The prescription of physical activity and exercise: principles and practice

Federico Schena

Why Exercise prescription?

- **Individual adaptation process**
- **Personal life expectations**

The optimal prescription for any individual is determined on an appropriate evaluation of:

- **GOAL (S) - (Final target to reach)**

- **Physical Capacity - (Physiological Test Performance Task, Clinical risk,**

- **Psychological profile - (attitude to exercise)**

- **Social aspects (Environment and Barriers)**

Managing Exercise Prescription or Counseling?

Exercise is a matter of health not simply recreation (according to OMS)

In the past exercise for individuals (not athletes) was generally proposed on the basis of ….

…reduced intensity in order to increased safety …..

without any check on the effects

Counseling is a good method, basically aimed at creating behavioural changes, however we need to link appropriate prescription to it

The art of exercise prescription is the successful integration of exercise science with behavioral techniques that resulting long-term program complianceand attainment of individual's goal.

ACSM Guidelines for exercise testing and prescription. ***6th edition***

Milestones of Exercise Prescription

Appropriate mode(s) of exercise

Intensity

Duration

Frequency

Progression

Aerobic training (Cardiovascular endurance)

1. **Improve the ability of the body to utilise oxygen**
2. **Basis for physical fitness**
3. **Measured by VO2 max or … other indexes**
4. **Expected changes in elderly from 5 to 40%**
5. **Improvement is inversely related to initial level**

Aerobic training
Mode of exercise

Use of large muscle for prolonged (several minutes) periods and rhythmic movements…….wide numbers of activities…..

Group 1 **Activities easily maintaned at constant intensity**
Low inter- individual diff. In EnExp or EnCost
Precise control, rehabilitation, oldest old

Group 2 **Activities where the rate of EE is related to skill**
EE is relatively constant for a given person
Early stage of conditioning for skilled people

Group 3 **Activities where skill and intensity are variable**
Provide group interaction and variety of ex
Caution for high risk and low fit (not diseased /disabled/ elderly ?)

Other considerations: risk of injuries,orthopedic stress, muscle strength requirement, ….travel cost, partner involvement

Aerobic training
Intensity & Duration

Intensity and duration are interelated determining overall EE of exercise activities

The same results (in terms od cardiovascular endurance) can be reached with prolonged exercise and low to moderate intensity (not too low!!!!)

Desirable intensity is from 50 to 80% of VO2 max but you can(have to) reached for short periods 90-100% VO2 max

Individual with very low fitness (< 25ml/Kg/min) can start from 40-50% of VO2 max

Aerobic training
Intensity

How to estabilish intensity:

- evaluation (you have to become very expert on it!)

Set the parameter to follow:

HR (% of maximum or HR reserve)

RPE (rate of perceived exertion) i.e. Borg Scale

VO2/METs

Thresholds

or others as

ventilatory requirements

lactate

pain limitation

Classification of intensity 30-60 min of exercise

% HR max	% VO2 max	RPE	Classification of intensity	
< 35	< 30	<10	Very light	
35-59	30-49	10-11	Light	
60-79	50-74	12-13	Moderate	
80-89	75-84	14-16	Haevy	
>90	>85	>16	Very Heavy	

Aerobic training
Duration

1. **Time constrains of the individual leads the choice!!!**
2. **From 5-10 min to 30-40 min inversely related to intensity**
3. **Gold standard 20-60 min at 55-75% VO2 max**
4. **Frail or low fit elderly could benefit also from repeated session of 5-10 min**
5. **Set the initial goal reasonably for the individual (auto regulation is the tomb of prescription!!!!)**
6. **Increase as a function of success and absence of fatigue**

Aerobic training
Frequency

1. **Inter-related to Intensity and duration**

2. **Set on functional capacity:**

   - very low fit subj. (<3 MET/h) require multiple daily sessions

   - low fit (3-5 MET/h) 2 or 3 sessions per day

   - normal (> 5 MET/h) 3-5 sessions/week

Number of exercise sessions per week also depends on caloric goals, subjects preference and limitations lifestyle,……

Aerobic training
Rate of progression

1. **It is determined by:**
   - **Functional capacity**
   - **Medical and health status**
   - **Age**
   - **Individual preference/goal**

2. **Three main stages**

   INITIAL CONDITIONING STAGE (4-6 wks)
   ….avoid risk and fatigue…

   IMPROVEMENT STAGE (4-5 mo)
   …..feel the increasing power…

   MAINTENANCE STAGE (> 6 mo)
   …..enjoy your exercise as part of your life…

Muscoloskeletal flexibility

Mode of exercise: Any that mantain an adequate range of motion (generally called stretching ex.)

