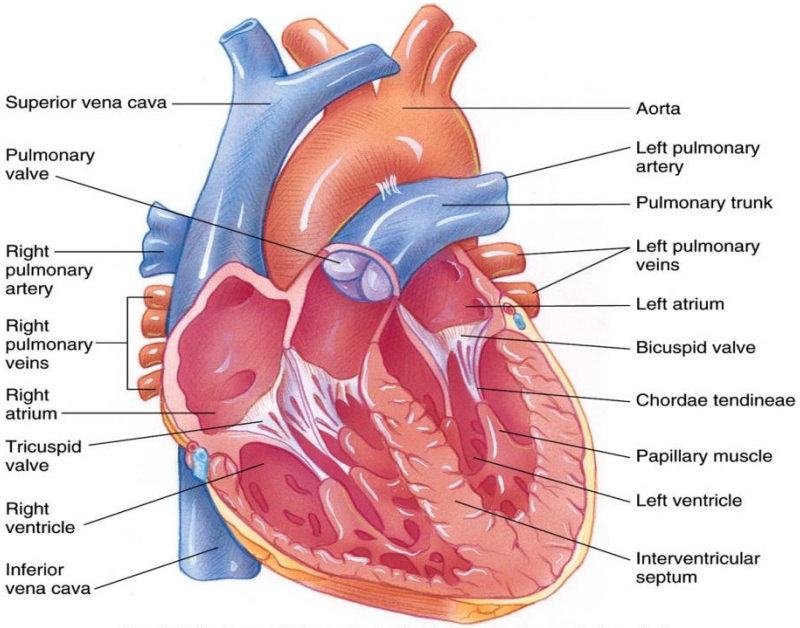


Fig. 3.2.2 Model of the relationships between endurance, strength and speed.

Different Concepts In Endurance



Cardiovascular Adaptation to Endurance Training

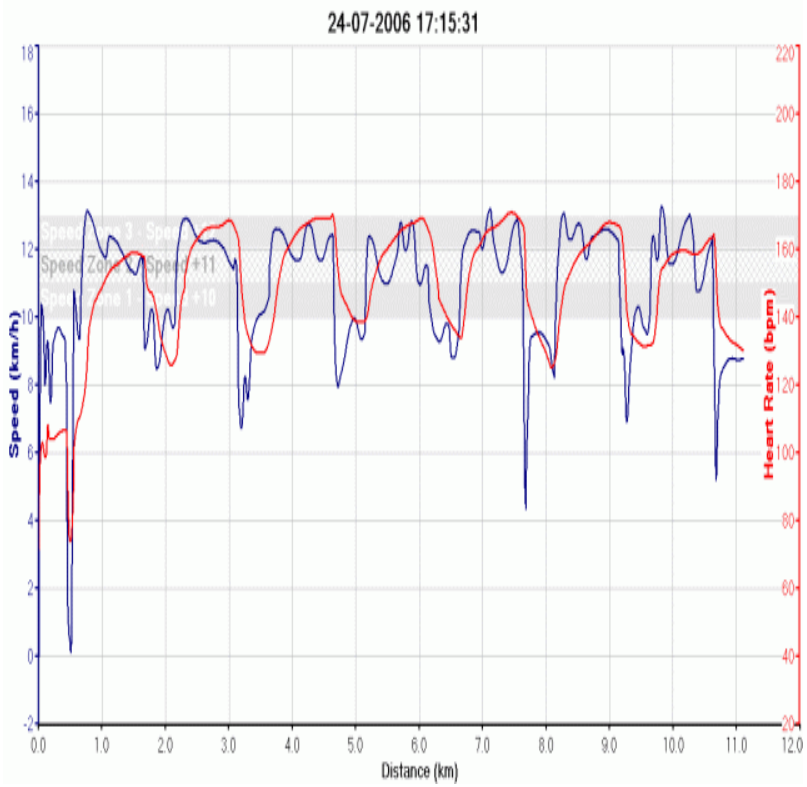


- Heart Size
- Stroke Volume
- Heart Rate
- Cardiac Output
- Blood Flow
- Blood Pressure
- Blood Volume

Respiratory Adaptation To Endurance Training

- Lung Volume
- Respiratory Rate
- Pulmonary Ventilation
- Pulmonary Diffusion
- Oxygen Extraction

Metabolic Adaptation To Endurance Training



- Muscle Fiber Type
- Muscle Fiber Size
- Myoglobin Content
- Mitochondria Function
- Oxidative Enzymes
- Non Oxidative Enzymes
- Lactate Threshold
- Lipid Metabolism
- Oxygen Consumption
- Aerobic System Efficiency

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Types of Aerobic Endurance Training

Type	Frequency (per week)	Duration (per session)	Intensity
Long, slow distance	1-2	Race distance or longer (or 30-120 min)	~70% VO2 max
Pace/tempo	1-2	20-30 min	At lactate threshold or slightly above race pace
Interval	1-2	3-5 min interval (work:rest ratio of 1:1)	Near VO2 max
Repetition	1	30-90 sec interval (work:rest ratio of 1:5)	Greater than VO2 max
Fartlek	1	20-60 min	Variable: ~70% VO2 max with bouts at or above lactate threshold

Adapted from Essentials of Strength Training & Conditioning (2000) (8)

Practical Methods Of Endurance Training

- Long-distance training
- Low intensity aerobic training
- Long slow distance
- Long easy distance
- HR=130-150
- Lactate=2-3.5

Practical Methods Of Endurance Training

- Long solid distance training
- A –constant effort work(HR constant)
- B-constant speed work (speed constant)
- HRR=60-75%

Practical Methods Of Endurance Training

- Long medium intensity training
- Anaerobic threshold training
- HRR=75-85%
- Lactate=3-6mmol

