

COME VALUTARE L'INTENSITA' DI UN ESERCIZIO? TERMINOLOGIA DI BASE

Milano, Sabato 3 Dicembre 2011

***“ACTIVE DOCTORS ACTIVE PEOPLE: L'ATTIVITA'/ESERCIZIO
FISICO COME PRESCRIZIONE MEDICA?”.***

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Responsabile Scientifico Technogym



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COSA SIGNIFICA ESSERE “ATTIVI?”

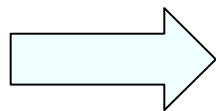
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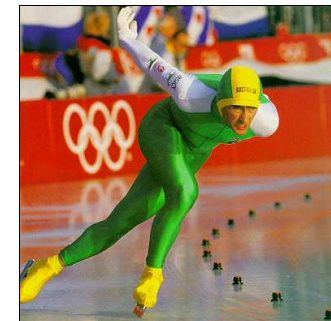
Attività fisica



Esercizio fisico



Sport



Physical Activity/Exercise and Type 2 Diabetes

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For decades, exercise has been considered a cornerstone of diabetes management, along with diet and medications. However, high-quality evidence on the importance of exercise and diabetes-related interventions has not been available until recently. The first American Diabetes Association (ADA) included evidence of exercise and type 2 diabetes (formerly known as non-insulin dependent diabetes) was published in 1993. The present work emphasizes the evidence that have accumulated since the last technical review was published.

Major developments since the 1993 technical review include:

- Advances in basic science, increasing our understanding of the effects of exercise on glucose regulation.
- Large clinical trials demonstrating that lifestyle interventions (diet and exercise) reduce incidence of type 2 diabetes in people with impaired glucose tolerance (IGT).
- Meta-analysis of structured exercise interventions in type 2 diabetes showing: 1) effectiveness of exercise in reducing HbA_{1c}, independent of body weight; and 2) association between exercise training intensity and change in HbA_{1c}.
- Large clinical trials showing that low-intensity and low physical activity level position increased risk of overall

and cardiovascular disease (CVD) mortality in people with diabetes.

- Clinical trials showing effectiveness of resistance training (such as weight lifting) for improving glycemic control in type 2 diabetes.
- New data on safety of moderate-to-high-intensity aerobic activity for CVD.

Based on this new evidence, we have revised the recommendations on the diet and exercise, nutrition, and importance of aerobic physical activity for people with diabetes. Resistance training will now be recommended to a broader group of patients and at a broader range of intensity than done previously. There are other scenarios in which new evidence is lacking, but we feel that previous recommendations may have been more conservative than necessary. These areas include indications for insulin therapy and when beginning an exercise program and procedures regarding exercise in the presence of some specific complications or suboptimal metabolic control. The levels of evidence used are defined by the ADA (see Ref. 1).

A new *Statement of Exercise* was published in 2003 by the ADA, including 10 articles by leading experts on specific topics related to diabetes and diabetes. These publications do not follow the present *Technical Commentaries* and, when appropriate, we refer the reader to chapters

in the *Statement of Exercise* and other review articles for additional details. The present review focuses on type 2 diabetes, unless otherwise specified as type 1 diabetes or well-controlled in a well-compensated individual.

Definitions

The following definitions are based on those outlined in "Physical Activity and Health," the 2008 report of the Surgeon General (1).

Physical activity. Bodily movement produced by the contraction of skeletal muscle that requires energy expenditure in excess of resting energy requirements.

Exercise. A subset of physical activity: planned, structured, and repetitively performed activities that improve or maintain one or more components of physical fitness. In the present review, the terms "physical activity" and "exercise" will be used interchangeably.

Physical fitness. This includes cardiorespiratory fitness, muscular fitness, and flexibility.

Cardiorespiratory fitness (also known as cardiorespiratory endurance or aerobic fitness). The ability of the cardiorespiratory and respiratory systems to supply oxygen during sustained physical activity. The gold standard for measurement of cardiorespiratory fitness is a test of maximal oxygen uptake ($\dot{V}O_{2max}$), typically performed using indirect calorimetry on a treadmill or bicycle apparatus. Cardiorespiratory fitness can be estimated noninvasively using graded maximal exercise testing on standard treadmill or bicycle apparatus protocols without indirect calorimetry (2).