Static exercises are to be preferred in elderly with emphasys to low back and thig area

Intensity: to position at middle discomfort

Duration:10 to 30 sec for each stretch 3 –5 reps

Frequency: at least 3 days per week

Muscolar fitness – Resistence training

(it should be a part of each protocol)

Mode of exercise: resistence training, strength training, daily activities requiring muscle power)

Intensity: from 40% to 80% of 1 RM or Max isom

Duration: at least 1 exercise for any major muscle groups (avg 8-10 ex) 8-12 reps for each

Frequency: at least 2 days per week

1. **Adherence to technique of exercise**
2. **Perform exercise in the correct range of motion**
3. **Avoid or reduce eccentric exercise or exercise with high level isometric component**

STRENGTH ASSESSMENT

Dynamometry (static force)

- ✓ One-repetition maximum or 1-RM (dynamic force)
- ✓ Computer-assisted force and power output determination

STRENGTH ASSESSMENT

MAXIMAL TEST

DIRECT TEST

↓

1MR - isometric

SUBMAXIMAL TEST

INDIRECT TEST

↓

MR

ESTIMATE THE 1-RM

Untrained

1-RM(kg)= 1.554 (7-10-RM weight(kg)) – 5.181

Trained

1-RM(kg)= 1.172 (7-10-RM weight(kg)) + 7.704

BRZYCKI FORMULA

$$1MR = \frac{\text{LIFTED WEIGHT}}{1.0278 - (0.0278 \times \text{reps})}$$

Effect of two training modalities on exercise tolerance in the elderly

Balestrieri F., Pogliaghi S., Cevese A., Schena F.1

1 CeBiSM, Università degli Studi di Trento, Italy
2 Facoltà di Scienze Motorie, Università degli Studi di Verona, Italy

Experimental procedures

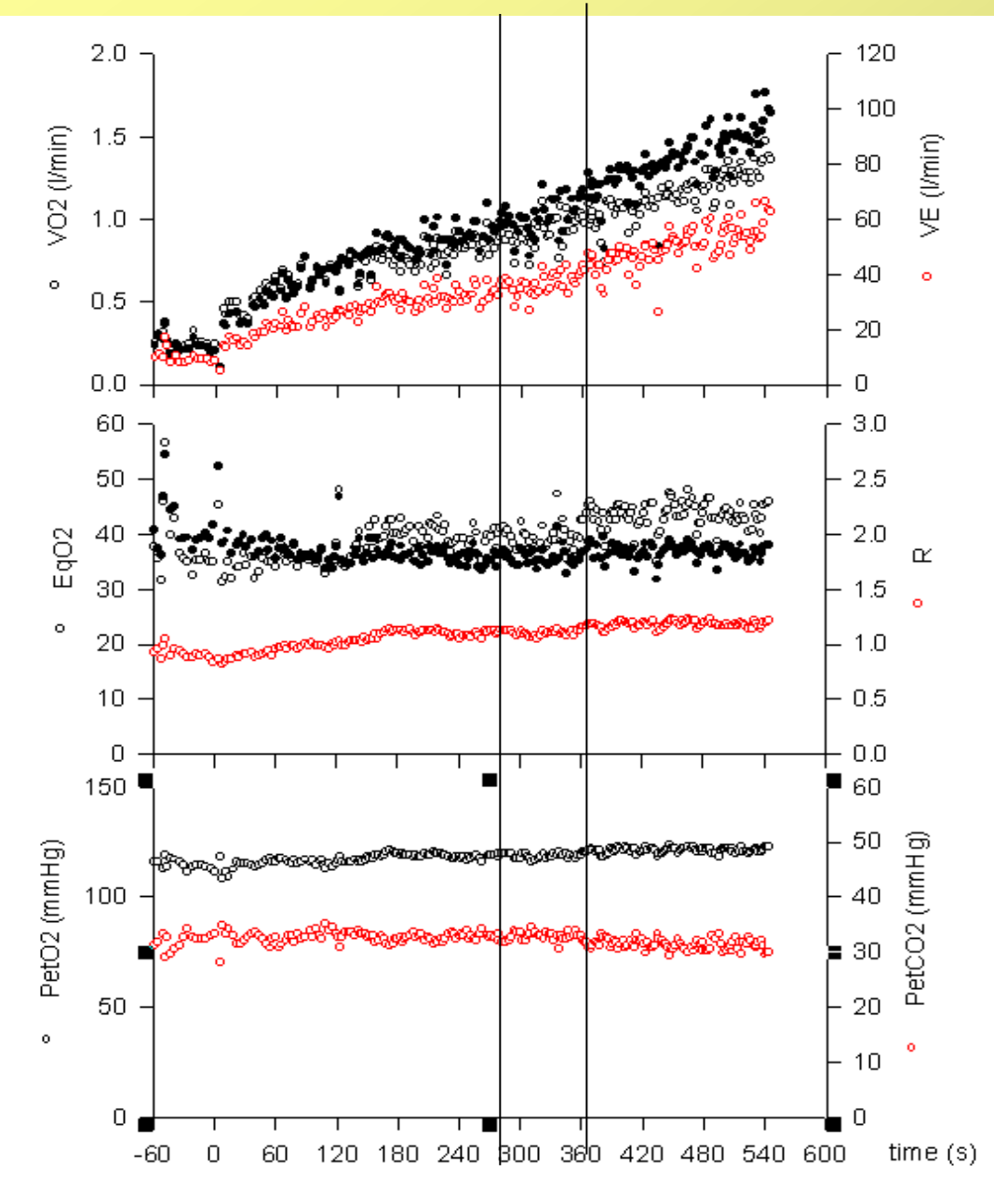
- *Medical check*: al subjects were free of cardiac, pulmonary, metabolic disease or exercise-limiting orthopaedic impairment.