Practical Methods Of Endurance Training

- Long high intensity training
- vVO2max training
- HRR=85-95

Practical Methods Of Endurance Training

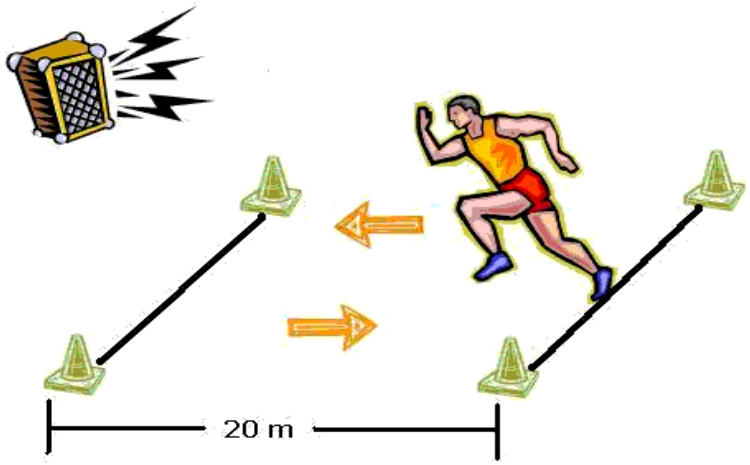


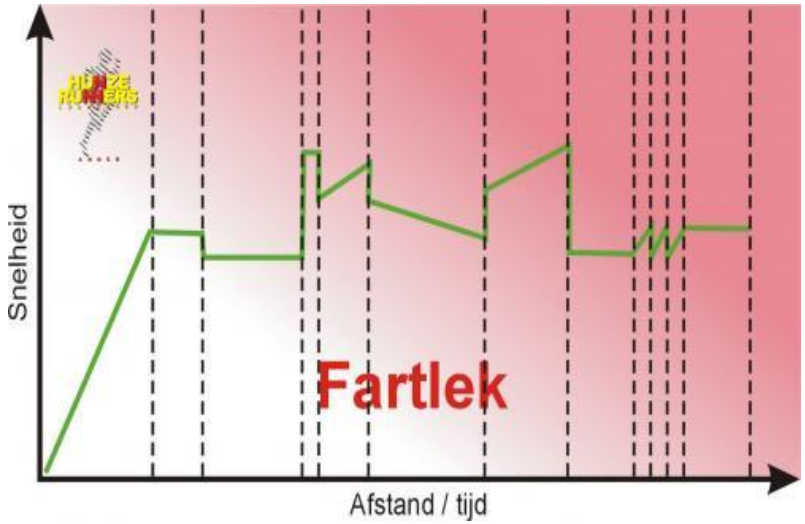
Fig.1 Test de Course Navette de Leger y Lambert

- Long graded distance training
- Stage=1-3 min

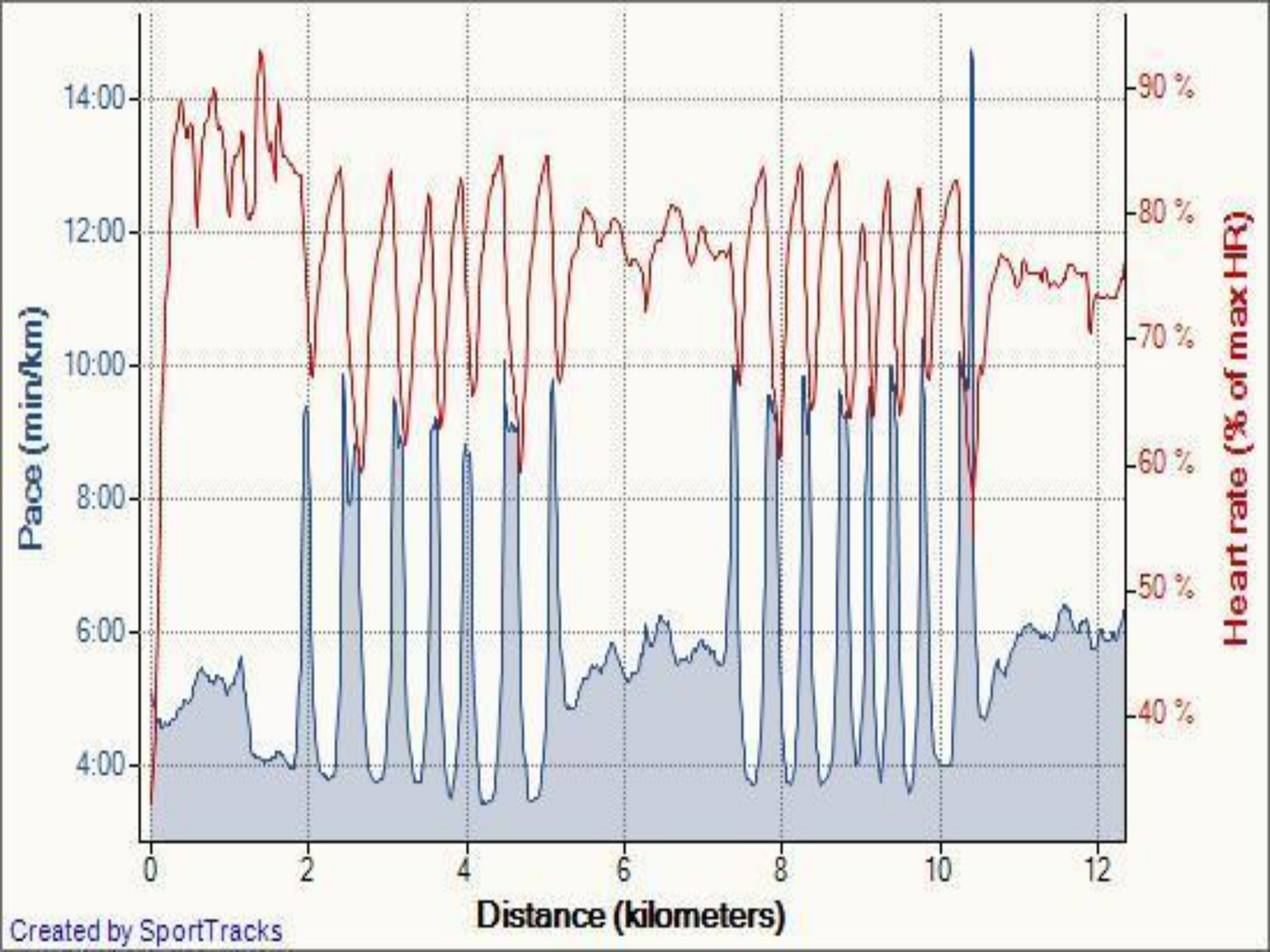
Ideal VO2 max scores for various sports

Vo2 max	Sport
>75 ml/kg/min	Endurance Runners and Cyclists
65 ml/kg/min	Squash
60-65 ml/kg/min	Football (male)
50 ml/kg/min	Volleyball
50 ml/kg/min	wrestling
60-65 ml/kg/min	Boxing