Aerobic exercise. This consists of rhythmic, repetitive, and continuous movements of the arms, legs, or trunk groups for at least 10 min to 1 hour. Examples include walking, bicycling, jogging, continuous swimming, water aerobics, and many sports. When performed at sufficient intensity and frequency, this type of exercise increases cardiorespiratory fitness.

Intensity of aerobic exercise. This will be described as "moderate" when it is at 40–60% of $\dot{V}O_{2max}$ (–50–70% of maxi-

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Abbreviations: ADA, American College of Sports Medicine; ADA, American Diabetes Association; IGT, impaired glucose tolerance; CVD, cardiovascular disease; IHD, chronic heart disease; HDL, high-density lipoprotein; LDL, low-density lipoprotein; HbA_{1c}, hemoglobin A_{1c}; IHD, impaired glucose tolerance; IHD, high-density lipoprotein; LDL, low-density lipoprotein; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

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Es: Raccomandazioni ADA all'esercizio

The amount and intensity recommended for aerobic exercise vary according to goals.

To improve glycemic control, assist with weight maintenance, and reduce risk of CVD, we recommend at least 150 min/week of moderate-intensity aerobic physical activity (**40–60% of VO₂max or 50–70% of maximum heart rate**) and/or at least 90 min/week of vigorous aerobic exercise (**60% of VO₂max or 70% of maximum heart rate**). The physical activity should be distributed over at least 3 days/week and with no more than 2 consecutive days without physical activity.

. Performing 4 h/week of moderate to vigorous aerobic and/or resistance exercise is associated with greater CVD risk reduction compared with lower volumes of activity (128).

. For long-term maintenance of major weight loss (13.6 kg [30 lb]), **larger volumes of exercise** (7 h/week of moderate or vigorous aerobic physical activity per week) **may be helpful.**

Come valutare l'intensità di un esercizio?

UNA TABELLA DI RIFERIMENTO MOLTO UTILE

TABLE 4. Classification of Physical Activity Intensity³

Intensity	Endurance-Type Activity								Strength-Type Exercise
	Relative Intensity			Absolute Intensity (METs) in Healthy Adults (age in years)					Relative Intensity*
	VO ₂ max (%) Heart Rate Reserve (%)	Maximum Heart Rate (%)	RPE†	Young (20–39)	Middle-aged (40–64)	Old (65–79)	Very old (80+)	RPE	Maximum Voluntary Contraction (%)
Very light	<25	<30	<9	<3.0	<2.5	<2.0	≤1.25	<10	<30
Light	25–44	30–49	9–10	3.0–4.7	2.5–4.4	2.0–3.5	1.26–2.2	10–11	30–49
Moderate	45–59	50–69	11–12	4.8–7.1	4.5–5.9	3.6–4.7	2.3–2.95	12–13	50–69
Hard	60–84	70–89	13–16	7.2–10.1	6.0–8.4	4.8–6.7	3.0–4.25	14–16	70–84
Very hard	≥85	≥90	>16	≥10.2	≥8.5	≥6.8	≥4.25	17–19	>85
Maximum‡	100	100	20	12.0	10.0	8.0	5.0	20	100

*Based on 8–12 repetitions for persons <50 and 10–15 repetitions for persons ≥50.

†Borg rating of Relative Perceived Exertion (RPE), 6–20 scale.³⁰

‡Maximum values are mean values achieved during maximum exercise by healthy adults.

Absolute intensity (metabolic equivalents [METs]) values are approximate mean values for men. Mean values for women are approximately 1–2 METs lower than those for men.

FREQUENZA CARDIACA

- ✓ Riferita alla % di FC max Teorica
- ✓ Riferita alla % di FC max Reale

FC MAX TEORICA = 220 – età (formula più utilizzata)

FREQUENZA CARDIACA DI RISERVA (metodo di Karvonen)

$(220 - \text{ETA}') - \text{FC Riposo}$

$X \% \text{ di lavoro} + \text{FC Riposo}$

ATTENZIONE

**Le percentuali di
FC max e FC di riserva
NON EQUIVALGONO**

220-ETA'

KARVONEN

% FC	60 anni	% VO2	55 fc	65 fc	75fc
90%	144	83%	142	144	145
80%	128	73%	131	134	137
70%	112	60%	118	122	126
60%	96	40%	97	103	109
50%	80	28%	84	91	100

