
THE
MOVI

Endurance & Giochi Sportivi

Carlo Castagna

Corso di Laurea in Scienze Motorie

Università di Roma Tor Vergata, Roma

castagnac@libero.it

Sommario

Giochi Sportivi:

- Calcio
- Calcio a 5
- Pallacanestro
- Tennis

Sommario

Sommario

- Richieste di gioco
- Valutazione
- Allenamento

Sommario

Giochi Sportivi:

Journal of Strength and Conditioning Research, 2007, 21(4), 1093–1100
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EFFECTIVE SPEED AND AGILITY CONDITIONING METHODOLOGY FOR RANDOM INTERMITTENT DYNAMIC TYPE SPORTS

JONATHAN BLOOMFIELD,[1] REMCO POLMAN,[2] PETER O'DONOGHUE,[3] AND LARS MCNAUGHTON[2]

[1]Sports Institute of Northern Ireland, University of Ulster, Jordanstown Campus, Shore Road, Newtownabbey, Co. Antrim, Northern Ireland, United Kingdom, BT37 0QB; [2]Department of Sport, Health & Exercise Science, The University of Hull, Cottingham Road, Hull, East Riding of Yorkshire, United Kingdom, HU6 7RX; [3]School of Sport, PE and Recreation, University of Wales Institute Cardiff, Cyncoed Campus, Cardiff, United Kingdom CF23 6XD.

Giochi Sportivi:

Journal of Strength and Conditioning Research, 2007, 21(4), 1093–1100
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RANDOM INTERMITTENT DYNAMIC TYPE SPORTS

JONATHAN BLOOMFIELD,[1] REMCO POLMAN,[2] PETER O'DONOGHUE,[3] AND LARS MCNAUGHTON[2]

[1]Sports Institute of Northern Ireland, University of Ulster, Jordanstown Campus, Shore Road, Newtownabbey, Co. Antrim, Northern Ireland, United Kingdom, BT37 0QB; [2]Department of Sport, Health & Exercise Science, The University of Hull, Cottingham Road, Hull, East Riding of Yorkshire, United Kingdom, HU6 7RX; [3]School of Sport, PE and Recreation, University of Wales Institute Cardiff, Cyncoed Campus, Cardiff, United Kingdom CF23 6XD.

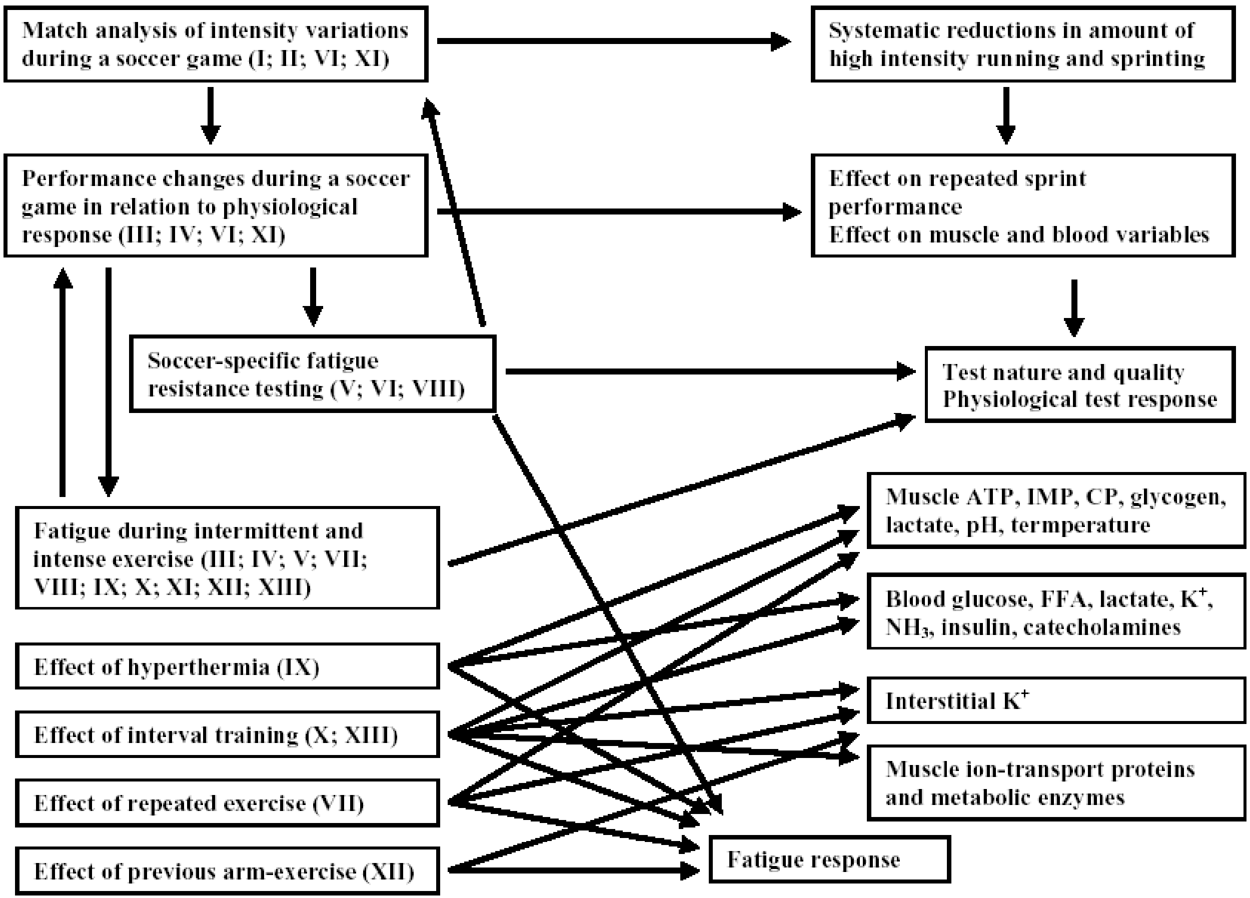
Giochi Sportivi: Topics

- Endurance
- Abilità Ripetere Sprint
- Fatica

Fatica: Calcio

Mohr 2008

Fig. 1.1 Approach to study fatigue development in soccer



Fatica: Calcio

Fatica: Calcio

- Temporanea
- Cumulativa
- “Iniziale”
- Permanente

Fatica: Sommario

Fatica: Handball

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SCANDINAVIAN JOURNAL OF
MEDICINE & SCIENCE
IN SPORTS

Acute fatigue-induced changes in muscle mechanical properties and neuromuscular activity in elite handball players following a handball match

J. B. Thorlund, L. B. Michalsik, K. Madsen, P. Aagaard

Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, Denmark
Corresponding author: Jonas Bloch Thorlund, MSc, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, DK-5230 Odense, Denmark. Tel: +45 6550 3684, Fax: +45 6550 3480, E-mail: jthorlund@health.sdu.dk

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Fatica: Handball

Fatica: Basketball

Journal of Science and Medicine in Sport (2008) 11, 202—208

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ORIGINAL PAPER

The Yo—Yo intermittent recovery test in basketball players

Carlo Castagna[a,b,*], Franco M. Impellizzeri[c], Ermanno Rampinini[c], Stefano D'Ottavio[b], Vincenzo Manzi[b]

[a] *Scuola Regionale dello Sport delle Marche, Italian Olympic Commitee (CONI), Italy*
[b] *School of Sport and Exercise Sciences, University of Rome Tor Vergata, Italy*
[c] *Human Performance Laboratory, S.S. MAPEI, Italy*

Received 4 August 2006; received in revised form 23 February 2007; accepted 26 February 2007

KEYWORDS
Field testing;
Shuttle running;
Intermittent exercise;
Line drill;
Fatigue

Summary The purpose of this study was to examine the physiological correlates of the Yo—Yo intermittent recovery test level 1 (Yo—Yo IR1) in basketball players. Twenty-two male basketball players (means ± S.D., body mass 72.4 ± 11.4 kg, height 181.7 ± 6.9 cm, age 16.8 ± 2.0 years) were tested for maximal oxygen uptake (VO_{2max}), ventilatory threshold (VT) and running economy (RE) on a motorized treadmill. Lower limb explosive strength and anaerobic-capacity was assessed using vertical jumps (CMJ), 15 m shuttle running sprint (15 mSR) and line drill (LD), respectively. The same test battery was replicated after an experimental basketball game in order to assess selective effect of fatigue on physical performance. Pre to post-game CMJ (40.3 ± 5.7 versus 39.9 ± 5.9 cm) and 15 mSR (5.80 ± 0.25 versus 5.77 ± 0.22 s) performances were not significantly different ($p > 0.05$). LD performance decreased significantly post-game (from 26.7 ± 1.3 to 27.7 ± 2.7 s, $p < 0.001$). Yo—Yo IR1 performances (m) were significantly related to VO_{2max} ($r = 0.77$, $p = 0.0001$), speed at VO_{2max} ($r = 0.71$, $p = 0.0001$) and $\%VO_{2max}$ at VT ($r = -0.60$, $p = 0.04$). Yo—Yo IR1 performance was significantly correlated to post-game LD decrements ($r = -0.52$, $p = 0.02$). These findings show that Yo—Yo IR1 may be considered as a valid basketball-specific test for the assessment of aerobic fitness and game-related endurance.
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Fatica: Basketball

Aerobic Fitness:

- Massima Potenza Aerobica VO_2max
- Soglia Anaerobica
- Economia

Pate and Kriska (1984)

Aerobico?