- *preliminary session*: familiarization with the laboratory setting, the study procedure and the working position.

- *exercise tests:* performed in a random order on two ergometer (Technogym,Italy) with a minimal recovery of 2 hours

maximal test on arm cranking (ARM): start from 45 watts with increases of 5 watts every 1 min until exhaustion; 60 rpm

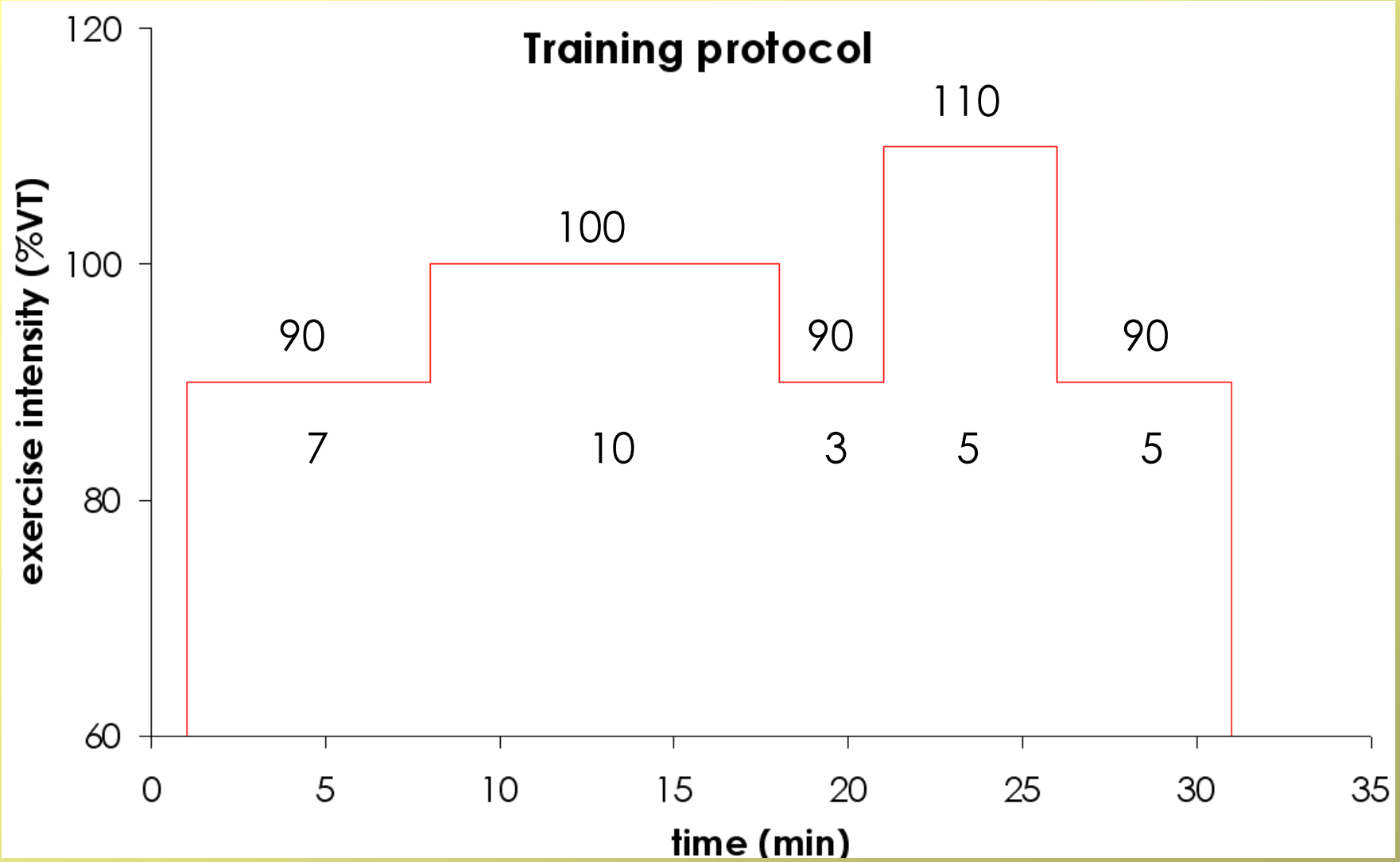
maximal test on leg cycling (CYC): start from 50 watts with increases of 10 watts every 1 min, until exhaustion; 60 rpm