Assoluto

l/min

$\dot{V}O_2$



Relativo

ml/kg/min

METS

E

METS /ORA

METS

$$\text{VO}_2 \frac{\text{Relative ml/kg/min}}{3.5}$$

METS/ORA

Minuti x intensità

60

SCALA DI BORG - RPE

0	nullo
0.5	leggerissimo
1	molto leggero
2	leggero
3	moderato
4	abbastanza duro
5	duro
7	molto duro
10	durissimo

6	
7	leggerissimo
8	
9	molto leggero
10	
11	piuttosto leggero
12	
13	abbastanza duro
14	
15	duro
16	
17	molto duro
18	
19	durissimo
20	

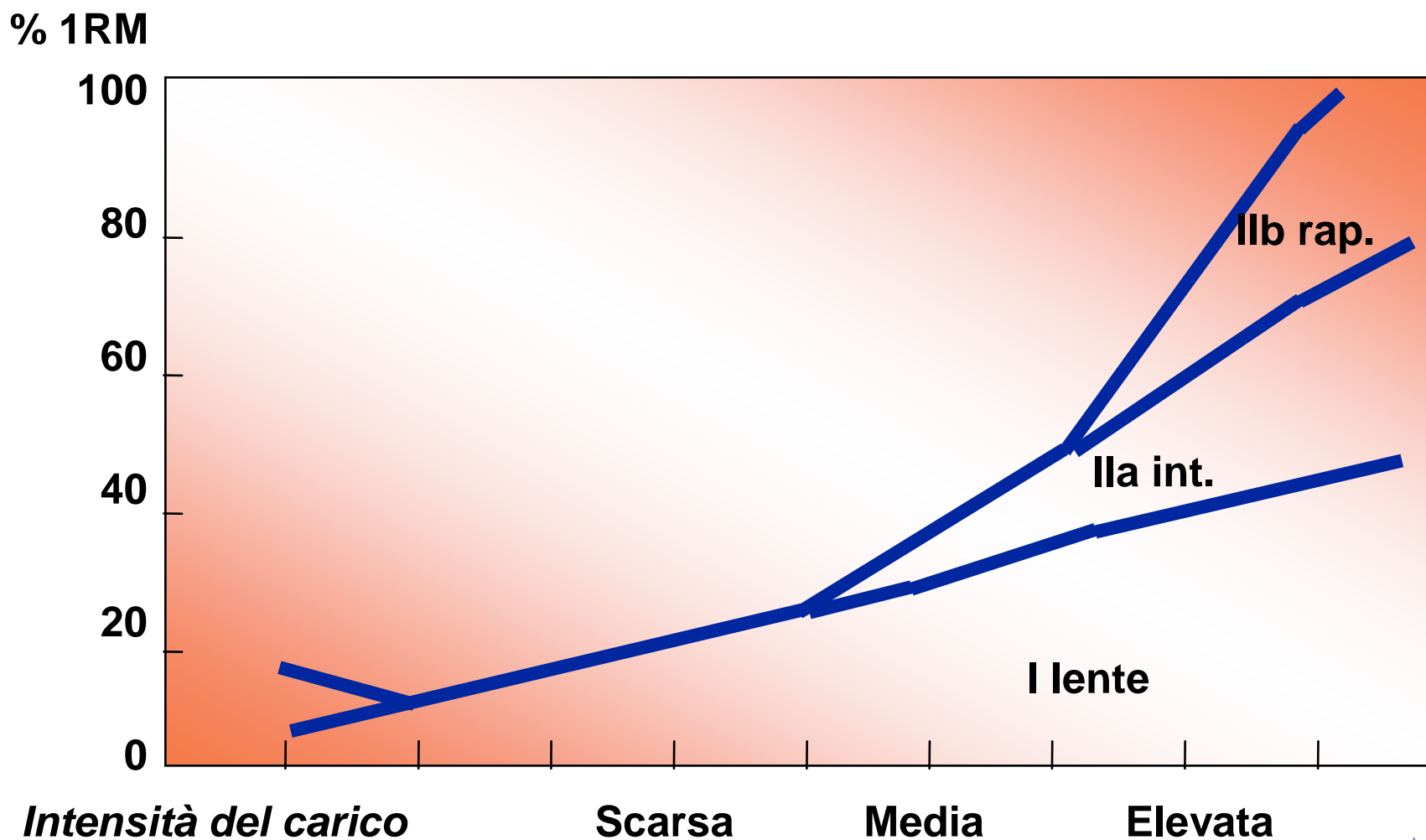
LA VALUTAZIONE DELLA FORZA

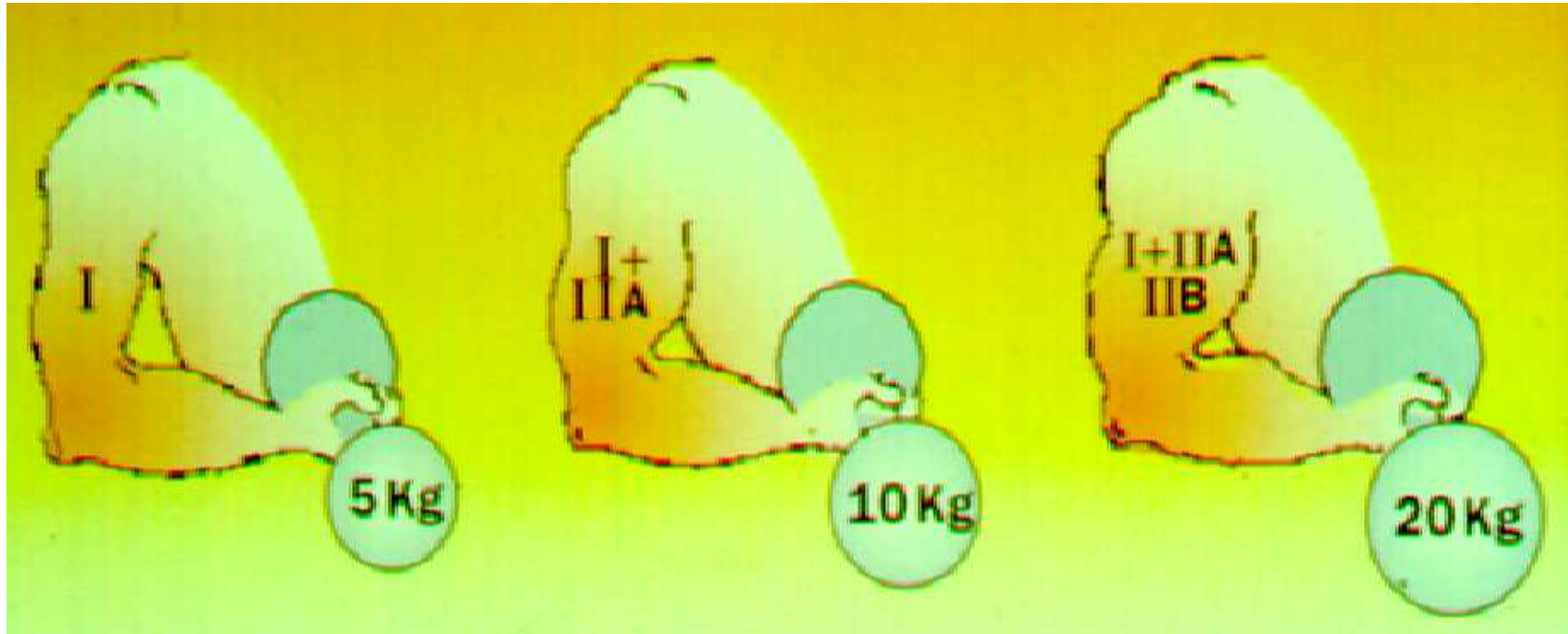


✓ FORZA STATICA
(isometria)

✓ FORZA
DINAMICA
(1-RM, MR)

Reclutamento delle fibre in funzione dell'intensità del carico (Costill 1980, modificato)





LA VALUTAZIONE DELLA FORZA

1-RM= Una ripetizione massimale

MR= Test delle massime ripetute

(si stima il massimale con una delle formule presenti in letteratura)

Formula di Brzycki :

$$1RM = \frac{\text{Carico sollevato}}{1.0278 - (0.0278 \times \text{rep})}$$

ALCUNI ESEMPI DALLA LETTERATURA



Effects of Aerobic Training, Resistance Training, or Both on Glycemic Control in Type 2 Diabetes

A Randomized Trial

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.....participants progressed from 15 to 20 minutes per session at 60% of the maximum heart rate to 45 minutes per session at 75% of the maximum heart rate.

Ann Intern Med. 2007;147:357-369.

For author affiliations, see end of text.

ClinicalTrials.gov registration number: NCT00195884.

