Extra S.U.B.I.T.O.
EXcercise TReatement Appropriate S.U.B.I.T.O. !

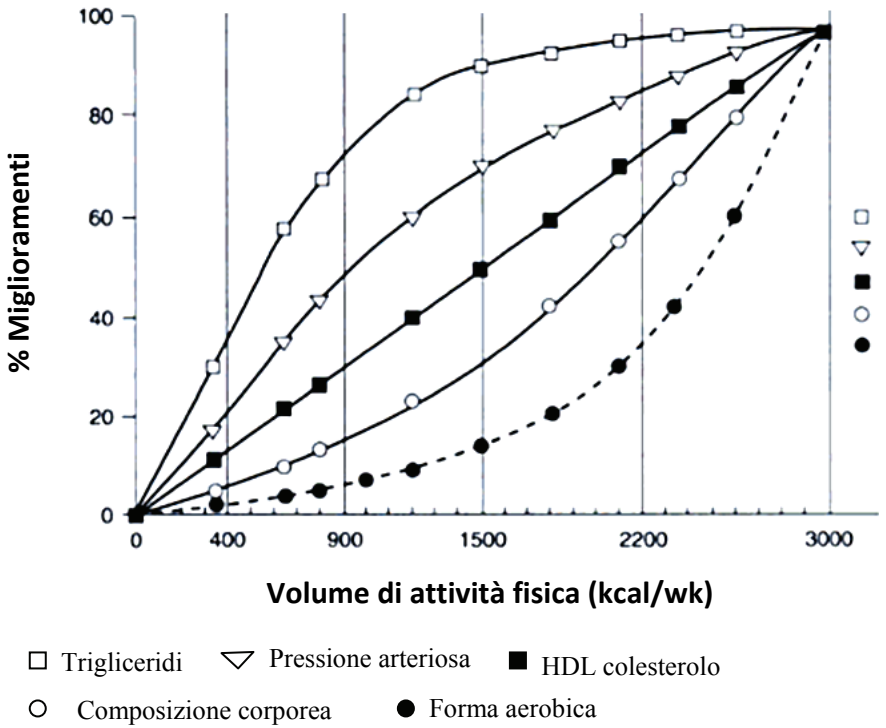
MASTER FORMAZIONE FORMATORI

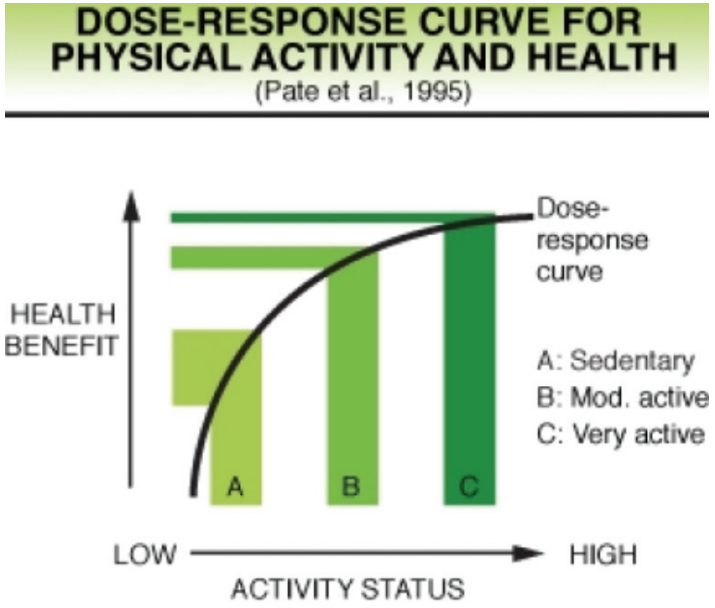
Attività fisica: monitoraggio del dispendio energetico (DE) e strumenti di misurazione

C. De Fazio

Roma 20-21 aprile 2012

Attività fisica ed alcuni indicatori dello stato di salute: concetto di volume





Dose = Frequenza x Tempo

Adattata da:The Canadian Physical Activity, Fitness & Lifestyle Approch: CSEP-Health & Fitness Program's Health Related Appraisal and Counselling Strategy, 3th Edition, 2003

Pate, R.R. et al. Physical activity and public health: a recommendation from the centre of disease control and prevention and the American College of Sport Medicine. Journal of the American Medical Association (1995) 273

Perché monitorare il DE?