VO2 (l/min)
VE (l/min)
EqO2
R
PetO2 (mmHg)
PetCO2 (mmHg)
time (s)
2.0
1.5
1.0
0.5
0.0
120
100
80
60
40
20
0
60
50
40
30
20
10
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
150
100
50
0
60
50
40
30
20
10
0
-60
0
60
120
180
240
300
360
420
480
540
600

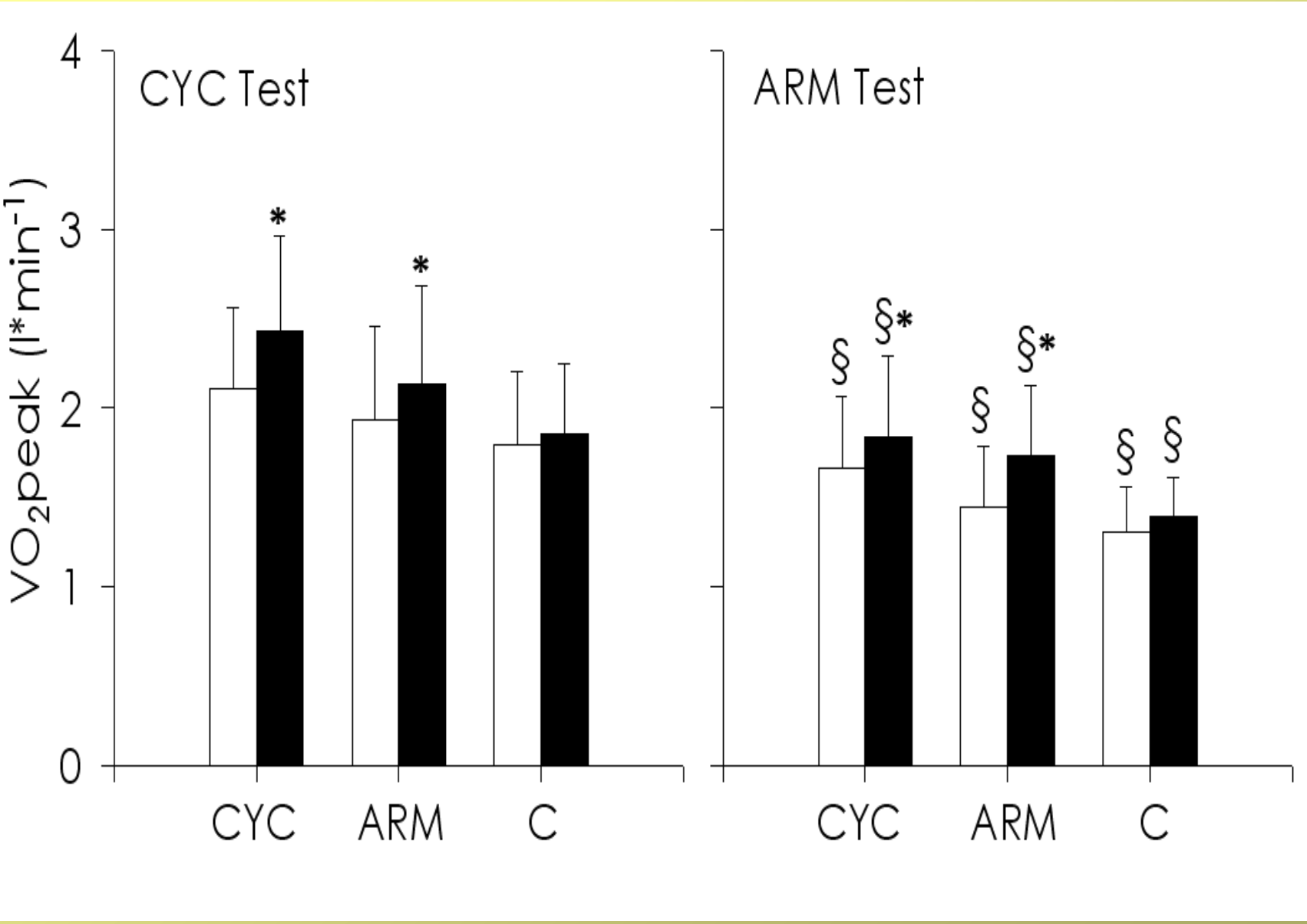
Training design (intensity, rate of progression):