Aerobico Giochi Sportivi

REVIEW ARTICLE

Sports Med 2005; 35 (6): 501-536
0112-1642/05/0006-0501/$34.95/0
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Physiology of Soccer
An Update

Tomas Stølen,[1] *Karim Chamari,*[2] *Carlo Castagna*[3] and *Ulrik Wisløff*[4,5]

1 Human Movement Science Section, Faculty of Social Sciences and Technology Management, Norwegian University of Science and Technology, Trondheim, Norway
2 Unité de Recherche 'Évaluation, Sport, Santé' – National Center of Medicine and Science in Sport (CNMSS), El Menzah, Tunis, Tunisia
3 School of Sport and Exercise Sciences, Faculty of Medicine and Surgery, University of Rome Tor Vergata, Rome, Italy
4 Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway
5 Department of Cardiology, St. Olavs Hospital, Trondheim, Norway

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SCANDINAVIAN JOURNAL OF MEDICINE & SCIENCE IN SPORTS

Physiological demands of competitive basketball

K. Narazaki[1], **K. Berg**[2], **N. Stergiou**[2], **B. Chen**[3]

[1]Department of Integrative Physiology, University of Colorado at Boulder, Boulder, Colorado, USA, [2]School of Health, Physical Education & Recreation, University of Nebraska at Omaha, Omaha, Nebraska, USA, [3]Department of Electronics Engineering, University of Nebraska at Lincoln, Omaha, Nebraska, USA
Corresponding author: Kris Berg, School of Health, Physical Education & Recreation, University of Nebraska at Omaha, 6001 Dodge Street HPER Building Room 207, Omaha, Nebraska 68182-0216, USA. Tel: +1 402 554 2670, Fax: +1 402 554 3693, E-mail: kberg@mail.unomaha.edu

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www.elsevier.com/locate/jsams

Match demands of professional Futsal: A case study

Carlo Castagna[a,*], Stefano D'Ottavio[a], Juan Granda Vera[b], Josè Carlos Barbero Álvarez[b]

[a] *Università di Roma Tor Vergata, Italy*
[b] *Departamento de Educación Física y Deportiva Universidad de Granada, Spain*

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Physical Fitness and Performance

A physiological profile of tennis match play

GERHARD SMEKAL, SERGE P. VON DUVILLARD, CLAUS RIHACEK, ROCHUS POKAN, PETER HOFMANN, RAMON BARON, HARALD TSCHAN, and NORBERT BACHL

Institute of Sports Sciences, Department of Sport Physiology of University Vienna, Vienna, AUSTRIA; Human Performance Laboratory, Department of Physical Education and Exercise Science, University of North Dakota, Grand Forks, ND; and Institute of Sport Sciences, University of Graz, AUSTRIA

ABSTRACT

SMEKAL, G., S. P. VON DUVILLARD, C. RIHACEK, R. POKAN, P. HOFMANN, R. BARON, H. TSCHAN, and N. BACHL. A physiological profile of tennis match play. *Med. Sci. Sports Exerc.*, Vol. 33, No. 6, 2001, pp. 999–1005. **Purpose:** The aim of this investigation was to examine physiological demands of single match play in tennis. **Methods:** 20 players performed 10 matches of 50 min. Respiratory gas exchange measures (RGEM) and heart rates (HR) were measured using two portable systems. Lactate concentration was determined after each game. The average oxygen uptake ($\dot{V}O_2$) of 270 games was 29.1 ± 5.6 $mL \cdot kg^{-1} \cdot min^{-1}$ (51.1 ± 10.9% of $\dot{V}O_{2max}$). Average $\dot{V}O_2$ for a game ranged from 10.4 to 47.8 $mL \cdot kg^{-1} \cdot min^{-1}$ (20.4 and 86.8% of $\dot{V}O_{2max}$). Average lactate concentration (LA) was 2.07 ± 0.9 $mmol \cdot L^{-1}$ (ranging from 0.7 to 5.2 $mmol \cdot L^{-1}$). Furthermore, we monitored the duration of rallies (DR), the effective playing time (EPT), and the stroke frequency (SF). The average values of 270 games were DR: 6.4 ± 4.1 s, EPT: 29.3 ± 12.1%, SF: 42.6 ± 9.6 $shots \cdot min^{-1}$. **Results:** Multiple regression revealed that the DR was the most promising variable for the determination of $\dot{V}O_2$ in match play (r = 0.54). The body surface area (BSA) and EPT were also entered into the calculation model. In games of two defensive players, $\dot{V}O_2$ was significantly higher than in games with at least one offensive player. **Conclusion:** Our results suggest that energy demands of tennis matches are significantly influenced by DR. The highest average $\dot{V}O_2$ of a game of 47.8 $mL \cdot kg^{-1} \cdot min^{-1}$ may be regarded as a guide to assess endurance capacity required to sustain high-intensity periods of tennis matches compared with average $\dot{V}O_2$ of 29.1 $mL \cdot kg^{-1} \cdot min^{-1}$ for the 270 games. Our results suggest that proper conditioning is advisable especially for players who prefer to play from the baseline. **Key Words:** TENNIS FIELD TEST, LACTATE, OXYGEN UPTAKE

Aerobico Giochi Sportivi

- **In pubblicazione**
- **In progresso**

Ben Abdelkrim & Castagna (2009)

Aerobico Giochi Sportivi

80-90% Aerobico

70-80% VO_2max

$48.6\ ml\ kg^{-1}min^{-1}$ ← Futsal

$47.8\ ml\ kg^{-1}min^{-1}$ ← Tennis

$37\ ml\ kg^{-1}min^{-1}$ ← Basket

Aerobico Giochi Sportivi

VO_2max Giochi Sportivi

Relazione Attività Gioco

Validità Costrutto

Intervento Attività Gioco

Stølen et al (2005)

Krustup et al (2005)

Ben Abdelkrim et al (2006)

Ben Abdelkrim et al (2009)

Aerobico Giochi Sportivi

Generalità:

- **Intervento Diretto**
- **Supporto**

Abilità Ripetere Sprint

Aerobico?

REVIEW ARTICLE

Sports Med 2005; 35 (12): 1025-1044
0112-1642/05/0012-1025/$34.95/0

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Physiological and Metabolic Responses of Repeated-Sprint Activities

Specific to Field-Based Team Sports

Matt Spencer,[1,2] *David Bishop*,[1] *Brian Dawson*[1] and *Carmel Goodman*[1]

1 Team Sport Research Group, School of Human Movement and Exercise Science, The University of Western Australia, Crawley, Western Australia, Australia
2 Department of Physiology, Australian Institute of Sport, Canberra, Australian Capital Territory, Australia

Aerobico?

Aerobico?

Eur J Appl Physiol (2005) 95: 27–34
DOI 10.1007/s00421-005-1382-8

ORIGINAL ARTICLE

Grégory Dupont · Grégoire P. Millet
Comlavi Guinhouya · Serge Berthoin

Relationship between oxygen uptake kinetics and performance in repeated running sprints

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© Springer-Verlag 2005

Abstract The purpose of this study was to test the hypothesis that subjects having a shorter time constant for the fast component of $\dot{V}O_2$ kinetics in a transition from rest to constant exercise would maintain their speed for a longer time during repeated sprint exercise (RSE). Eleven male soccer players completed a graded test, two constant exercises at 60% maximal aerobic speed and RSE, consisting of fifteen 40-m sprints alternated with 25 s of active recovery. All the tests were performed on the field (200 m indoor track). The parameters of the $\dot{V}O_2$ kinetics (time delay, time constant, and amplitude of the primary phase) during the

Introduction

In many sports such as soccer, rugby, basketball, or hockey, decisive actions are often preceded by sprints. In these sports, players have to sprint to receive the ball before their opponents, to surprise them, then to kick, throw, or hit the ball before the opponent reaches it. During a soccer match, high-speed running (≥21 km h^{-1}) represents only 2.8% of the total playing time (Bangsbo 1994a). However, it appears that high-speed runs are decisive and the most obvious difference

Aerobico?