Studio PASSI

Progressi delle **A**ziende **S**anitarie per la **S**alute in **I**talia

	% (IC 95%)
Livello di attività Fisica	
Attivo*	32,5% (32,0- 33,2)
Parzialmente atti	
Sedentario***	

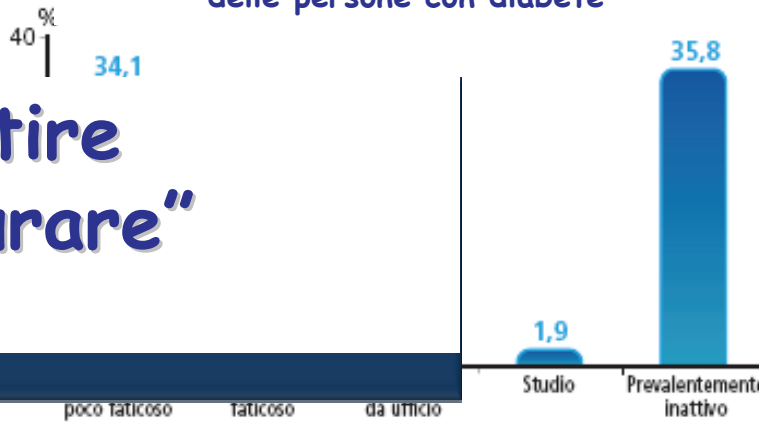
*lavoro pesante oppure moderata per almeno 5 per più di 20 minuti per a
** non fa lavoro pesante libero, senza però raggiu
*** non fa un lavoro pes libero.

Prevalenza sedentari 2007-2010

Studio DAWN

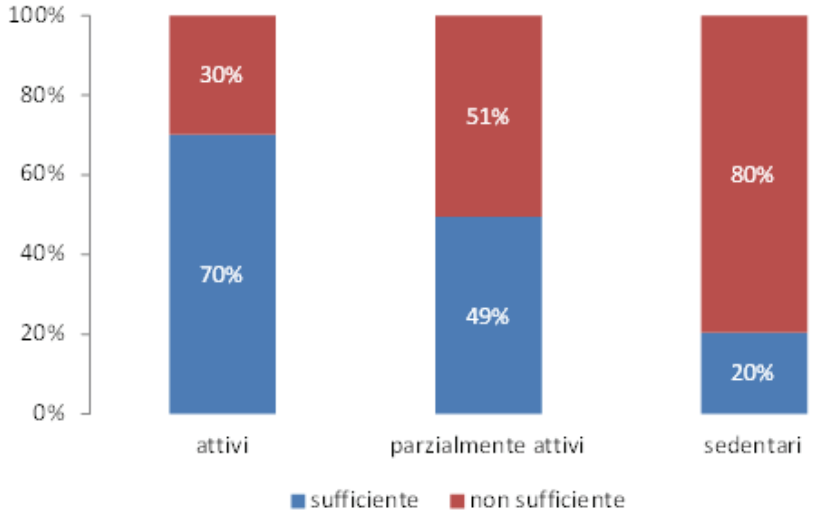
Diabete Attitudes Wishes & Needs in Italia