Exercise-Induced Changes in Insulin Action and Glycogen Metabolism in Elderly Adults

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...we examined the influence of moderate intensity (50% of V_{O2} max) versus high intensity (75% of V_{O2} max) exercise training on insulin-stimulated glucose disposal in elderly individuals.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

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Validation of a Counseling Strategy to Promote the Adoption and the Maintenance of Physical Activity by Type 2 Diabetic Subjects

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OBJECTIVE — There is enough evidence that physical activity is an effective therapeutic tool in the management of type 2 diabetes. The present study was designed to validate a counseling strategy that could be used by physicians in their daily outpatient practice to promote the adoption and maintenance of physical activity by type 2 diabetic subjects.

RESEARCH DESIGN AND METHODS — The long-term (2-year) efficacy of the behavioral approach ($n = 182$) was compared with usual care treatment ($n = 158$) in two matched, randomized groups of patients with type 2 diabetes who had been referred to our Outpatient Diabetes Center. The outcome of the intervention was consistent patient achievement of an energy expenditure of >10 metabolic equivalents (METs)-h/week through voluntary physical activity.

RESULTS — After 2 years, 69% of the patients in the intervention group (27.1 ± 2.0 METs \times h/week) and 18% of the control group (4.1 ± 0.8 METs \times h/week) achieved the target ($P < 0.001$) with significant ($P < 0.001$) improvements in BMI (intervention group 28.9 ± 0.2 versus control group 30.4 ± 0.3 kg/m²) and HbA_{1c} (intervention group 7.0 ± 0.1 versus control group $7.6 \pm 0.1\%$).

CONCLUSIONS — This randomized, controlled study shows that physicians can motivate most patients with type 2 diabetes to exercise long-term and emphasizes the value of individual behavioral approaches in daily practice.

with their recommendations. In fact, adults with diabetes are less likely to engage in regular physical activity than the general adult population (6), and only 23% of older adults with type 2 diabetes reported >60 min of weekly physical activity (7). The fact that people with diabetes have greater concerns with exercise than the general public might explain these negative figures, signifying the importance of proper education.

Regular physical exercise requires more time and effort than modifications to diet and taking medications, and patients often perceive it as a significant and difficult change in their lifestyle. For this reason, there is the need for reproducible interventions that can be used in daily ambulatory practice to motivate diabetic patients to regularly practice physical activity. In 1996, the U.S. Department of Health and Human Services reviewed all the interventions facilitating participation in physical activity (8), and consequently, we designed individualized counseling strategies based on the approaches that this panel of experts showed to be most effective.

To validate the long-term (2-year) efficacy of our intervention, we compared



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POSITION STAND

Exercise and Type 2 Diabetes

Monitoring the intensity of physical activity in persons with type 2 diabetes may require the use of heart rate or ratings of perceived exertion (RPE) (4). Although a percentage of heart rate reserve (50–85%) or maximal heart rate (60–90%) is commonly used to identify exercise intensity for nondiabetic individuals, those with type 2 diabetes may develop autonomic neuropathy (192), which affects the heart rate response to exercise. Consequently, using heart rate as the only means to monitor intensity may be unsuitable for some with type 2 diabetes. A more appropriate adjunct to gauge the intensity of physical activity may be to use the RPE scale, especially in those who do not require specific heart rate limits (4). It is imperative that those using this scale become familiar with its use (e.g., matching description of level of perceived effort with a corresponding number) for proper implementation.

A Randomized Controlled Trial of Resistance Exercise Training to Improve Glycemic Control in Older Adults With Type 2 Diabetes

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studies of endurance exercise training strongly support its efficacy for diabetes prevention and management (7). In contrast, research on the effects of resistance exercise on diabetes management is

....training intensities during week 1-8 were 60-80% of baseline 1RM, whereas intensities during weeks 10-14 were 70-80% of midstudy 1RM.

Twice-Weekly Progressive Resistance Training Decreases Abdominal Fat and Improves Insulin Sensitivity in Older Men With Type 2 Diabetes

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Type 2 diabetes is a common disease in the elderly (1). Older people tend to have a decline in insulin sensitivity because of their decreased physical activity and increased central obesity (2).

RESEARCH DESIGN AND METHODS — Nine older men (aged 66.6 ± 3.1) with type 2 diabetes participated in a 16-week PRT supervised program (50–80% of the one repetition maximum), for all main muscle groups. Basal glycemia, HbA_{1c}, diet, habitual physical activity,