Match Analysis:

- Fasi Cruciali
- (Medie)

Aerobico?

Aerobico?

Sequenze ad alta intensità

Fatica:

- Temporanea
- Cumulativa

Mohr (2008)

Aerobico?

Questions:

- Quale?
- Quando?
- How much is enough?
- Concurrent Training?

Aerobic endurance training improves soccer performance

JAN HELGERUD, LARS CHRISTIAN ENGEN, ULRIK WISLØFF, and JAN HOFF

Norwegian University of Science and Technology, Department of Sport Sciences, N-7491 Trondheim, NORWAY

ABSTRACT

HELGERUD, J., L. C. ENGEN, U. WISLØFF, and J. HOFF. Aerobic endurance training improves soccer performance. *Med. Sci. Sports Exerc.*, Vol. 33, No. 11, 2001, pp. 1925–1931. **Purpose:** The aim of the present study was to study the effects of aerobic training on performance during soccer match and soccer specific tests. **Methods:** Nineteen male elite junior soccer players, age 18.1 ± 0.8 yr, randomly assigned to the training group ($N = 9$) and the control group ($N = 10$) participated in the study. The specific aerobic training consisted of interval training, four times 4 min at 90–95% of maximal heart rate, with a 3-min jog in between, twice per week for 8 wk. Players were monitored by video during two matches, one before and one after training. **Results:** In the training group: a) maximal oxygen uptake ($\dot{V}O_{2max}$) increased from 58.1 ± 4.5 $mL \cdot kg^{-1} \cdot min^{-1}$ to 64.3 ± 3.9 $mL \cdot kg^{-1} \cdot min^{-1}$ ($P < 0.01$); b) lactate threshold improved from 47.8 ± 5.3 $mL \cdot kg^{-1} \cdot min^{-1}$ to 55.4 ± 4.1 $mL \cdot kg^{-1} \cdot min^{-1}$ ($P < 0.01$); c) running economy was also improved by 6.7% ($P < 0.05$); d) distance covered during a match increased by 20% in the training group ($P < 0.01$); e) number of sprints increased by 100% ($P < 0.01$); f) number of involvements with the ball increased by 24% ($P < 0.05$); g) the average work intensity during a soccer match, measured as percent of maximal heart rate, was enhanced from 82.7 ± 3.4% to 85.6 ± 3.1% ($P < 0.05$); and h) no changes were found in maximal vertical jumping height, strength, speed, kicking velocity, kicking precision, or quality of passes after the training period. The control group showed no changes in any of the tested parameters. **Conclusion:** Enhanced aerobic endurance in soccer players improved soccer performance by increasing the distance covered, enhancing work intensity, and increasing the number of sprints and involvements with the ball during a match. **Key Words:** $\dot{V}O_{2max}$, LACTATE THRESHOLD, RUNNING ECONOMY, SKILL

Interval-Training:

- 4x4min 90-95% FCmax
- Rec. 3min 70-70% FCmax
- 2 x week x 4-8 weeks

Interval-Training:

- Miglioramento Attività Gioco
- Aumento Aerobic Fitness
- Conservazione Performance Neuromuscolare

Aerobic Training

Generico Vs Specifico:

- Interval Training
- Small-Sided Games
- Sprint Training

Aerobic Training

F. M. Impellizzeri[1]
S. M. Marcora[2]
C. Castagna[3]
T. Reilly[4]
A. Sassi[1]
F. M. Iaia[1]
E. Rampinini[1]

Physiological and Performance Effects of Generic versus Specific Aerobic Training in Soccer Players

Abstract

The aim of this study was to compare the effects of specific (small-sided games) vs. generic (running) aerobic interval training on physical fitness and objective measures of match performance in soccer. Forty junior players were randomly assigned to either generic (n = 20) or specific (n = 20) interval training consisting of 4 bouts of 4 min at 90 – 95 % of maximum heart rate with 3 min active rest periods, completed twice a week. The following outcomes were measured at baseline (Pre), after 4 weeks of pre-season training (Mid), and after a further 8 weeks of training during the regular season (Post): maximum oxygen uptake, lactate threshold (Tlac), running economy at Tlac, a soccer-specific endurance test (Ekblom's circuit), and indices of physical performance during soccer matches (total distance and time spent standing, walking, and at low- and high-intensity running speed). Training load, as quantified by heart rate and rating of perceived exertion, was recorded during all training sessions and was similar between groups. There were significant improvements in aerobic fitness and match performance in both groups of soccer players, especially in response to the first 4 weeks of pre-season training. However, no significant differences between specific and generic aerobic interval training were found in any of the measured variables including soccer specific tests. The results of this study showed that both small-sided games and running are equally effective modes of aerobic interval training in junior soccer players.

Key words
Small-sided games · aerobic fitness · match analysis · football · interval training

Introduction

Aerobic fitness is important for soccer players. A high maximal aerobic power ($\dot{V}O_{2max}$) has been correlated with work-rate during a game and a high aerobic capacity is reported to aid recovery during high-intensity intermittent exercise, typical of soccer performance and training [35]. Furthermore, an increase in the capacity of the oxygen transport system leads to a higher aerobic contribution to the energy expended, taxing the anaerobic energy system less and, consequently, reducing fatigue through sparing glycogen and preventing the decrease of muscle pH [5, 6, 8, 10, 41]. The relevance of aerobic fitness for soccer players has been also confirmed by some studies showing a relationship between aerobic power and competitive ranking, team level, and distance covered during the match [1, 13, 27, 39, 45]. For these reasons, soccer training programmes commonly include aerobic conditioning.

Aerobic Training

Aerobic Training

Impellizzeri e coll 2006

Training

Intermittente Lungo

4x4' corsa 90-95% FC_{max}

Rec.3' 60-70% FC_{max}

Helgerud e coll 2001

Intermittente Casuale

4x4' Partite 90-95% FC_{max}

Rec. 3' 60-70%

Generic vs Specific

Aerobic Training

Non Significative Differenze!!!

Training

Intermittente Lungo

Helgerud e coll 2001

=

Intermittente Casuale

Impellizzeri e coll 2006

Generic vs Specific

Training Study

Impellizzeri e coll 2006

Pre Campionato 4 sett.

	Int Lungo	Int Casuale
VO2max	+7.4%	+6.4%
LT	+8%	+7.2%
RE	------	------
Ekblom	-12%	-13%

Training Study

Training Study

Campionato 8 sett.

	Int Lungo	Int Casuale
VO2max	+8.3%	+7.1%
LT	+13%	+10.8%
RE	------	------
Ekblom	-14.4%	-15.8%

Impellizzeri e coll 2006

Training Study

Aerobic Training

Allenamento SPECIFICO???

Training → { Intermittente Lungo / Intermittente Casuale }

Intermittente Lungo

Helgerud e coll 2001

=

Intermittente Casuale

Impellizzeri e coll 2006

Generic vs Specific Training

Evidenza Effetti:

Training →

4x4’ ESERCIZIO 90-95% FC_{max}

Rec.3’ 60-70% FC_{max}

Aerobic Fitness

Match Performance

Helgerud e coll 2001

Impellizzeri e coll 2006

Evidenza Effetti:

Training → 4x4′ ESERCIZIO 90-95% FC_{max}

Rec.3′ 60-70% FC_{max}

Effetti → Aerobic Fitness

Match Performance

Helgerud e coll 2001

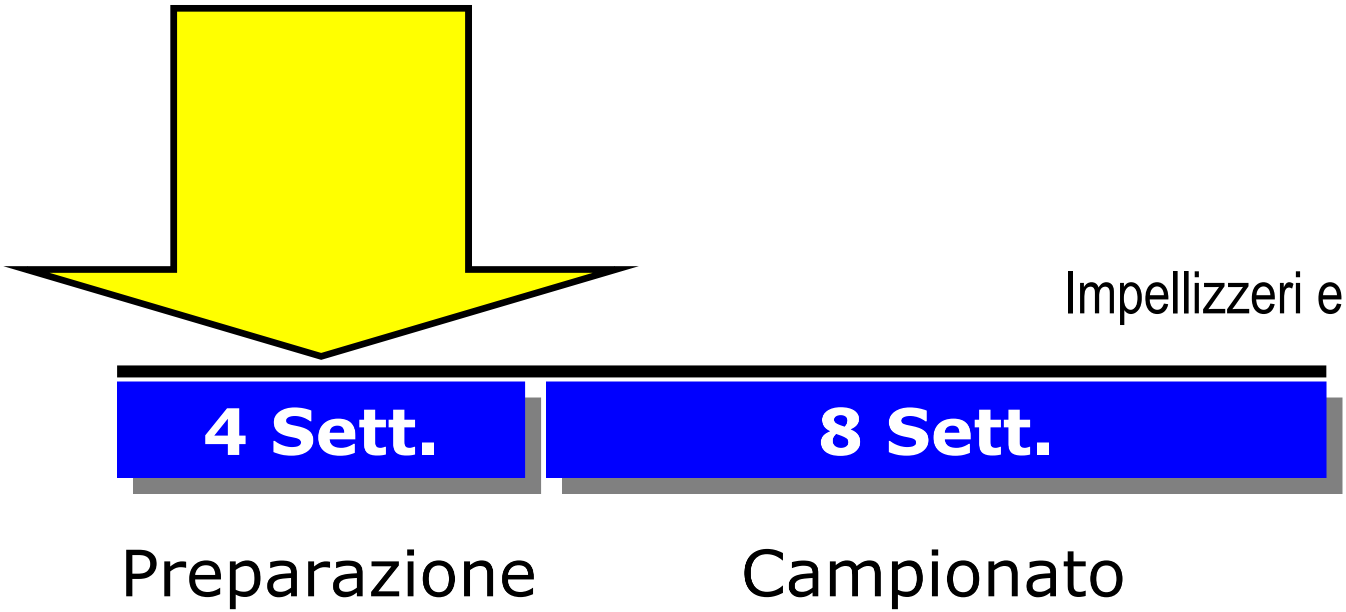
Impellizzeri e coll 2006

Training Study

Carico Aerobico Preparazione

9 sedute [144min] 6% Carico Totale

Impellizzeri e coll 2006

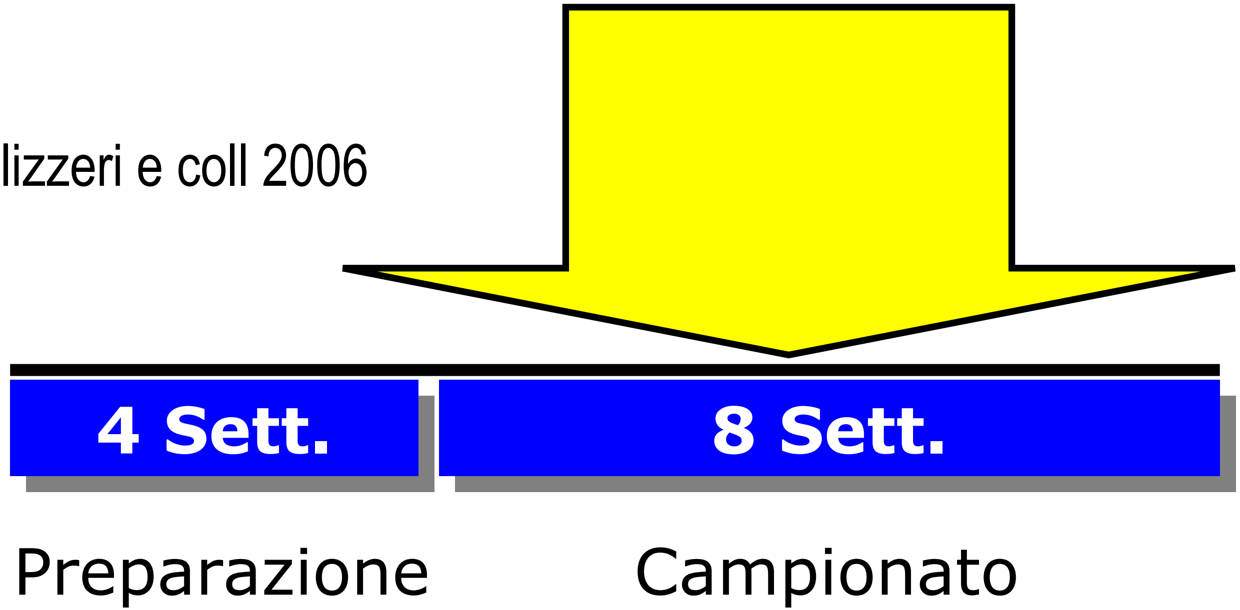


Training Study

Carico Aerobico Campionato

15 sedute [240min] 7% Carico Totale

Impellizzeri e coll 2006



Training Study

Training Study

Aerobic High-Intensity Intervals Improve $\dot{V}O_{2max}$ More Than Moderate Training

JAN HELGERUD[1,2], KJETILL HØYDAL[1], EIVIND WANG[1], TRINE KARLSEN[1], PÅLR BERG[1], MARIUS BJERKAAS[1], THOMAS SIMONSEN[1], CECILIES HELGESEN[1], NINAL HJORTH[1], RAGNHILD BACH[1], and JAN HOFF[1,3]

[1]*Department of Circulation and Imaging, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, NORWAY;* [2]*Hokksund Medical Rehabilitation Centre, Hokksund, NORWAY;* [3]*Department of Physical Medicine and Rehabilitation, St. Olav's University Hospital, Trondheim, NORWAY*

ABSTRACT

HELGERUD, J., K. HØYDAL, E. WANG, T. KARLSEN, P. BERG, M. BJERKAAS, T. SIMONSEN, C. HELGESEN, N. HJORTH, R. BACH, and J. HOFF. Aerobic High-Intensity Intervals Improve $\dot{V}O_{2max}$ More Than Moderate Training. *Med. Sci. Sports Exerc.*, Vol. 39, No. 4, pp. 665–671, 2007. **Purpose:** The present study compared the effects of aerobic endurance training at different intensities and with different methods matched for total work and frequency. Responses in maximal oxygen uptake ($\dot{V}O_{2max}$), stroke volume of the heart (SV), blood volume, lactate threshold (LT), and running economy (C_R) were examined. **Methods:** Forty healthy, nonsmoking, moderately trained male subjects were randomly assigned to one of four groups:1) long slow distance (70% maximal heart rate; HR_{max}); 2) lactate threshold (85% HR_{max}); 3) 15/15 interval running (15 s of running at 90–95% HR_{max} followed by 15 s of active resting at 70% HR_{max}); and 4) 4 × 4 min of interval running (4 min of running at 90–95% HR_{max} followed by 3 min of active resting at 70% HR_{max}). All four training protocols resulted in similar total oxygen consumption and were performed 3 $d \cdot wk^{-1}$ for 8 wk. **Results:** High-intensity aerobic interval training resulted in significantly increased $\dot{V}O_{2max}$ compared with long slow distance and lactate-threshold training intensities ($P < 0.01$). The percentage increases for the 15/15 and 4 × 4 min groups were 5.5 and 7.2%, respectively, reflecting increases in $\dot{V}O_{2max}$ from 60.5 to 64.4 $mL \cdot kg^{-1} \cdot min^{-1}$ and 55.5 to 60.4 $mL \cdot kg^{-1} \cdot min^{-1}$. SV increased significantly by approximately 10% after interval training ($P < 0.05$). **Conclusions:** High–aerobic intensity endurance interval training is significantly more effective than performing the same total work at either lactate threshold or at 70% HR_{max}, in improving $\dot{V}O_{2max}$. The changes in $\dot{V}O_{2max}$ correspond with changes in SV, indicating a close link between the two. **Key Words:** LACTATE THRESHOLD, AEROBIC POWER, 4 × 4-MIN INTERVALS, 15/15 TRAINING, STROKE VOLUME, BLOOD VOLUME

BASIC SCIENCES

Training Study

Aerobic Training

Helgerud e coll 2007

Training

Intermittente Lungo

4x4′ corsa 90-95% FC_{max}
Rec.3′ 60-70% FC_{max}

Intermittente Breve

15″-15″ 90-95% FC_{max} Rec. 70%

Training

Lungo Lento

70% FC_{max}

Soglia Anaerobica

85% FC_{max}

Intermittente vs Continuo

Aerobic Training

Helgerud e coll 2007

TABLE 1. Changes in physiological parameters from pre- to posttraining.