La principale attività giornaliera delle persone con diabete

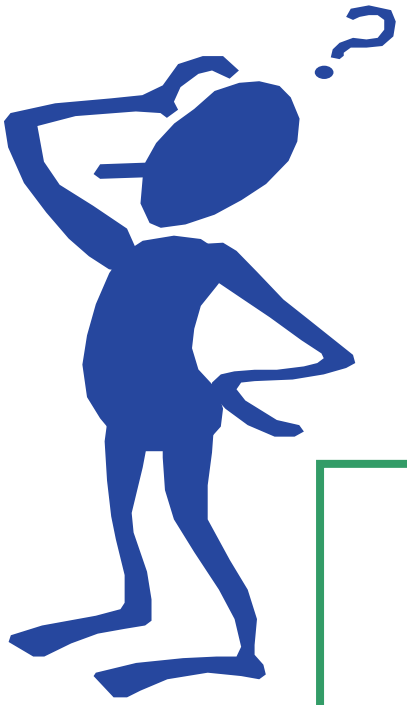


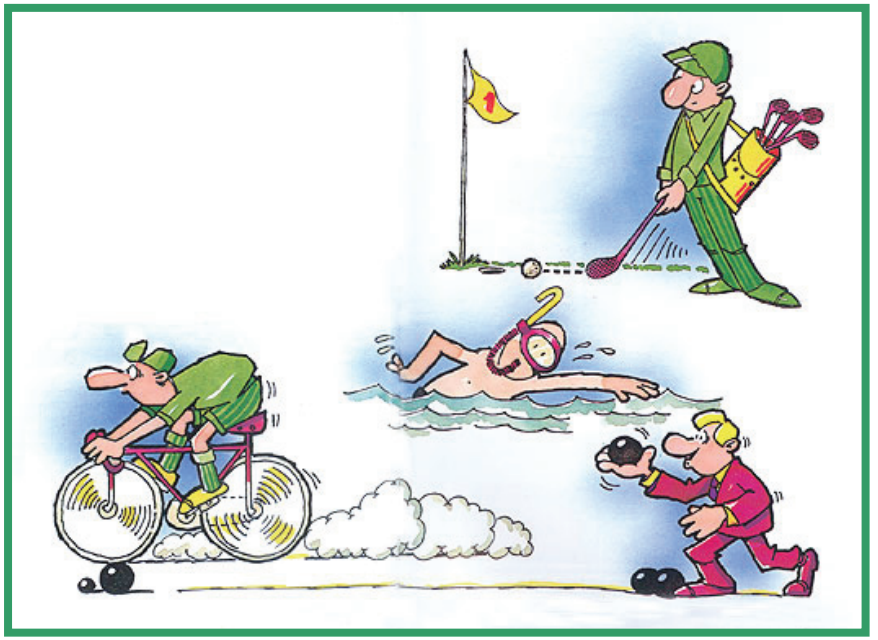
"Non si può gestire se non si può misurare" (R.Kaplan)

Autopercezione del livello di AF



Come monitorare la quantità di AF?





Heart Failure Reviews 1999;3:305–311

The Value of Questionnaires in Assessing Physical Activity, Fitness, and Quality of Life

Dennis V. Cokkinos
Onassis Cardiac Surgery, Athens, Greece

The measurement of functional cardiac capacity by means of ergospirometry, i.e., oxygen consumption and its kinetics, yields an accurate estimate of the ability of patients to achieve functional activity. After an initial "familiarization" test, ergospirometry is not only accurate but also reproducible [1,2]. However, it is not a simple task to perform an exercise functional capacity test. It requires advanced apparatus utilization and time, and it is costly. Moreover, a certain percentage of patients cannot perform physical exercise due to heart failure. According to our experience, 5 out of 40 patients with clinical severe heart failure and an ejection fraction below 30% were not able to attain an exercise level that could be adequately evaluated [3].

To circumvent these difficulties, questionnaires that can yield a reliable estimation of physical activity have been developed during the last 20 years. The first questionnaire of its kind was the Minnesota Leisure Time Physical Activity (LTPA) questionnaire, developed by Taylor et al. in 1978 [4]. Here it must be stressed that most questionnaires assess leisure time, including sports, occupation, and home and household activity. The time of recall of these questionnaires is from the past week to the past 12 months. Time frames of 1 to 3 days can also be used [5]. The questionnaires are either interviewer administered or self-administered, usually with supervision.

In a very recent supplement of *Medicine and Science in Sports and Exercise*, directions are given for interviewers [5]. These directions stress that during an interview, special attention must be given to limiting any bias and preventing the interview from becoming too cumbersome. The need for skillful interrogation in order to assess a whole year's average activity is especially emphasized, as is the need for establishing rapport with the person being interviewed. Also, the need to avoid unnecessary details and as the importance of clarity and accuracy are given special emphasis.