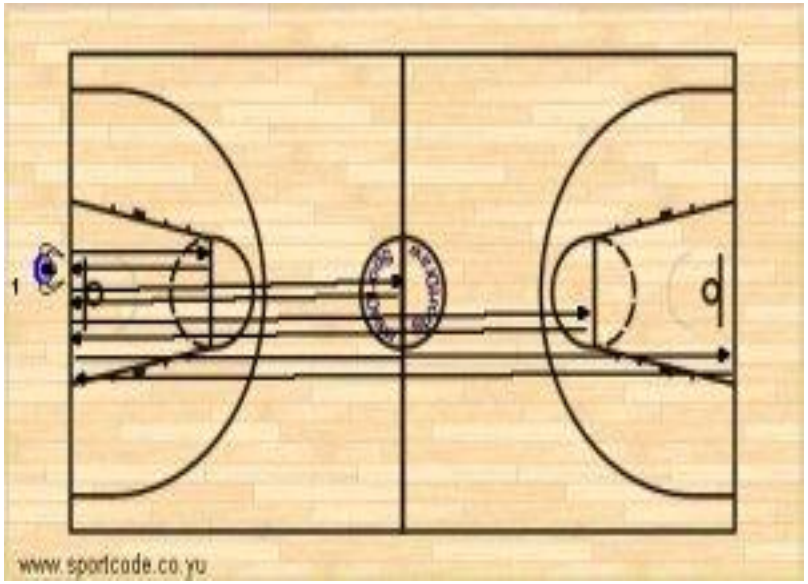
Practical Methods Of Endurance Training



- Fartlek training
- Variable continuous method

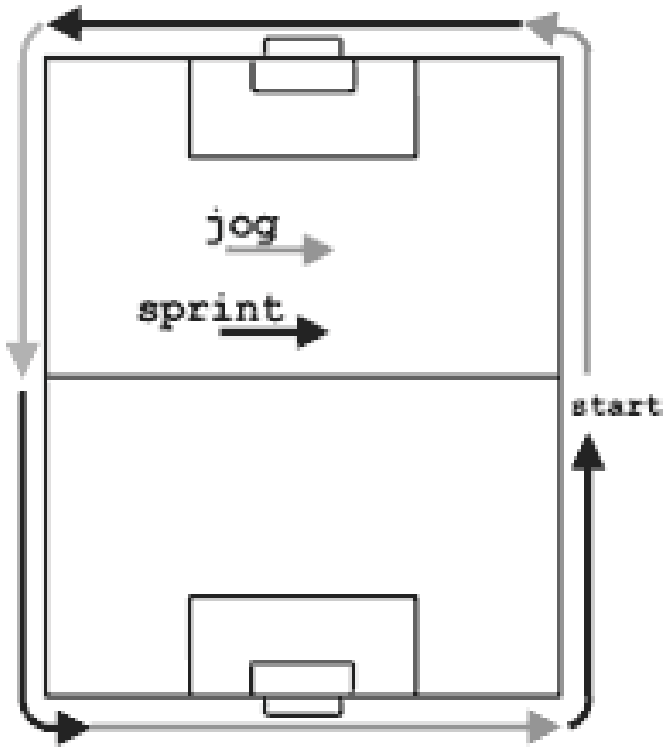

14:00
12:00
10:00
8:00
6:00
4:00
Pace (min/km)
90 %
80 %
70 %
60 %
50 %
40 %
Heart rate (% of max HR)
0
2
4
6
8
10
12
Distance (kilometers)
Created by SportTracks

Practical Methods Of Endurance Training



- Time trials
- Intermittent training
- Repetitive method

Practical Methods Of Endurance Training



- Interval training
- Aerobic interval
- Anaerobic interval
- Intensive interval
- Extensive interval
- Progressive interval
- Diminishing interval

Interval Training for Different Energy Systems

% of Maximum Anaerobic Power	Energy System Taxed	Interval Time	Work:Rest Ratio
90-100	Phosphogen	5-10s	1:12 to 1:20
75-90	Fast glycolysis	15-30s	1:3 to 1:5
30-75	Fast glycolysis and oxidative	1-3min	1:3 to 1:4
20-35	Oxidative	> 3min	1:1 to 1:3

From Essentials of Strength Training and Conditioning, NSCA (2000)

تمرين تناوبي شديد

تعريف : انجام تمرين تناوبي كه شدت مراحل فعاليت در آن بيشتر از 100 درصد vo2max باشد.