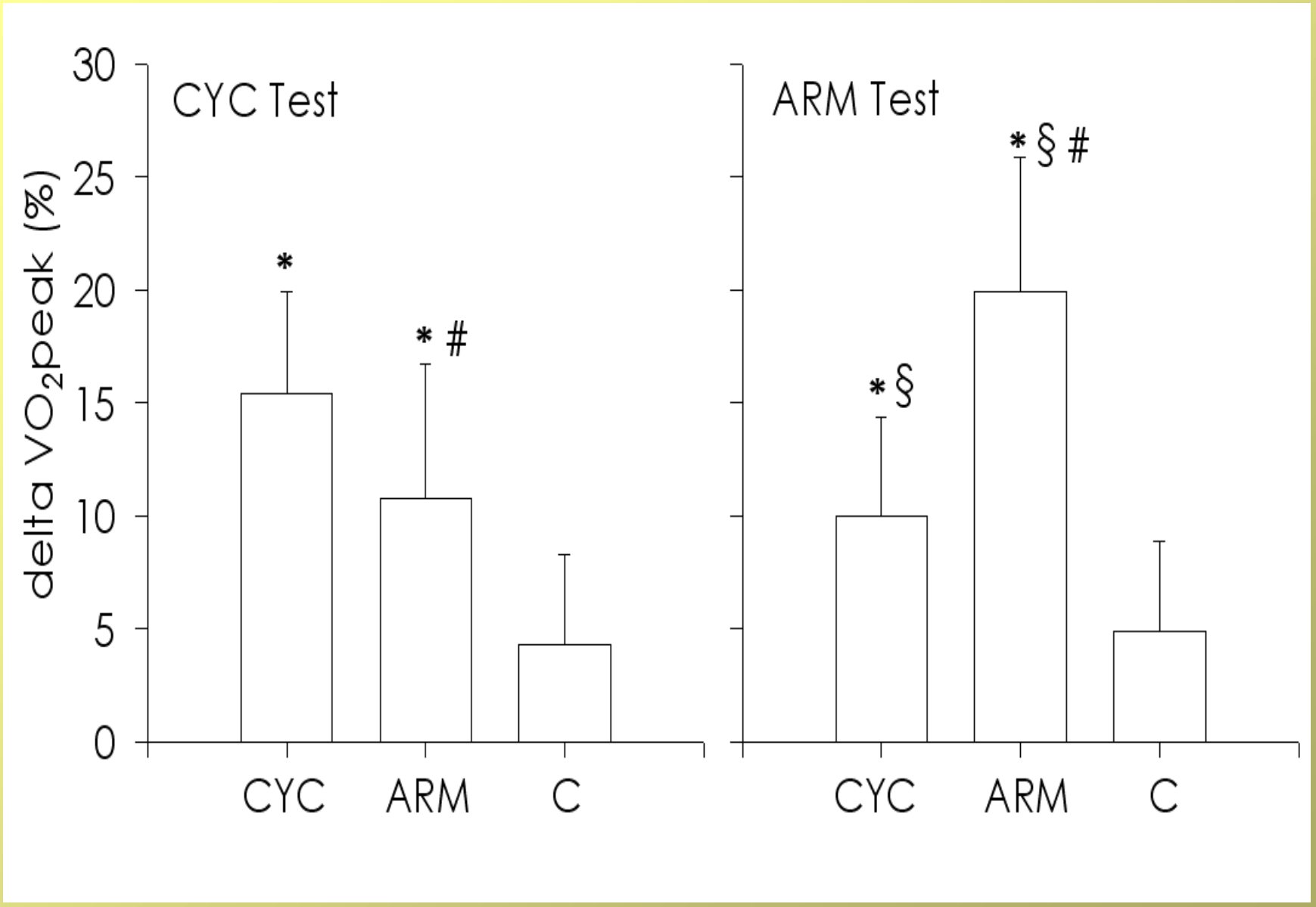
- ✓ **VT identification during incremental test**
- ✓ **HR corresponding to VT**
- ✓ **using steady-state tests, translate HR_{VT} in W_{VT}**
- ✓ **calculate $W_{90\%VT}$ and $W_{110\%VT}$**

- ✓ **every 2 weeks check the HR/W relationship**



12-week training, 3 times /week


CYC Test
ARM Test
VO_2peak ($l*min^{-1}$)
4
3
2
1
0
*
*
§
§*
§
§*
§
§
CYC
ARM
C
CYC
ARM
C


CYC Test
ARM Test
delta VO2peak (%)
30
25
20
15
10
5
0
*
* #
* §
* § #
CYC
ARM
C
CYC
ARM
C