A detailed account of how to administer the questionnaires has recently been published [5]. Poor quality can yield unreliable results and confuse meaningful correlations. In a methodologic critique of previous studies, it was stressed that only 20% of estimates of physical activity were good; 40% were satisfactory, and 40% were judged as unsatisfactory. The improvement in quality from unsatisfactory to good led to an increase in statistically significant associations among studies from 50% to 88% [5–7].

The Minnesota LTPA questionnaire includes 63 items pertaining to sports, recreational, yard, and household activities. Activity over the last 12 months is evaluated. Very specific rules for estimating activity have been set. The year is considered as comprising 240 work days and the month 22 work days, with 100 weekend days per year [8]. Also, estimated times for various activities are given: climbing one flight of stairs is estimated to take half a minute, one bowling game 10 minutes, a tennis singles set 20 minutes, and a tennis doubles set 30 minutes. Specific attention is given to details such as the difference between socializing and actually being involved in a sporting activity, especially with reference to swimming, tennis, and bowling. Finally, a total activity metabolic index is computed by differentiating between light, moderate, and heavy activities. To create the index, every activity is given a score of intensity units, multiplied by the minutes dedicated to this activity per week, month, and year; e.g., walking for pleasure is alloted 3.5 intensity units, while tennis is given 8 intensity units. This questionnaire has been widely used and validated. Correlations for peak VO_2 range from 0.19 [9] to 0.47 [10]. The best correlations are found when heavy activity is assessed.

Most subsequent questionnaires have used a similar format, although some questionnaires assign MET values to activity levels. Another expression of METs is given in calories. Thus, 1 MET-h/wk can be expressed as 1 kcal/kg/wk. Many questionnaires use kcal/kg directly [11], while other questionnaires only differentiate among activity levels, i.e., inactive, very low, low, moderately and highly active [12].

Types and Purposes of Questionnaires

The purposes of the questionnaires have been variable, but these can be subdivided into four general categories.

General purpose questionnaires

General purpose questionnaires are specifically used to establish a risk factor profile. Many studies have shown that leisure activity or occupational physical activity is inversely related to cardiovascular and especially to

Address for correspondence: Dennis Cokkinos, Onassis Cardiac Surgery, Athens, Greece.

QUESTIONARIO MINNESOTA
SULL'ATTIVITA' FISICA NEL TEMPO LIBERO
DEFINIZIONE INDIVIDUALE ISTANTANEA (DII)

NOME.....|__|__|__|__|__|__|__|__|__|__|__|__|

Identificativo.....|__|__|__|__|__|

LISTA DI ATTIVITÀ FISICHE
(Marchi con una croce la casella corrispondente alla attività fisica che ha realizzato nell'ultimo anno.)

Camminare - Ballare – Salire le scale
|__|1 Passeggiare
|__|2 Camminare da casa al lavoro o nella pausa lavoro
|__|3 Camminare (portando un carrello con la spesa)
|__|4 Camminare (portando le sporte della spesa)
|__|5 Salire le scale
|__|6 Camminare in campagna/traking
|__|7 Escursioni con lo zaino
|__|8 Scalate in montagna
|__|9 Andare in bicicletta al lavoro
|__|10 Ballo
|__|11 Aerobica o balletto
|__|12 Giocare con i bambini

Esercizi di mantenimento generale
|__|13 Ginnastica in casa
|__|14 Ginnastica in palestra
|__|15 Camminare velocemente
|__|16 "Jogging"
|__|17 Corsa 8-11 km/h
|__|18 Corsa 12-16 km/h
|__|19 Sollevamento pesi

Attività acquatiche
|__|20 Sci acquatico
|__|21 Surf
|__|22 Navigazione a vela
|__|23 Canotaggio o remi (dilettante)
|__|24 Canotaggio o remi (professionista)
|__|25 Fare un viaggio in canoa
|__|26 Nuoto in piscina (più di 150 metri)
|__|27 Nuoto nel mare
|__|28 Andare sott'acqua, snoorking