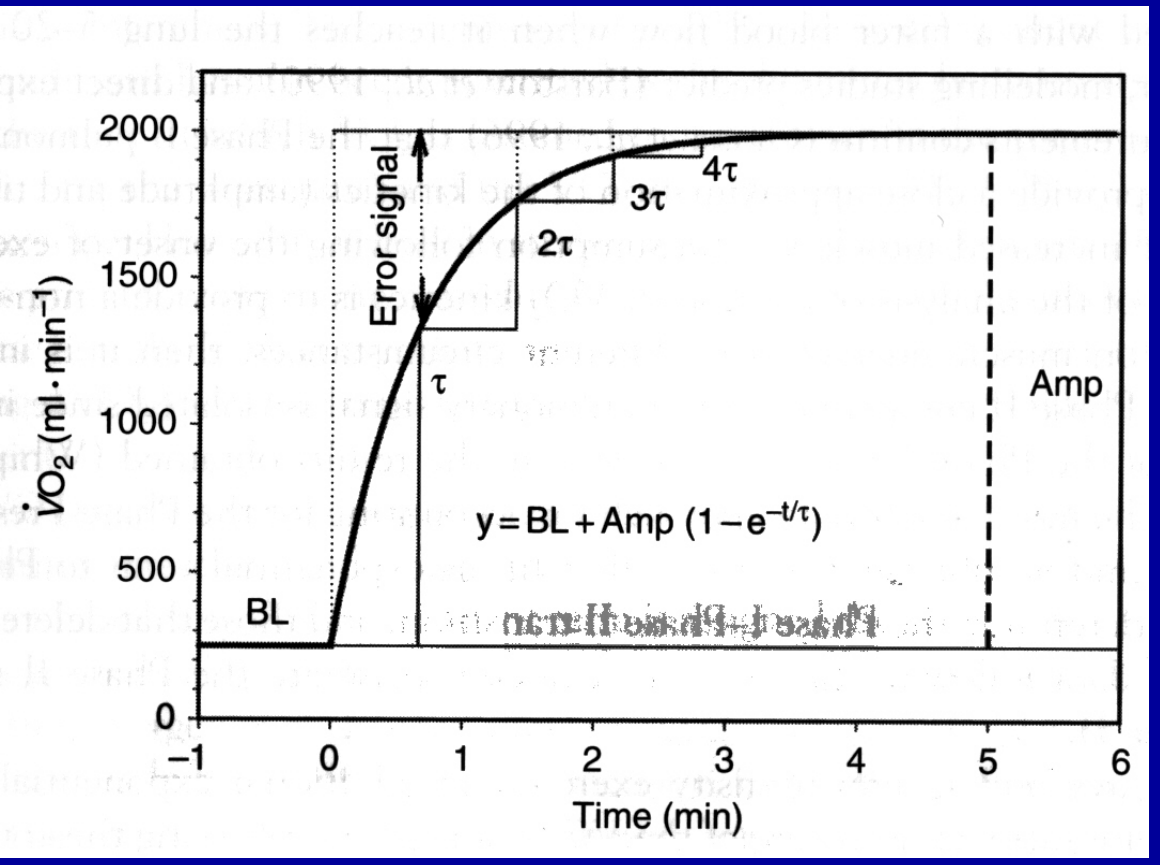
براي مثال

6*1 min at 112 % vvo2max ,1,2

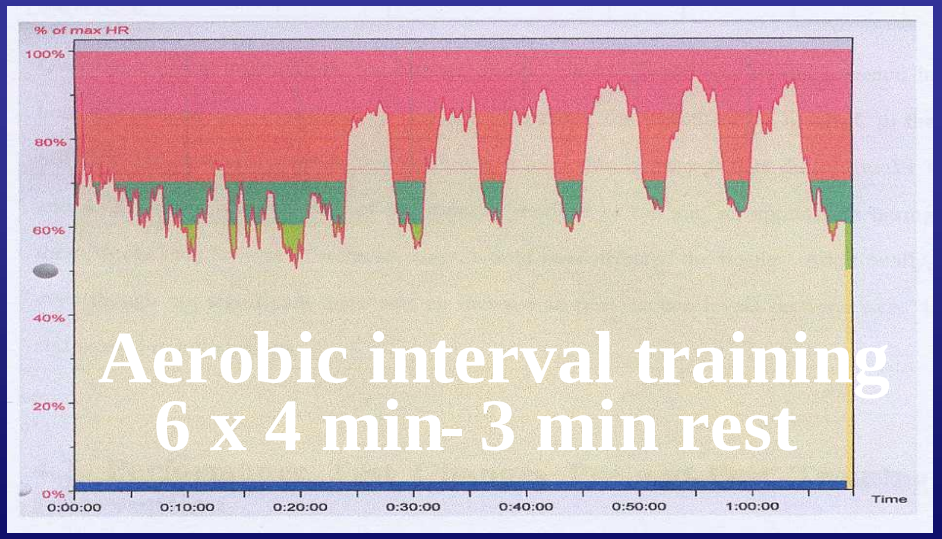
سازگاري :

افزايش ظرفيت بي هوازي بدون لاكتيک
افزايش ظرفيت دستگاه گليکوليز بي هوازي
افزايش ظرفيت تجزيه و دفع لاكتات
افزايش ظرفيت بافري
افزايش توان هوازي
افزايش كارايي حركتي (كارايي تعامل سيستمهاي انرژي)
افزايش زمان رسيدن به واماندگي

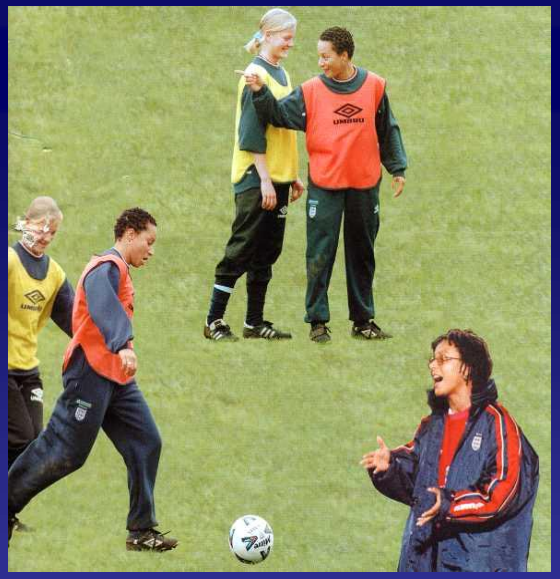
ثابت زماني(τ)

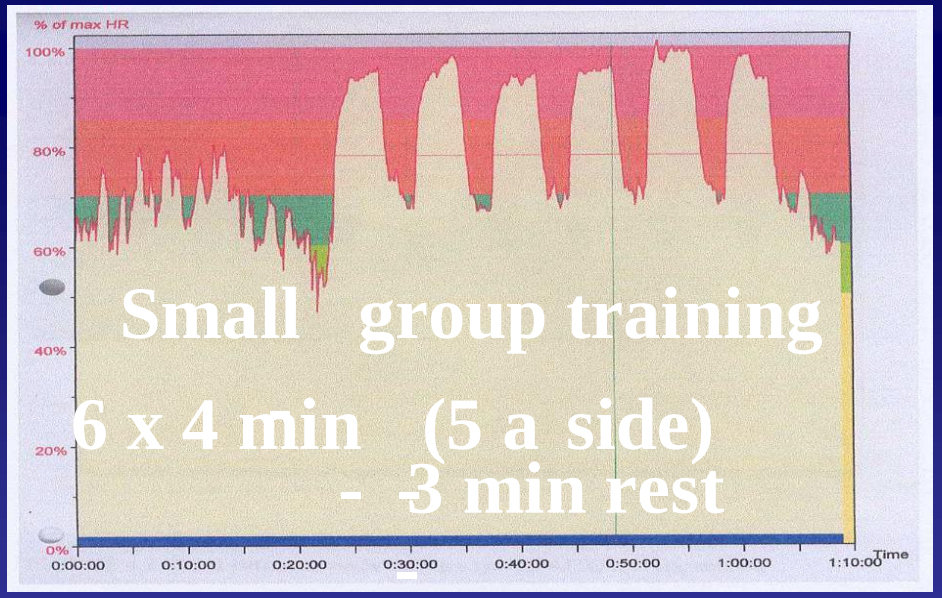


- time constant (τ) = time for amplitude to ↑ 63%
  - 2τ = 86% of amplitude
  - 3τ = 95%
  - 4τ = 98%