Congresso Firenze SIGG 2000

IL SIGNIFICATO DELL'ATTIVITÀ FISICA NELL'ANZIANO ISTITUZIONALIZZATO: UNA ESPERIENZA ITALIANA

F. Schena, C. Martinelli, G. Noro.

Giornale di Gerontologia, 9:597 - 607, 2000

Protocollo

RSA - (case di riposo)

1° TRAINING GROUP	*2° TRAINING GROUP*	*CONTROL GROUP*
Casa di Riposo di GARDOLO	**Casa di Riposo di TRENTO**	**Case di Riposo di Povo, Gardolo e Trento**
GrWM (Weight machines)	**GrEB (Elastic Band)**	
n = 7	**n = 8**	**n = 10**
(6F, 1M - **83,43** ± 8 anni)	(6F, 2M - **79,25** ± 8,78 anni)	(8F,2M - **81,5**±6 anni)

TRAINING

12 SETTIMANE 3 giorni a settimana per 50 min.

Allenamento alla forza per arti superiori ed inferiori

Macchine isotoniche (**Leg and Chest press, Vertical row, Recline Technogym**)	**Bande elastiche + Esercizi carico naturale**	**NO TRAINING** Mantenimento delle normali attività previste dalla struttura residenziale

GrWM Programma di allenamento

Arti superiori

CHEST PRESS

VERTICAL ROW

40% della M.V.C.

ogni 2 sett

Incremento del 20%

Apparecchiatura Isotonica

Arti inferiori

LEG PRESS

50% della M.V.C

ogni 2 sett

incremento del 20%

SET

3	dalla 1° alla 6° settimana	3
4	dalla 7° alla 12° settimana	5

RIPETIZIONI

6 (1° settimana) 8 (2° settimana) 10-12 (da 3° a 12° sett.)