Sport invernali
|__|29 Sci di discesa
|__|30 Sci di fondo
|__|31 Pattinaggio (ruote o ghiaccio)

Altre attività
|__|32 Ippica
|__|33 Boowling
|__|34 Pallavolo
|__|35 Ping-Pong
|__|36 Tennis individuale
|__|37 Tennis doppio
|__|38 Badminton
|__|39 Pallacanestro (non in partita)
|__|40 Pallacanestro (giocando una partita)
|__|41 Pallacanestro (da arbitro)
|__|42 Squash
|__|43 Calcio
|__|44 Golf (portando il carrello)
|__|45 Golf (camminando e portando le mazze)
|__|46 Pallamano
|__|47 Bocce
|__|48 Arti marziali
|__|49 Motociclismo
|__|50 Ciclismo in strada o montagna

Attività di giardinaggio
|__|51 Tagliare il prato con la falciatrice
|__|52 Tagliare il prato manualmente
|__|53 Pulire il giardino
|__|54 Coltivare l'orto
|__|55 Spalare la neve

Lavori e attività casalinghe
|__|56 Lavoro di carpenteria in casa
|__|57 Lavoro di carpenteria (all'aperto)
|__|58 Imbiancare in casa
|__|59 Imbiancare (all'aperto)
|__|60 Pulire la casa
|__|61 Spostare mobili

Caccia e pesca
|__|62 Tiro con la pistola
|__|63 Tiro con l'arco
|__|64 Pesca in riva al mare
|__|65 Pesca nel fiume (in acqua)
|__|66 Caccia piccola
|__|67 Caccia grossa (cervi, orsi...)
Altro (specificare)
|__|68 .....
|__|69 .....
|__|70 .....

Taylor, H. L., D. R. Jacobs, B. Schucker, J. Knudsen, A. S. Leon, and G. Debacker. A questionnaire for the assessment of leisure time physical activities. J. Chron. Dis. 31:741-755, 1978.

DE delle LTPA in METs

Attività Fisica	METS
1 Passeggiare	3.5
2 Camminare da casa al lavoro o nella pausa lavoro	4.0
3 Camminare (portando un carrello con la spesa)	3.5
4 Camminare (portando le sporte della spesa)	5.5
5 Salire le scale	8.0
6 Camminare in campagna/traking	6.0
7 Escursioni con lo zaino	7.0
8 Scalate in montagna	8.0
9 Andare in bicicletta al lavoro	4.0
10 Ballo	4.5
11 Aerobica o balletto	6.0
12 Giocare con i bambini	4.5
Esercizi di mantenimento generale	
13 Ginnastica in casa	4.5
14 Ginnastica in palestra	6.0
15 Camminare velocemente	4.5
16 "Jogging"	6.0
17 Corsa 8-11 km/h	10.0
18 Corsa 12-16 km/h	15.0
19 Sollevamento pesi	6.0
Attività acquatiche	
20 Sci acquatico	6.0
21 Surf	6.0
22 Navigazione a vela	3.0
23 Canotaggio o remi (dilettante)	3.5
24 Canotaggio o remi (professionista)	12.0
25 Fare un viaggio in canoa	4.0
26 Nuoto in piscina (più di 150 metri)	6.0
27 Nuoto nel mare	6.0
28 Andare sott'acqua, snoorking	5.0
Sport invernali	
29 Sci di discesa	7.0
30 Sci di fondo	8.0
31 Pattinaggio (ruote o ghiaccio)	7.0