	LSD (*N* = 10)		LT (*N* = 10)		15/15 (*N* = 10)		4 × 4 min (*N* = 10)	
	Pretraining	Posttraining	Pretraining	Posttraining	Pretraining	Posttraining	Pretraining	Posttraining
$\dot{V}O_{2max}$								
($L \cdot min^{-1}$)	4.77 ± 0.49	4.74 ± 0.46	4.58 ± 0.38	4.67 ± 0.40	4.91 ± 0.60	5.18 ± 0.56***#[a]	4.56 ± 0.62	4.89 ± 0.52***#[b]
($mL \cdot kg^{-1} \cdot min^{-1}$)	55.8 ± 6.6	56.8 ± 6.3	59.6 ± 7.6	60.8 ± 7.1	60.5 ± 5.4	64.4 ± 4.4**#[a]	55.5 ± 7.4	60.4 ± 7.3***#[b]
($mL \cdot kg^{-0.75} \cdot min^{-1}$)	169.4 ± 17.5	171.6 ± 17.0	176.1 ± 18.0	179.5 ± 16.6	183.1 ± 16.4	194.7 ± 14.7**#[a]	167.0 ± 19.9	181.7 ± 19.1***#[b]

Intermittente vs Continuo

Aerobic Training

Helgerud e coll 2007

Training

Training

Training interventions. The present study consists of four training interventions. To equate the total amount of work for each of the training sessions, a thorough calculation was carried out.

1. Long slow distance running (LSD): The first group performed a continuous run at 70% HR_{max} (137 ± 7 bpm) for 45 min.
2. Lactate threshold running (LT): The second group performed a continuous run at lactate threshold (85% HR_{max}, 171 ± 10 bpm) for 24.25 min.
3. 15/15 interval running (15/15): The third group performed 47 repetitions of 15-s intervals at 90–95% HR_{max} (180 to 190 ± 5 bpm) with 15 s of active resting periods at warm-up velocity, corresponding to 70% HR_{max} (140 ± 6 bpm) between.
4. 4 × 4-min interval running (4 × 4 min): A fourth group trained 4 × 4-min interval training at 90–95% HR_{max} (180 to 190 ± 5 bpm) with 3 min of active resting periods at 70% HR_{max} (140 ± 6 bpm) between each interval.

BASIC SCIENCES

Intermittente vs Continuo

Training Study

3g/sett.x8 sett.

	4'x4'	15"-15"	70%	85%
VO2max	+7.2%	+5.5%	-----	-----
RE	-10%	-7.5%	-7.5%	-12%
vLT	+8.7%	+9.8%	+8%	+12%
SV	+10.4%	+9.5%	------	------

Helgerud e coll 2007

Intermittente vs Continuo

Sprint Training:

Training → Aerobic Fitness

Sprint Training

Eur J Appl Physiol (1998) 78: 163–169

© Springer-Verlag 1998

ORIGINAL ARTICLE

Brian Dawson · Martin Fitzsimons · Simon Green
Carmél Goodman · Michael Carey · Keith Cole

Changes in performance, muscle metabolites, enzymes and fibre types after short sprint training

Accepted: 5 January 1998

Abstract In contrast to endurance training, little research has been carried out to investigate the effects of short (< 10 s) sprint training on performance, muscle metabolism and fibre types. Nine fit male subjects performed a mean of 16 outdoor sprint running training sessions over 6 weeks. Distances sprinted were 30–80 m at 90–100% maximum speed and between 20 and 40 sprints were performed in each session. Endurance (maximal oxygen consumption; $\dot{V}O_{2max}$), sprint (10 m and 40 m times), sustained sprint (supramaximal treadmill run) and repeated sprint (6 × 40 m sprints, 24 s recovery between each) performance tests were performed before and after training. Muscle biopsy samples (vastus lateralis) were also taken to examine changes in metabolites, enzyme activities and fibre types. After training, significant improvements were seen in 40 m time ($P < 0.01$), supramaximal treadmill run time ($P < 0.05$), repeated sprint performance ($P < 0.05$) ...

... thase activity decreased ($P < 0.01$), but no significant changes were recorded in myokinase and phosphofructokinase activities. The proportion of type II muscle fibres increased significantly ($P < 0.05$). These results demonstrate that 6 weeks of short sprint training can improve endurance, sprint and repeated sprint ability in fit subjects. Increases in the proportion of type II muscle fibres are also possible with this type of training.

Key words Maximal intensity · Phosphagens · Type I and II muscle fibres · Maximal oxygen consumption · Enzyme activities

Introduction

Short sprint training is utilised in the physical preparation of athletes for many sports, yet the physiological

Sprint Training

Sprint Training

Protocol

N=9

20-42 rep./session

Sprint <10s

90-100% max

30-80 m

Results

Test	Increments
10m	3.2%
40m	2.4%+++
RSA 6x40m/24s	2.2%+++
VO_{2max}	6.1%+++
Max Run	11.2%+++

16 sessions

6 weeks ~3d/w

Sprint Training

Sprint Training

Protocol

Dawson e coll. EJAP 1998

Week	Session							% Maximum effort	W:R	Number of reps.
1	1	6 × 80	6 × 60	6 × 40	4 × 40			90	1:6	22
	2	6 × 80	6 × 60	6 × 40	4 × 40			90	1:6	22
	3	6 × 80	6 × 60	6 × 40	6 × 40			90	1:6	24
2	4	6 × 80	6 × 60	6 × 40	8 × 30			90	1:5	26
	5	6 × 80	6 × 60	6 × 40	8 × 30			90	1:5–6	26
	6	4 × 80	6 × 50	8 × 40	6 × 40	6 × 30		90/100	1:5–6	30
3	7	4 × 80	6 × 50	8 × 40	6 × 40	6 × 30		90/100	1:6	30
	8	8 × 30	6 × 50	8 × 30	6 × 40	6 × 30		90/100	1:5–6	34
	9	8 × 30	6 × 50	8 × 30	6 × 40	6 × 30		90/100	1:5–6	34
4	10	6 × 60	8 × 50	6 × 40	8 × 50	6 × 60		90/100	1:5	34
	11	6 × 60	8 × 50	6 × 40	8 × 50	6 × 60		90/100	1:6	34
	12[a]	6 × 60	8 × 50	6 × 40	6 × 40			90/100	1:5	24
5	13	8 × 50	8 × 40	8 × 40	8 × 40	8 × 50		90/100	1:5–6	40
	14	8 × 50	8 × 40	8 × 30	8 × 40	8 × 50		90/100	1:5–6	40
	15	8 × 50	8 × 40	8 × 30	8 × 40	8 × 50		90/100	1:4–6	40
6	16	8 × 50	8 × 40	8 × 30	6 × 50	6 × 40	6 × 30	90/100	1:4–6	42
	17	8 × 30	8 × 40	8 × 50	6 × 50	6 × 40	6 × 30	90/100	1:4–6	42
	18	8 × 30	8 × 40	6 × 50	6 × 50	6 × 40	6 × 30	90/100	1:4–6	40

Sprint Training

Training & Testing

Sprint vs. Interval Training in Football

Authors D. Ferrari Bravo[1], F. M. Impellizzeri[1,2], E. Rampinini[1], C. Castagna[3], D. Bishop[4], U. Wisloff[5]

Affiliations The affiliations are listed at the end of the article

Key words
- soccer
- aerobic power
- anaerobic training
- specific endurance

Abstract

The aim of this study was to compare the effects of high-intensity aerobic interval and repeated-sprint ability (RSA) training on aerobic and anaerobic physiological variables in male football height and power, and RSA. Significant group × time interaction was found for YYIRT ($p = 0.003$) with RSG showing greater improvement (from 1917 ± 439 to 2455 ± 488 m) than ITG (from 1846 ± 329 to 2077 ± 300 m). Similarly, a significant interaction was found in RSA mean time

Sprint Training

Sprint Training

Bravo e coll 2008

Training

Intermittente Lungo

4x4′ corsa 90-95% FC_{max}

Rec.3′ 60-70% FC_{max}

Helgerud e coll 2001

Sprint Training

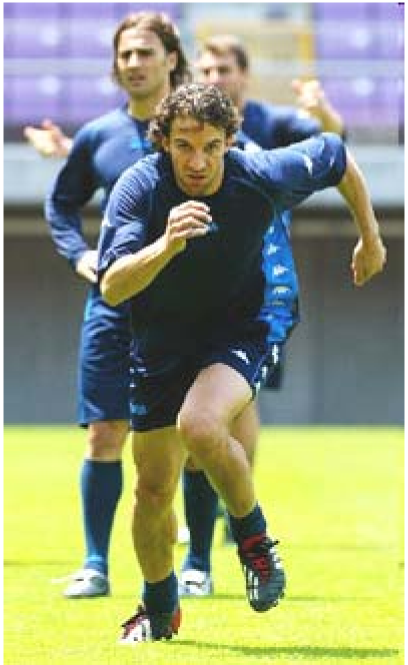
3x6x40m navetta

Rec. 20′′/rip & 4′/serie

Sprint Training

Interval *vs* Sprint Training

Bravo e coll 2008	ST	IT	Δ%
VO_2max	=		5.9
RCP	=		3.6
Yo-Yo IR1	28.1	12.5	
CMJ	n.s.		
SJ	n.s.		
10m	n.s.		
RSA	2.1	n.s.	