GrEB Programma di allenamento

15 min

Carico naturale

ARTI INFERIORI

FLESSIONI, PIEGAMENTI, SEMIPIEGAMENTI e AFFONDI

2 - 3 SETS di 8 – 10 – 12 RIPETIZIONI

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5 min

ESERCIZI DI MOBILITÀ PER GLI ARTI SUPERIORI

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20 min

Bande elastiche

ARTI SUPERIORI ⇩ **ARTI INFERIORI** ⇩

FLESSIONE, ESTENSIONE ED ABDUZIONE

2 - 3 SET di 8 – 10 – 12 RIPETIZIONI

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10 min

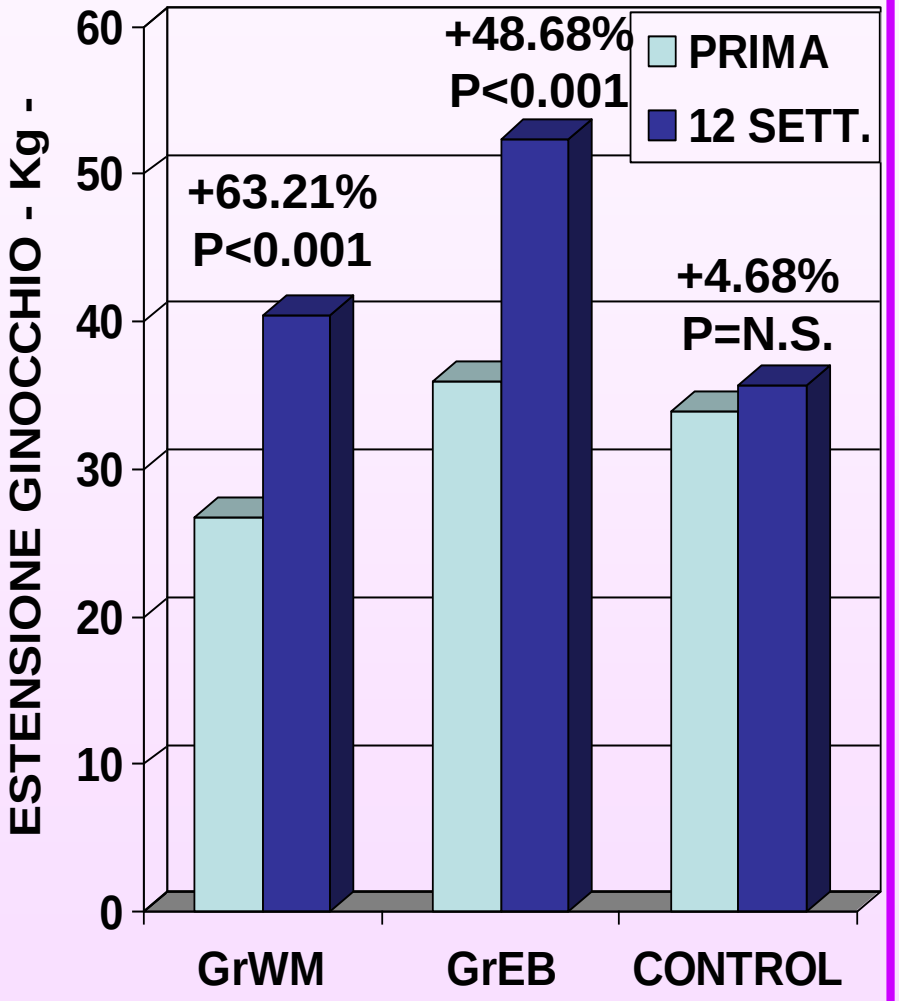
CON

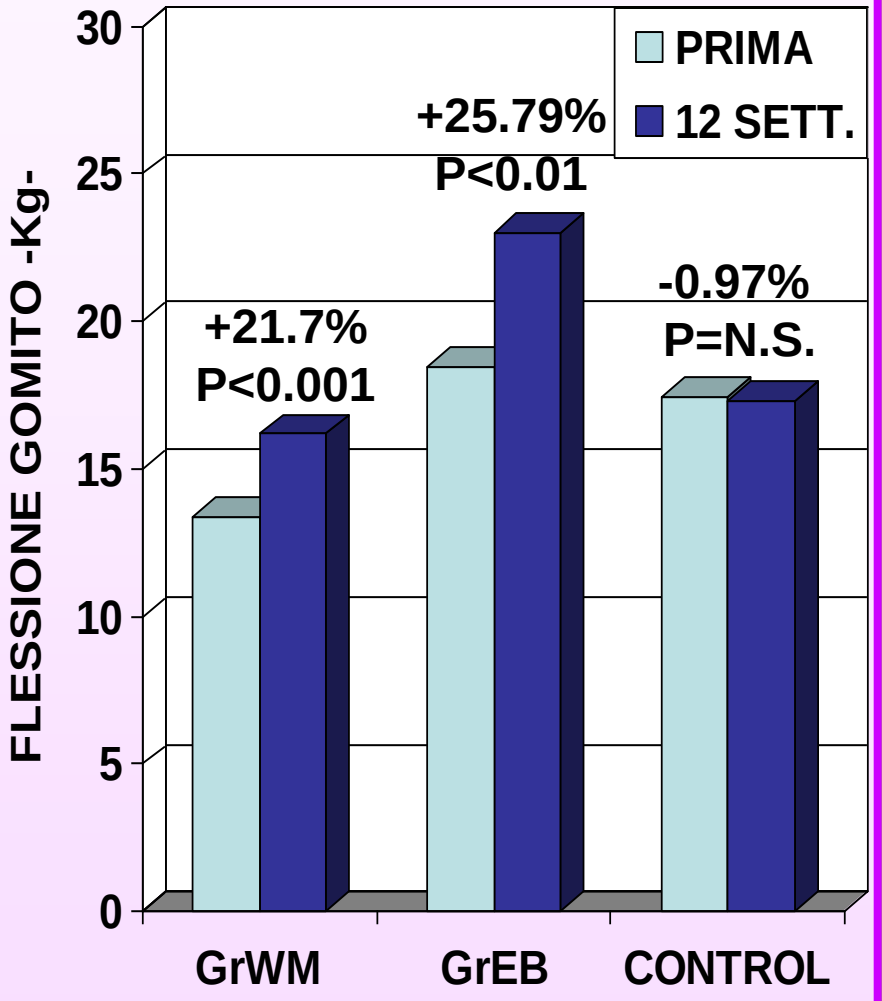
ESERCIZI DI DEAMBULAZIONE E COORDINAZIONE

LANCI DI PALLINE .