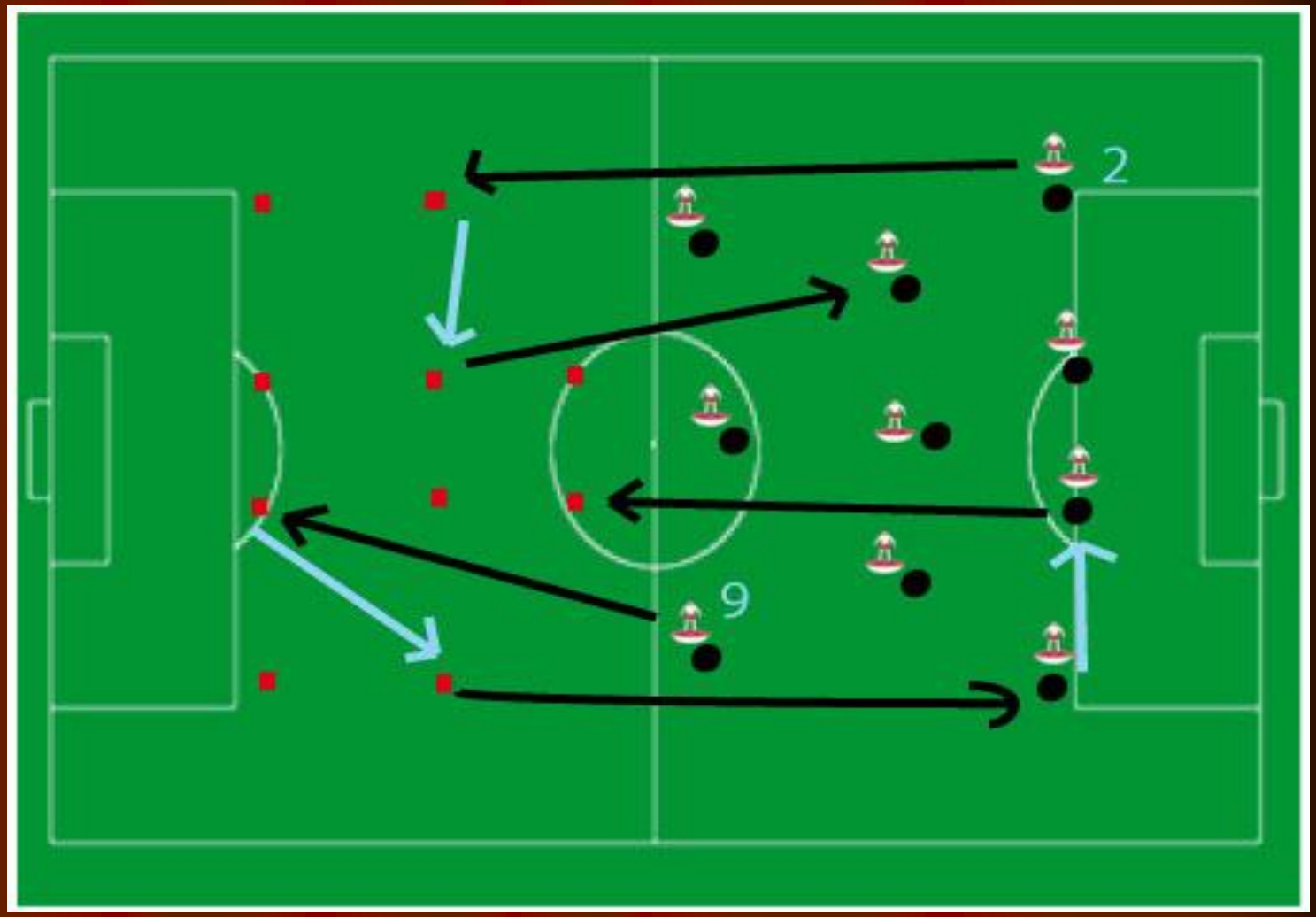
Aerobic interval training
6 x 4 min- 3 min rest