Sprint Training

Interval *vs* Sprint Training

Bravo e coll 2008

- Simile Effetto Aerobic Fitness
- Effetto Specifico ST
- No Effetto Neuromuscolare

VO_2max in Youth Football?

Results

Construct (elite level) Validity

for

60 $ml \cdot kg^{-1} \cdot min^{-1}$ Reilly et al 2000

Castagna et al 2008 unpublished data

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Take Home Message

Small-Sided Games

@

Interval-Running

Aerobic Fitness Training

Journal of Sports Sciences, April 2007; 25(6): 659 – 666

Routledge
Taylor & Francis Group

Factors influencing physiological responses to small-sided soccer games

ERMANNO RAMPININI[1], FRANCO M. IMPELLIZZERI[1], CARLO CASTAGNA[2], GRANT ABT[3], KARIM CHAMARI[4], ALDO SASSI[1], & SAMUELE M. MARCORA[5]

[1]*Human Performance Laboratory, S.S. MAPEI, Castellanza, Varese, Italy,* [2]*School of Motor Sciences, University of Tor Vergata, Rome, Italy,* [3]*St. Martin's College, Lancaster, UK,* [4]*Unité de Recherche "Evaluation, Sport, Santé", National Centre of Medicine and Science in Sports, El Menzah, Tunisia, and* [5]*School of Sport, Health and Exercise Sciences, University of Wales, Bangor, UK*

(Accepted 26 April 2006)

Valutazione?

Aerobic Fitness

Aerobic Performance

Test da Campo

Aerobic Performance

The Yo-Yo Intermittent Recovery Test: Physiological Response, Reliability, and Validity

PETER KRUSTRUP[1], MAGNI MOHR[1], TOMMAS AMSTRUP[3], TORBEN RYSGAARD[3], JOHNNY JOHANSEN[3], ADAM STEENSBERG[2], PREBEN K. PEDERSEN[3], and JENS BANGSBO[1]

[1]Institute of Exercise and Sport Sciences, August Krogh Institute, Department of Human Physiology, and [2]Copenhagen Muscle Research Centre, Rigshospitalet, University of Copenhagen, DENMARK; [3]Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, DENMARK

ABSTRACT

KRUSTRUP, P., M. MOHR, T. AMSTRUP, T. RYSGAARD, J. JOHANSEN, A. STEENSBERG, P. K. PEDERSEN, and J. BANGSBO. The Yo-Yo Intermittent Recovery Test: Physiological Response, Reliability, and Validity. *Med. Sci. Sports Exerc.*, Vol. 35, No. 4, pp. 697–705, 2003. **Purpose:** To examine the physiological response and reproducibility of the Yo-Yo intermittent recovery test and its application to elite soccer. **Methods:** Heart rate was measured, and metabolites were determined in blood and muscle biopsies obtained before, during, and after the Yo-Yo test in 17 males. Physiological measurements were also performed during a Yo-Yo retest and an exhaustive incremental treadmill test (ITT). Additionally, 37 male elite soccer players performed two to four seasonal tests, and the results were related to physical performance in matches. **Results:** The test-retest CV for the Yo-Yo test was 4.9%. Peak heart rate was similar in ITT and Yo-Yo test (189 ± 2 vs 187 ± 2 bpm), whereas peak blood lactate was higher ($P < 0.05$) in the Yo-Yo test. During the Yo-Yo test, muscle lactate increased eightfold ($P < 0.05$) and muscle creatine phosphate (CP) and glycogen decreased ($P < 0.05$) by 51% and 23%, respectively. No significant differences were observed in muscle CP, lactate, pH, or glycogen between 90 and 100% of exhaustion time. During the precompetition period, elite soccer players improved ($P < 0.05$) Yo-Yo test performance and maximum oxygen uptake ($\dot{V}O_{2max}$) by 25 ± 6 and 7 ± 1%, respectively. High-intensity running covered by the players during games was correlated to Yo-Yo test performance ($r = 0.71$, $P < 0.05$) but not to $\dot{V}O_{2max}$ and ITT performance. **Conclusion:** The test had a high reproducibility and sensitivity, allowing for detailed analysis of the physical capacity of athletes in intermittent sports. Specifically, the Yo-Yo intermittent recovery test was a valid measure of fitness performance in soccer. During the test, the aerobic loading approached maximal values, and the anaerobic energy system was highly taxed. Additionally, the study suggests that fatigue during intense intermittent short-term exercise was unrelated to muscle CP, lactate, pH, and glycogen. **Key Words:** MUSCLE METABOLITES, INTERMITTENT EXERCISE, FATIGUE, TIME-MOTION ANALYSIS, SOCCER PERFORMANCE

Yo-Yo IR1

Aerobic Performance

Yo-Yo Intemittent Recovery Test

↓

Pestazione Fisica di Gioco

Yo-Yo IR1

Aerobic Performance

Journal of Sports Sciences, Month 2008; 26(0): 1–8

Routledge
Taylor & Francis Group

Fitness determinants of success in men's and women's football

IÑIGO MUJIKA[1], JUANMA SANTISTEBAN[1], FRANCO M. IMPELLIZZERI[2], & CARLO CASTAGNA[3]

[1]*Department of Research and Development, Athletic Club Bilbao, Bilbao, Spain,* [2]*Neuromuscular Research Laboratory, Schulthess Klinik, Zurich, Switzerland and* [3]*School of Sport and Exercise Sciences, University of Rome "Tor Vergata", Rome, Italy*

(Accepted 22 August 2008)

Abstract

In this study, we examined gender and age differences in physical performance in football. Thirty-four elite female and 34 elite male players (age 17 ± 1.6 to 24 ± 3.4 years) from a professional football club were divided into four groups ($n = 17$ each) according to gender and competitive level (senior males, senior females, junior males, and junior females). Players were tested for specific endurance (Yo-YoIR1), sprint over 15 m (Sprint-15m), vertical jump without (CMJ) or with (ACMJ) arm swing, agility (Agility-15m), and ball dribbling over 15 m (Ball-15m). The Yo-YoIR1 and Agility-15m performances showed both a gender and competitive level difference ($P < 0.001$). Senior and junior males covered 97 and 153% more distance during the Yo-YoIR1 than senior and junior females, respectively ($P < 0.001$). Gender but not age differences were found for Sprint-15m performance ($P < 0.001$). No difference in vertical jump and Ball-15m performances were found between senior and junior males ($P > 0.05$). More marked gender differences were evident in endurance than in anaerobic performance in female players. These results show major fitness differences by gender for a given competitive level in football players. It is suggested that training and talent identification should focus on football-specific endurance and agility as fitness traits in post-adolescent players of both sexes.