Attività Fisica	METS
Altre attività	
32 Ippica	5.0
33 Boowling	3.0
34 Pallavolo	4.0
35 Ping-Pong	4.0
36 tennis individuale	8.0
37 Tennis doppio	6.0
38 Badminton	7.0
39 Pallacanestro (non in partita)	6.0
40 Pallacanestro (giocando una partita)	8.0
41 Pallacanestro (da arbitro)	7.0
42 Squash	12.0
43 Calcio	10.0
44 Golf (portando il carrello)	3.5
45 Golf (camminando e portando le mazze)	5.5
46 Pallamano	10.0
47 Bocce	3.0
48 Arti marziali	10.0
49 Motociclismo	4.0
50 Ciclismo in strada o montagna	9.0
Attività di giardinaggio	
51 Tagliare il prato con la falciatrice	4.5
52 Tagliare il prato manualmente	6.0
53 Pulire il giardino	4.5
54 Coltivare l'orto	5.0
55 Spalare la neve	6.0
Lavori e attività casalinghe	
56 Lavoro di carpenteria in casa	3.0
57 Lavoro di carpenteria (all'aperto)	6.0
58 Imbiancare in casa	4.5
59 Imbiancare (all'aperto)	5.0
60 Pulire la casa	3.5
61 Spostare mobili	6.0
Caccia e pesca	
62 Tiro con la pistola	2.5
63 Tiro con l'arco	3.5
64 Pesca in riva al mare	3.5
65 Pesca nel fiume (con gli stivali dentro l'acqua)	6.0
66 Caccia piccola	5.0
67 Caccia grossa (cervi, orsi...)	6.0
68 Altro (specificare)	

Esempio di compilazione del diario

Una giornata tipo: 50anni 52Kg

- ORE 8.00: sveglia e colazione
- ORE 9.00: esce per andare al mercato (Tragitto Casa-Mercato 30 Min A Piedi) – **PASSEGGIARE - 30 min -**
- ORE 10.30: torna dal mercato con le borse della spesa – **CAMMINARE PORTANDO LE BORSE DELLA SPESA - 30 min -**
- ORE 11.05: la signora decide di fare le scale – abita al 4° piano e impiega 5 minuti per salire – **SALIRE LE SCALE – 5 min**
- ORE 11.30: spolvera la casa – nel frattempo inizia a cucinare – **PULIRE LA CASA – 30 min -**
- ORE 13.00: pranzo
- ORE 15.30: esce con una amica per andare al parco (fara' una camminata di un'ora a passo svelto) – **CAMMINATA A PASSO SVELTO – 60 min -**
- ORE 16.30: tornando dal parco passa a prendere la nipotina che esce da scuola, con la quale a piedi torna a casa (20 min) – **PASSEGGIARE – 20 min -**
- ORE 17.00: merenda con la nipotina
- ORE 18.30: inizia a cucinare per la sera
- ORE 19.30: cena
- ORE 22.00: esce con le amiche per andare a ballare Latino-Americano fino alle 24.00 – **BALLARE – 120 min –**
- ORE 24.15: dopo una giornata così **ATTIVA**, soddisfatta si concede il MERITATO RIPOSO.....ronf ronf ...

ULTIMA SETTIMANA

Codice dell'attività Física	Giorni di pratica	Minuti di pratica /die

ULTIMO MESE

Codice dell'attività Física	Giorni di pratica	Minuti di pratica /die

Codice dell'attività Física	ora	Minuti di pratica /die	METs totali	Kcal
1	9 e16,30	50	2.91 (3.5)	150
4	10,30	30	2.75 (5.5)	143
5	11,05	5	0.66 (8)	34
60	11,30	30	1.75 (3.5)	91
15	15,30	60	4.5 (4.5)	234
10	22	120	9 (4.5)	468
TOTALE		**4h 55'**	**21.57**	**1120**

BMR (H&B)
1202 (50.1/h) Kcal

Quali strumenti di misurazione utilizzare?

podometro

bioimpedenziometro

cardiofrequenzimetro

Armband

L'impiego del contapassi nel monitoraggio della Marcia

Classificazione dell'Attività motoria conseguente caratterizzazione dei soggetti

STEPs/day	soggetti
< 5.000	SEDENTARI
5.000- 7.499	SCARSAMENTE ATTIVI
7.500- 9.999	ABBASTANZA ATTIVI
> 10.000	ATTIVI
> 12.500	MOLTO ATTIVI

Tudor-Locke C., Bassett Dr Jr., "How many steps/day are enough? Preliminary pedometer indices for public health", Sports Med. 2004; 34 (1):1-8.