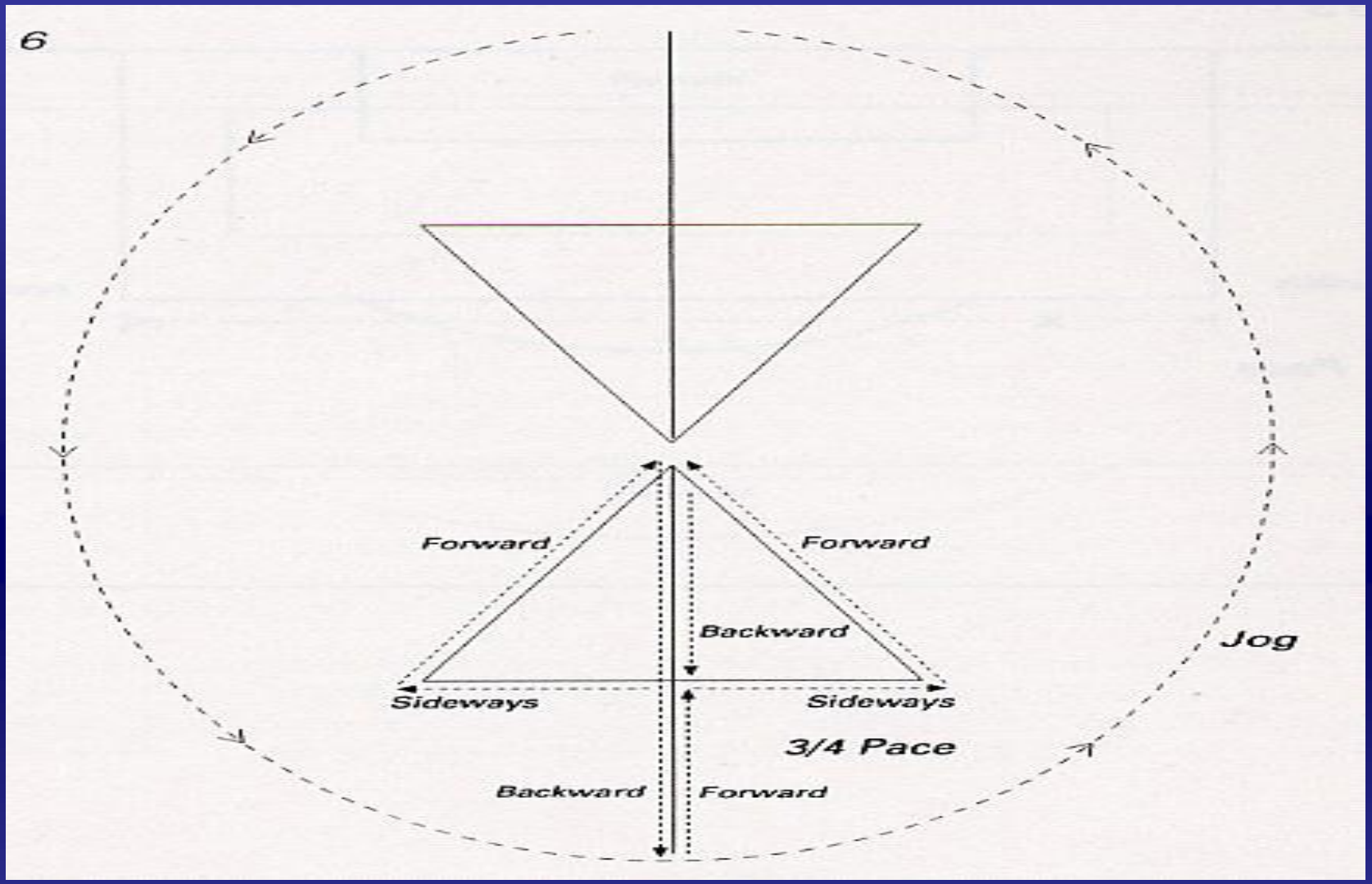




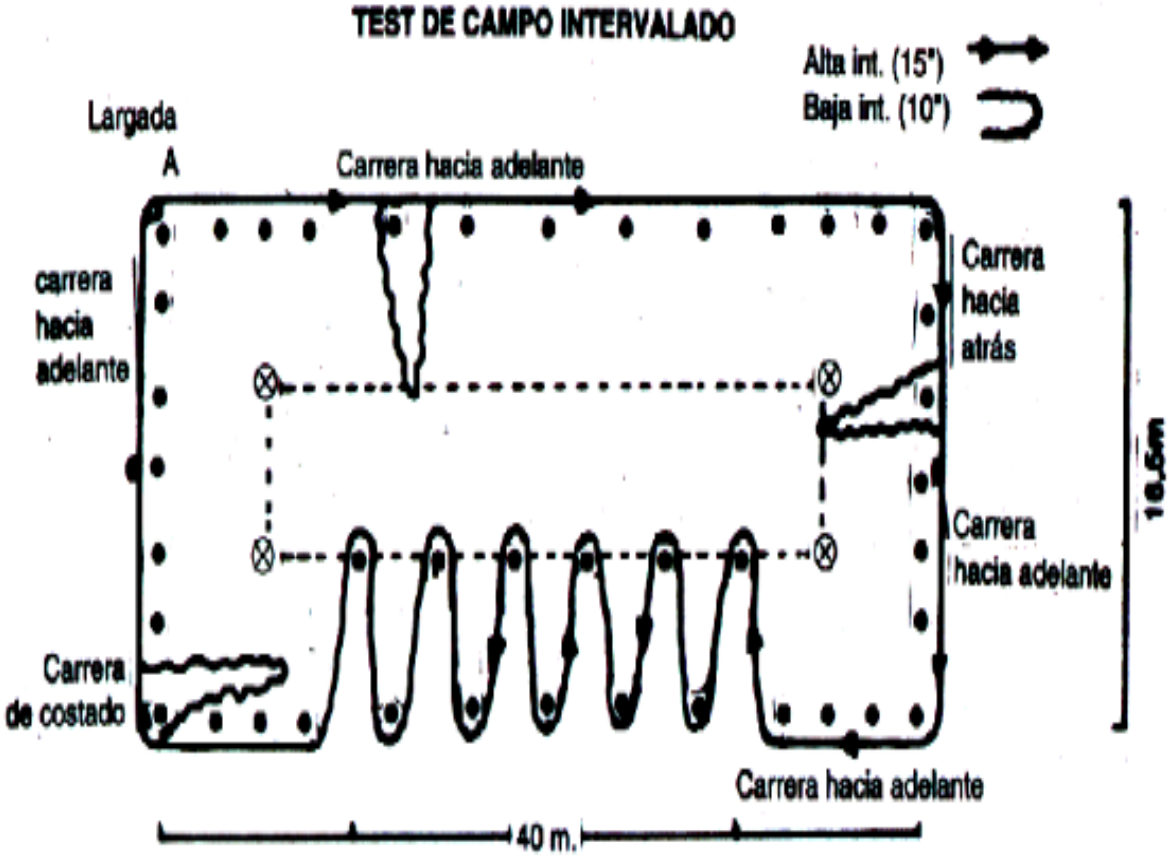
Small group training

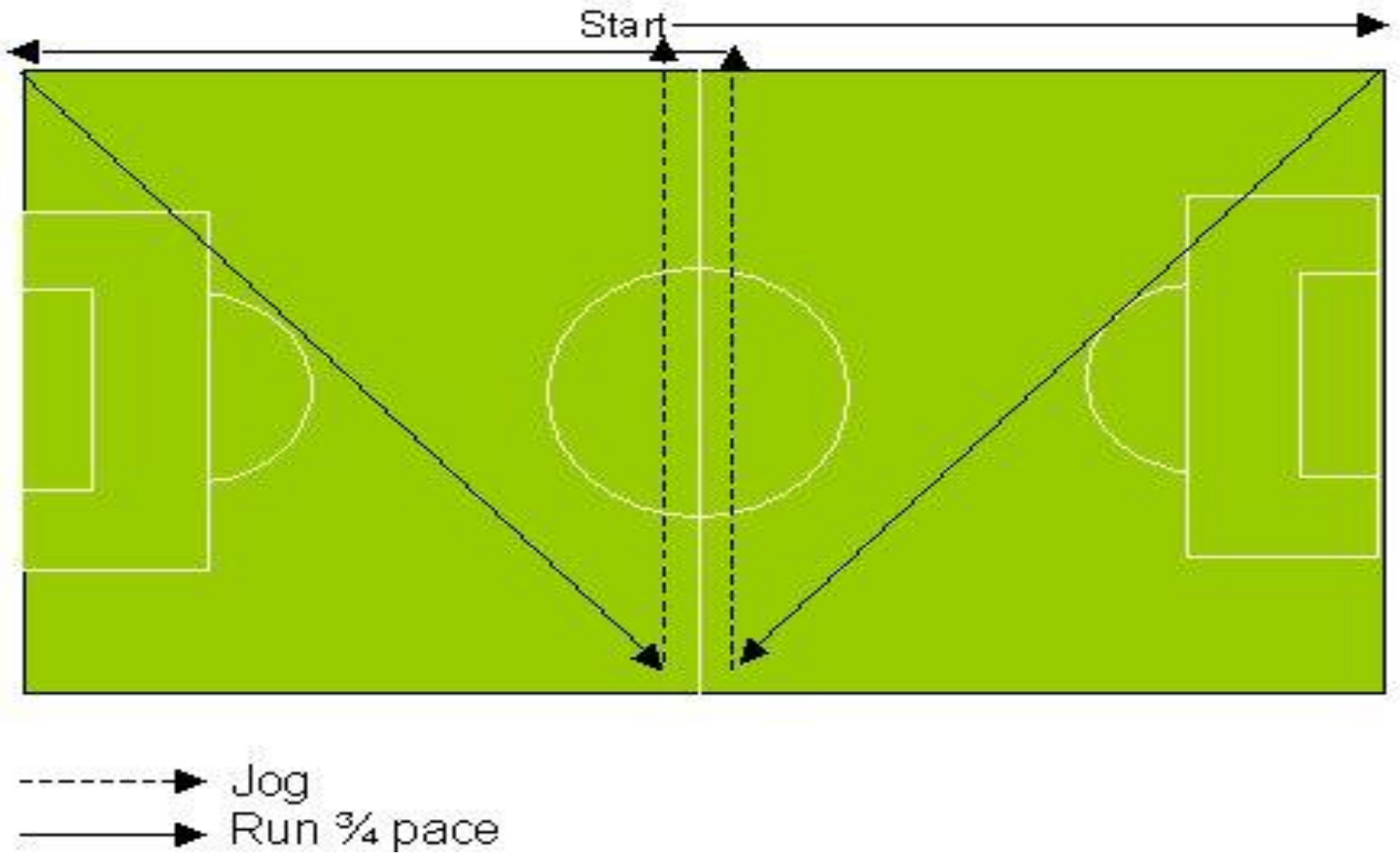
6 x 4 min (5 a side)
- 3 min rest

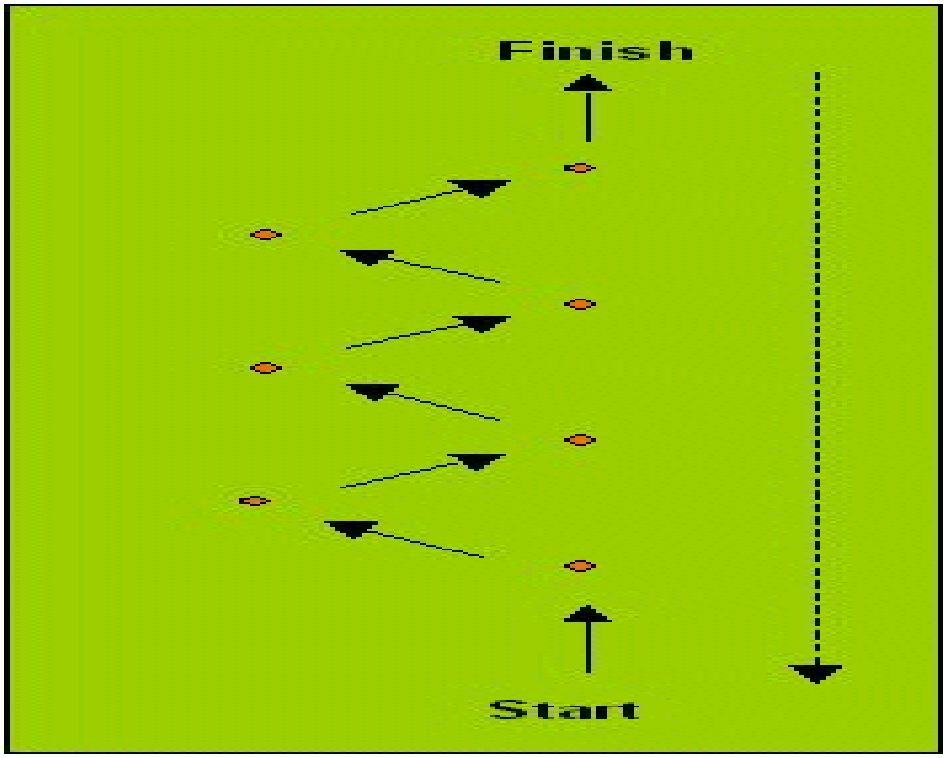

2
9



Example of a soccer-specific drill for aerobic training


TEST DE CAMPO INTERVALADO
Alta int. (15")
Baja int. (10")
Largada
A
Carrera hacia adelante
carrera
hacia
adelante
Carrera
hacia
atrás
Carrera
hacia adelante
Carrera
de costado
Carrera hacia adelante
40 m.
19,5m


Start
Jog
Run ¾ pace

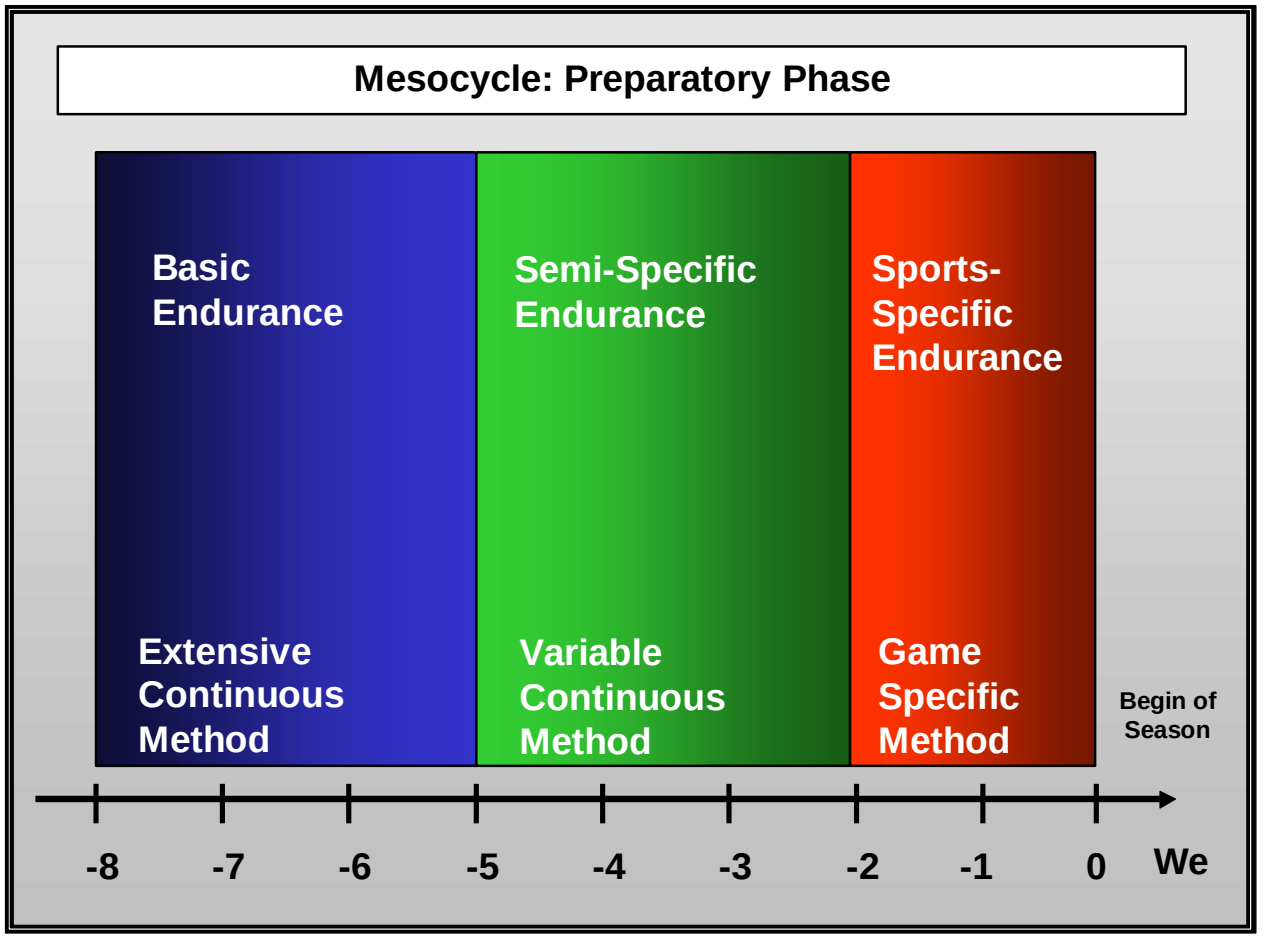

Finish
Start

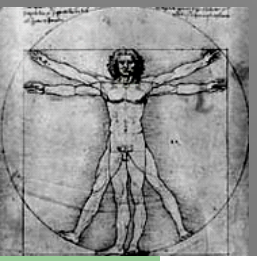
Periodization of Biomotor Abilities

	Preparatory		Competitive		Transition
	General preparatory	Specific preparatory	Pre -comp	Main competition	Transition
Strength	Anatomical adaptation	Maximum strength	Conversion -Power -Muscular endurance -Both	Maintenance	Compensation
Endurance	Aerobic endurance	-Aerobic endurance -Specific endurance (ergogenesis)	Specific endurance (ergogenesis)		Aerobic endurance
Speed	Aerobic & anaerobic endurance	-Alactic speed -Anaerobic endurance (ergogenesis)	-Specific speed * Alactic * Lactic * Speed enduranace	-Specific speed -Agility -Reaction time -Speed endurance	