Keywords: *Soccer, performance, gender difference, intermittent exercise, agility*

Yo-Yo IR1

Yo-Yo Intermittent Recovery

Direct Validity **Level 1**

- **Referees** Krustrup et al 2001
- **Adult Male-Football** Krustrup et al 2003
- **Adult Female-Football** Krustrup et al 2005
- **Young Male-Football** Castagna et al 2008
- **Basketball** Castagna et al 2008
- **Handball** Hermassi et al 2008

Yo-Yo Intermittent Recovery

Physical Fitness and Performance

Effect of Match-Related Fatigue on Short-Passing Ability in Young Soccer Players

ERMANNO RAMPININI[1], FRANCO M. IMPELLIZZERI[1,2], CARLO CASTAGNA[3], ANDREA AZZALIN[1], DUCCIO FERRARI BRAVO[1], and ULRIK WISLØFF[4]

[1]Human Performance Laboratory, Mapei Sport Research Center. Castellanza, Varese, ITALY; [2]Neuromuscular Research Laboratory, Schulthess Clinic, Zurich, SWITZERLAND; [3]School of Sport and Exercise Sciences, Faculty of Medicine and Surgery, University of Rome Tor Vergata, Rome, ITALY; and [4]Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Faculty of Medicine, Trondheim, NORWAY

ABSTRACT

RAMPININI, E., F. M. IMPELLIZZERI, C. CASTAGNA, A. AZZALIN, D. F. BRAVO, and U. WISLØFF. Effect of Match-Related Fatigue on Short-Passing Ability in Young Soccer Players. *Med. Sci. Sports Exerc.*, Vol. 40, No. 5, pp. 000–000, 2008. **Purpose:** To examine whether the fatigue accumulated during match play or determined by short bouts of high-intensity intermittent activities affect short-passing ability in junior soccer players. A further aim was to examine the influence of physical fitness as measured using the Yo-Yo Intermittent Recovery Test (YYIRT) on the changes in short-passing ability after a 5-min simulation of high-intensity activities (HIS). **Methods:** Sixteen players (mean ± SD: age 17.6 ± 0.5 yr, height 174 ± 7 cm, body mass 68 ± 6 kg) participated in the study. A quasi-experimental control-period design was used for the study. Short-passing ability was measured using the Loughborough Soccer Passing Test (LSPT). Players completed the LSPT in two sessions during the 1-wk control period, followed by two unofficial matches during which the LSPT was performed during and after the first and the second halves of the game. Furthermore, the change in LSPT performance was determined after 5 min of HIS. **Results:** A decline in LSPT performance was found during and after the game ($P < 0.01$). The accuracy of the LSPT decreased after the HIS. A significant correlation was found between the YYIRT scores and the decline in LSPT performance (accuracy, total time, total time with penalties) after HIS ($r = -0.51$ to -0.65; $P < 0.05$). **Conclusions:** This study showed that the fatigue developed during a match and after relatively short bouts of high-intensity intermittent activities has a detrimental effect on short-passing ability, and that the fatigue-related decline in technical proficiency for a given intensity is associated with the fitness level of the players. **Key Words:** EFFORT, PHYSICAL FITNESS, DETERIORATION, GAME, TECHNICAL SKILLS

Yo-Yo Intermittent Recovery

Yo-Yo Intermittent Recovery

Direct Validity **Level 1**

- **Referees** Krustrup et al 2001
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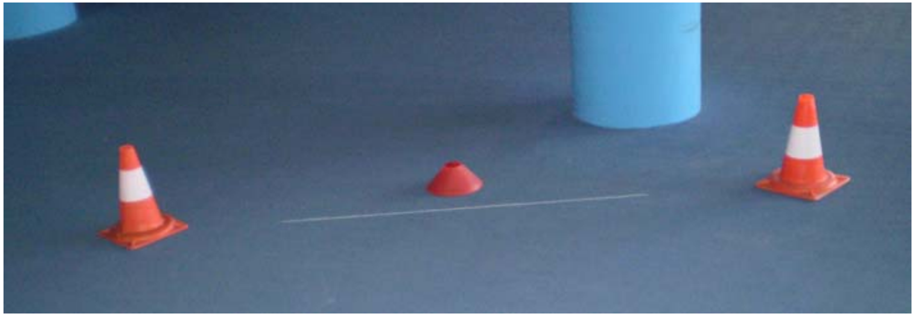
- **Young Male-Football** Castagna et al 2008
- **Basketball** Castagna et al 2008
- **Handball** Hermassi et al 2008

Yo-Yo Intermittent Recovery

Yo-Yo Tests (L1-2)

Field Tests   Shuttle-Running

- **Endurance**
- **Intermittent Endurance**
- **Intermittent Recovery**



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Yo-Yo Intermittent Recovery

Direct Validity **Level 1**

- **Referees** Krustrup et al 2001
- **Adult Male-Football** Krustrup et al 2003
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- **Young Male-Football** Castagna et al 2008

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Yo-Yo Intermittent Recovery

Protocol **Level 1**

- 20m Shuttle Running
- 10” Recovery /40m
- 2x5m in 10”
- Starting Speed $10 km \cdot h^{-1}$

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Yo-Yo Intermittent Recovery

Direct Validity **Male Young Players**

- **N=22 age 14.1±02 yrs**
- **Yo-Yo IR1 → 842±352 m**
- **Match Analysis GPS Technology**

Castagna et al 2008 in press JSCR

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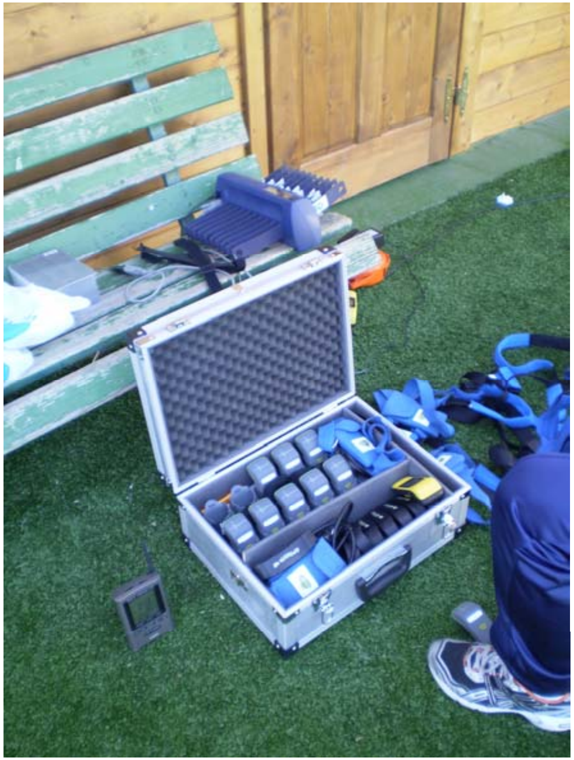
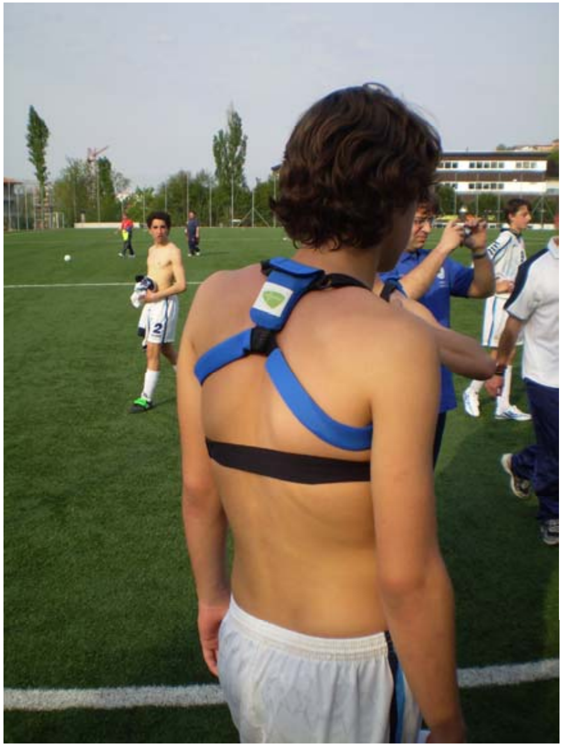
Yo-Yo Intermittent Recovery

Direct Validity **Male Young Players**





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Yo-Yo Intermittent Recovery

Direct Validity **Male Young Players**

Results:

- **Yo-Yo IR1 vs HI → r=.77,** $p<.01$
- **Yo-Yo IR1 vs TD → r=.65,** $p<.01$

Castagna et al 2008 in press JSCR

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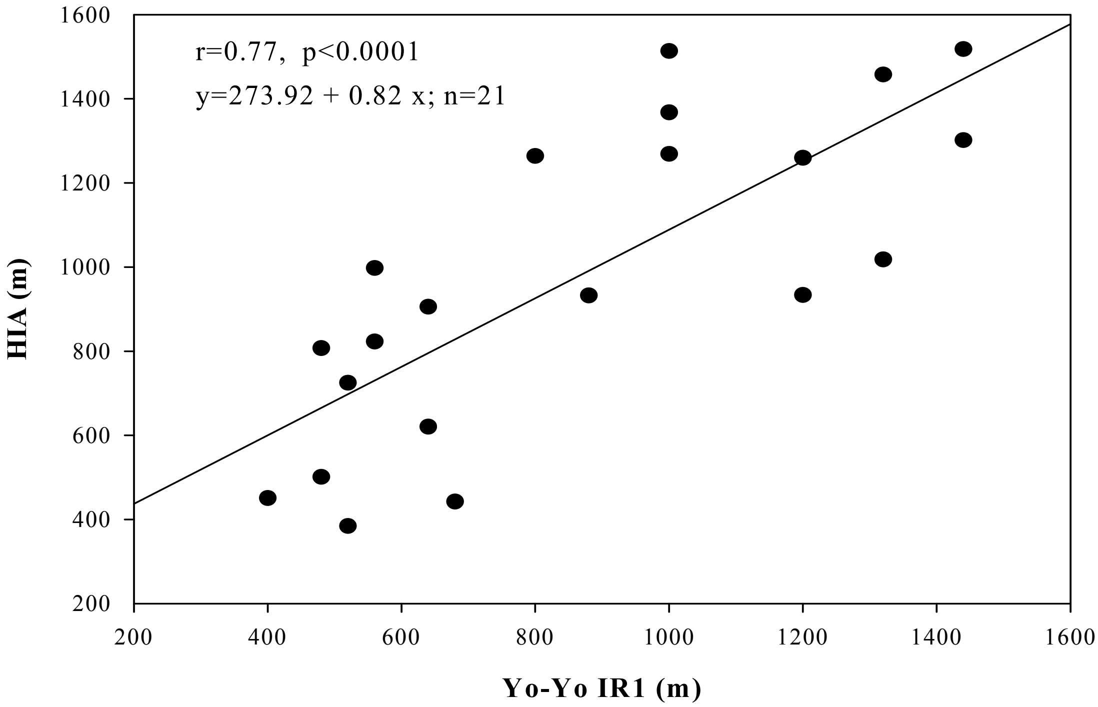
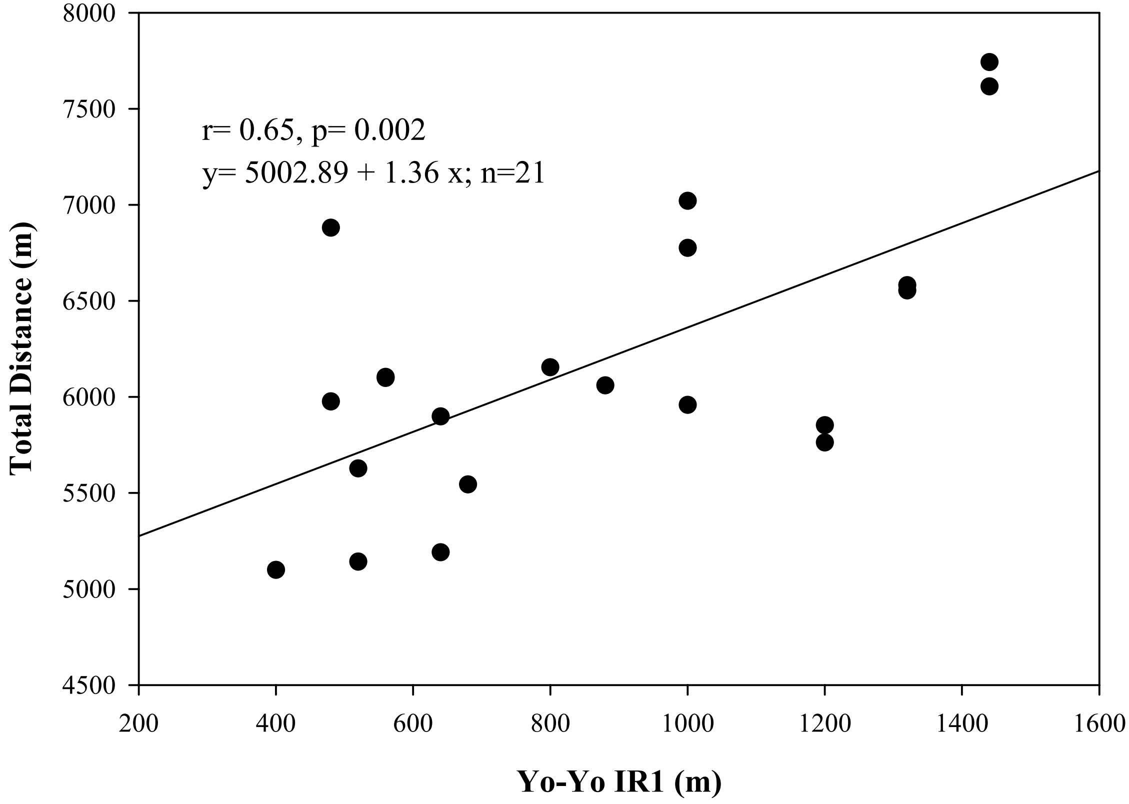
Yo-Yo Intermittent Recovery

Direct Validity **Male Young Players**



Yo-Yo Intermittent Recovery

Direct Validity **Male Young Players**



Physical Fitness and Performance

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ERMANNO RAMPININI[1], FRANCO M. IMPELLIZZERI[1,2], CARLO CASTAGNA[3], ANDREA AZZALIN[1], DUCCIO FERRARI BRAVO[1], and ULRIK WISLØFF[4]

[1]*Human Performance Laboratory, Mapei Sport Research Center. Castellanza, Varese, ITALY;* [2]*Neuromuscular Research Laboratory, Schulthess Clinic, Zurich, SWITZERLAND;* [3]*School of Sport and Exercise Sciences, Faculty of Medicine and Surgery, University of Rome Tor Vergata, Rome, ITALY; and* [4]*Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Faculty of Medicine, Trondheim, NORWAY*

ABSTRACT

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Yo-Yo Intermittent Endurance

Protocol **Level 1**

- 20m Shuttle Running
- 5” Recovery /40m
- 2x2.5m in 5”
- Starting Speed 8 $km \cdot h^{-1}$

Yo-Yo Intermittent Recovery

Male Young Players

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Yo-Yo Intermittent Endurance L1

Unpublished Study

	Yo-Yo IE^{High}	Yo-Yo IE^{Low}
VO_{2max}	58.8±4.4	52.7±6.6***
sVO_{2max}	157±13	141±17***
Hoff (m)	1480±154	1326±132***
10m (s)	2.06±0.19	2.08±0.14
30m (s)	4.78±0.29	4.95±0.38*
Kick ($km \cdot h^{-1}$)	76.6±8.5	69.6±13.6*

Del et al 2008 unpublished data

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Yo-Yo Endurance

Protocol **Level 1**

- **20m Shuttle Running**
- **Starting Speed 8 $km \cdot h^{-1}$**
- **Speed increments 0.5 $km \cdot h^{-1} \cdot min^{-1}$**

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Yo-Yo Endurance

Multistage Fitness Test **Level 1**

Ramsbottom et al. 1988

- **Criterion Validity**

Young Male-Football

Williford et al. 1999

Young Female?

- **Direct Validity?**

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Yo-Yo Endurance

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Yo-Yo Endurance

Young Female (n=26, age 12.1±0.9 years)

Castagna et al. 2008 submitted

Aerobic Test

VO_2 test vs Distance $r=0.73$, $p<0.001$

Avoid using Predicting Formula

23% underestimation actual VO_2

Use ONLY Distance as Performance

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Yo-Yo Endurance

- **Tips :**

Castagna et al. 2008 submitted

Yo-Yo Endurance (MSFT) 950±213m

HR_{max} Assessment

CV 7%

VO_{2peak} Assessment ($K4b^2$)

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Yo-Yos

Which one?

- Endurance
- Intermittent Endurance
- Intermittent Recovery

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Yo-YOs

Direct Validity in YF

Castagna et al. 2008 unpublished data

	Related with Match Performance?	
Endurance	♥ ♥	0.60-0.72
Yo-Yo IR L1	♥ ♥ ♥	0.70-0.76
Hoff Test	----	

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Concurrent training

REVIEW ARTICLE

Sports Med 2004; 34 (3): 165-180
0112-1642/04/0003-0165/$31.00/0

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Endurance and Strength Training for Soccer Players

Physiological Considerations

Jan Hoff and *Jan Helgerud*

Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway

Concurrent training

Concurrent training

Neuromuscolare Vs Aerobico

- No Conflicts
- Positivi effetti
- Necessario Performance

Concurrent training

Grazie x l'attenzione

Carlo Castagna

Corso di Laurea in Scienze Motorie

Università di Roma Tor Vergata, Roma

castagnac@libero.it