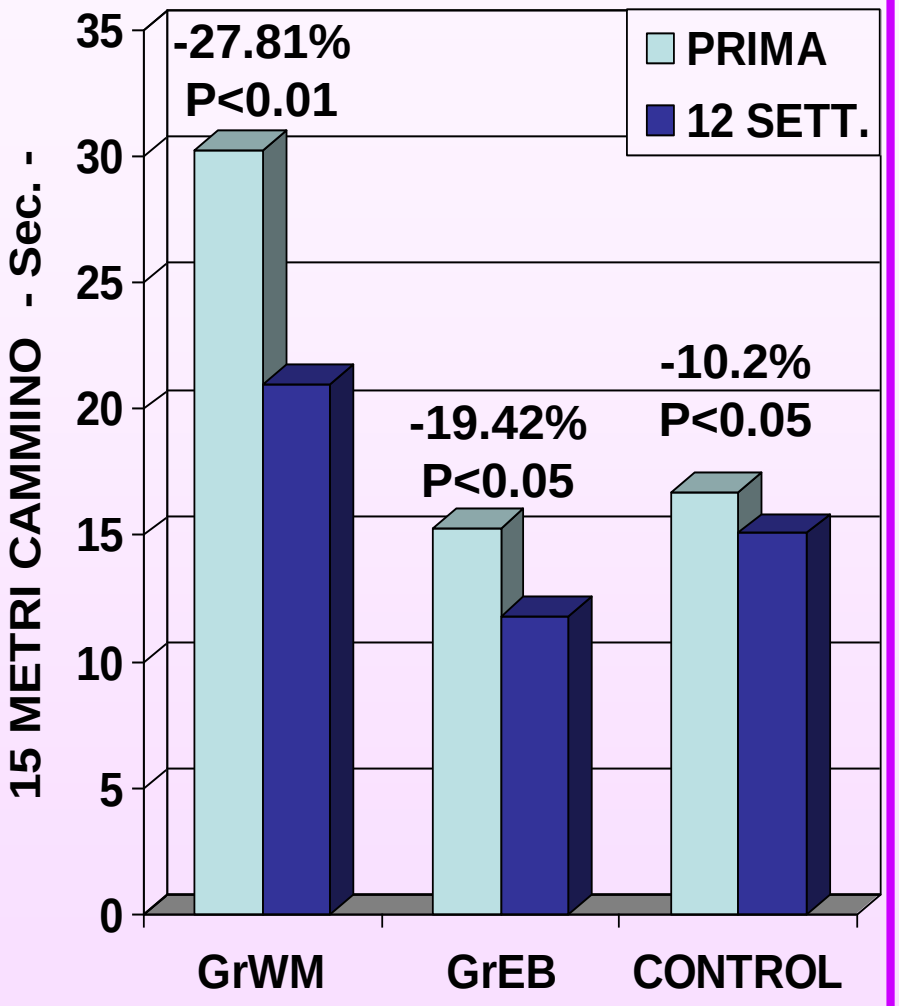

VIETATO FUMARE

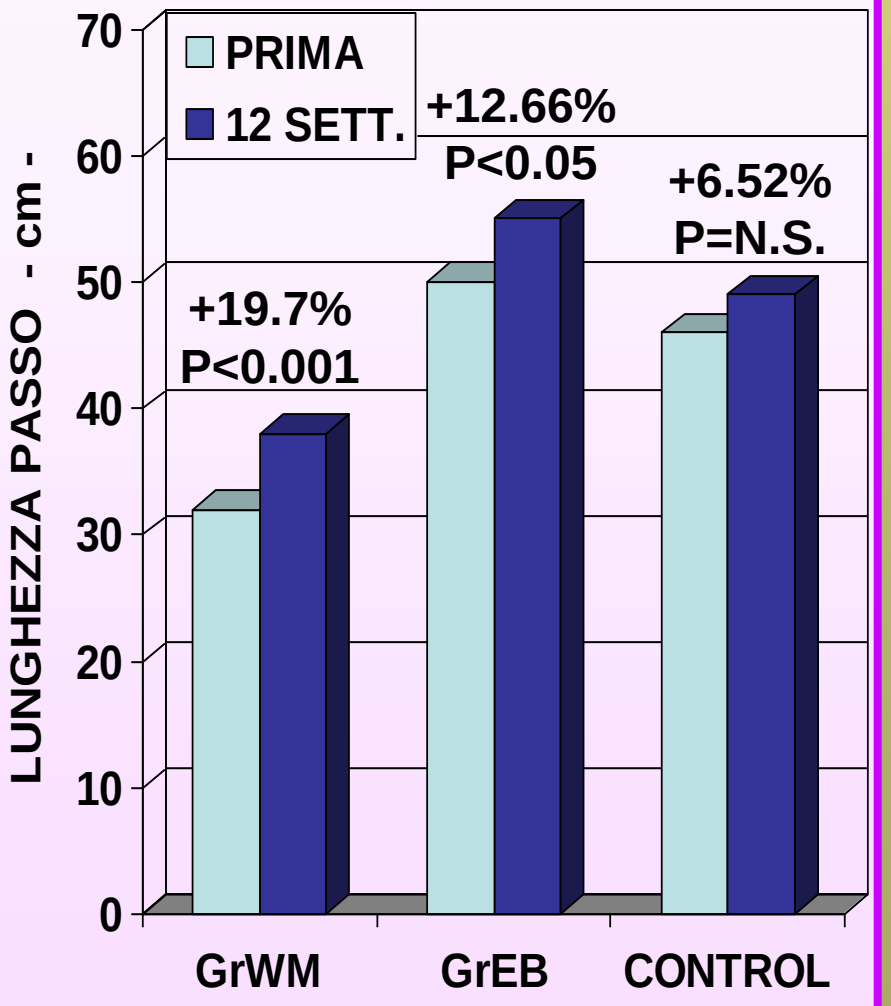
Massima forza isometrica delle gambe e delle braccia





15 metri di cammino: tempo e lunghezza media del passo






Night & Day