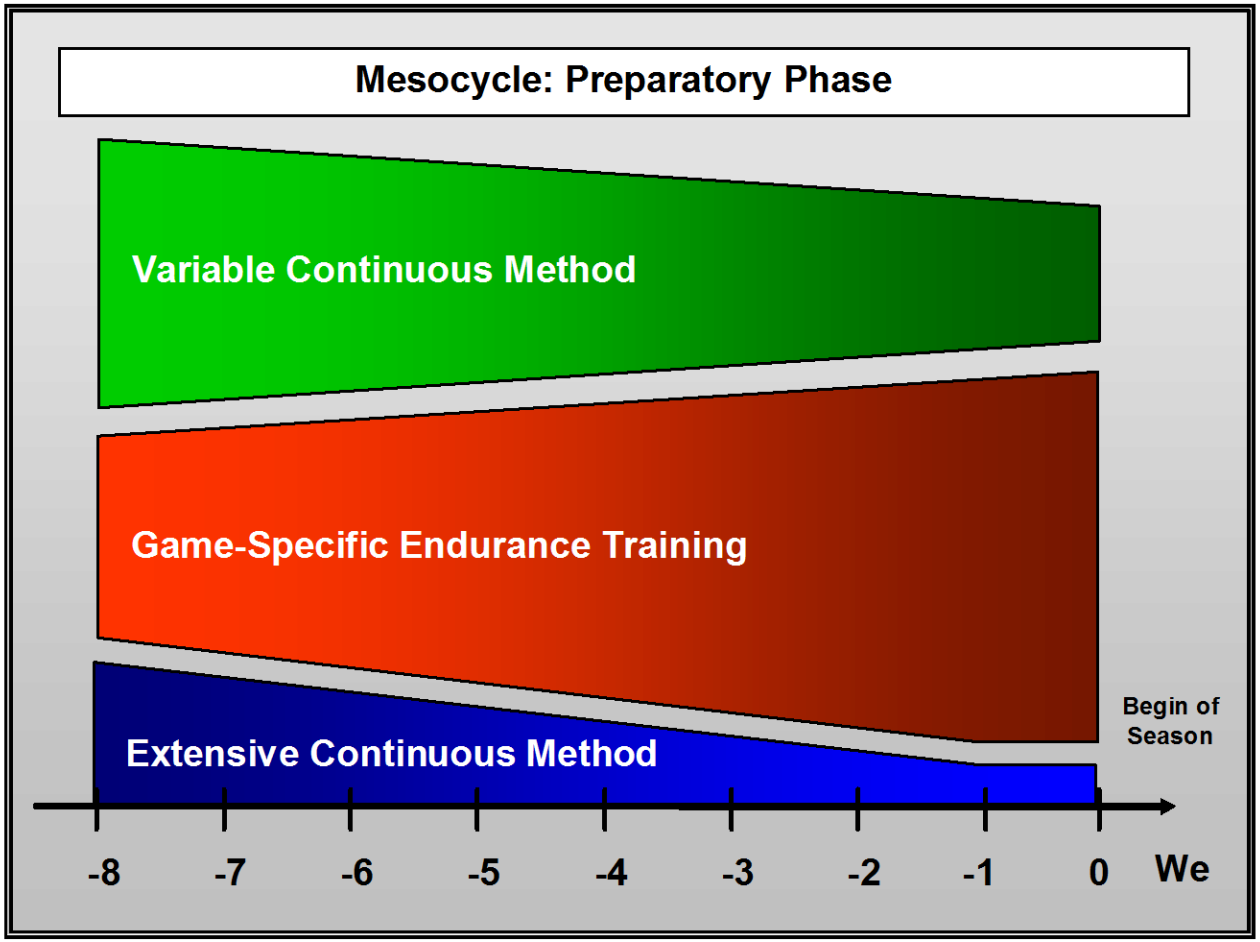
Periodization of main biomotor abilities

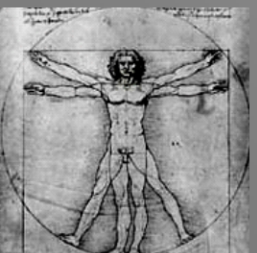
Different Types of Mesocycles for Training Endurance in Game Sports





Different Types of Mesocycles for Training Endurance in Game Sports





Sports Science 1

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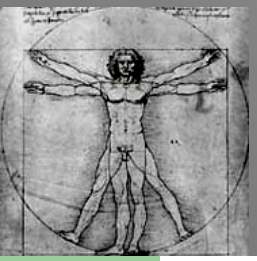
University of the West of England

Characteristics of Different raining Methods and their Use in Periodisation

RECOM-Training	BE 1 - Training	BE 2 - Training	CSE – Training
GOAL	**GOAL**	**GOAL**	**GOAL**
Support recovery; Increasing the ability to mobilise adaptation reserves for high intensive training at a later time	Stabilising the higher level of BE; Increasing the aerobic performance	Increasing the BE performance; Enhancing the aerobic /anaerobic performance	Developing the competition specific endurance; Lactate tolerance
METHOD	**METHOD**	**METHOD**	**METHOD**
Continuous Method	Continuous M.; Changeable Continuous M. (Fartlek)	Extensive Interval Method; Changeable Continuous M.	Intensive Interval Method; Competition M.; Repetition M.
INTENSITY	**INTENSITY**	**INTENSITY**	**INTENSITY**
Very low HR: 60 - 70% Lactate: < 2mmol/l	Low to medium HR: 70 - 80% Lactate:<2,5mmol/l	Middle to high HR: 80- 90% Lactate: 3-6mmol/l	High to maximal HR: > 90% Lactate: >6 mmol/l
DURATION	**DURATION**	**DURATION**	**DURATION**
< 45 min.	> 45 min.	20 – 120 min.	10 – 45 min.



Microcycle in the PP III of an Endurance Athlete