Attività motoria giornaliera raccomandata dalle Linee Guida per "mantenere lo stato di buona salute"

- **12.000- 16.000 steps/giorno per 8-10 aa**
  (valore < per le femmine, > per i maschi)
- **7.000- 13.000 steps/giorno per giovani adulti in salute**
  (valore < per le femmine, > per i maschi)
- **6.000- 8.500 steps/giorno per adulti sani**
- **3.500- 5.500 steps/giorno per soggetti con inabilità o malattie croniche**

Tudor-Locke CE, Myers AM, "Methodological considerations for researches and practitioners using pedometers to measure physical (ambulatory) activity", Res Q Exerc Sport 2001 Mar; 72 (1): 1-12.

Consumo energetico del cammino

	Consumo energetico in Kcal	
Peso (Kg)	5000 passi	10000 passi
40	100	200
50	125	250
60	150	300
70	175	350
80	200	400
90	225	450
100	250	500

Bray G.A. (2003), Contemporary Diagnosis and Management of Obesity (2° ed.), Handbook in Health Care Co. Newton, Pensylvania.

Stima del dispendio energetico della marcia e della corsa

4 Km/h	0.5 Kcal x Kg x Km
8-20 Km/h	1 Kcal x Kg x Km

Luoghi comuni contraddittori

"VAI PIÙ VELOCE CHE BRUCI DI PIÙ"

le calorie consumate sono in funzione della distanza e del peso corporeo, non della velocità

"CAMMINA O CORRI PIANO CHE BRUCI PIÙ GRASSI"

4Km (Lento) 300Kcal	40% CHO 60% NEFA	300 x 60% /9=20gr NEFA
4Km (veloce) 300Kcal	60% CHO 40% NEFA	300 x 40% /9=13gr NEFA

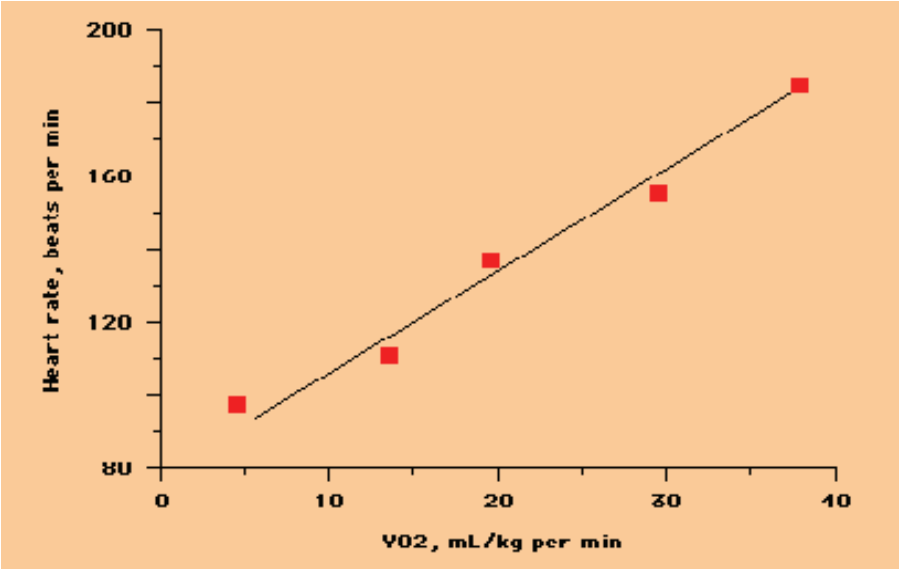
Corsa lenta (1h)	4Km	70 x 4Km /20= 19gr NEFA
Corsa veloce (1h)	8Km	70 x 8Km/20= 28gr NEFA

VARIABILE Excess Postexercise Oxygen Consumption)

L'impiego del cardiofrequenzimetro nel monitoraggio della frequenza cardiaca (FC)

Variazione della FC in EF aerobico (5Km/h)

Soggetto 50 aa, Fc riposo 80 bpm,
Fcmax 170 bpm
Target Zona aerobica 100-130 bpm-
% VO2 max 30-40%



Relazione tra incremento del consumo di O_2 durante EF e FC

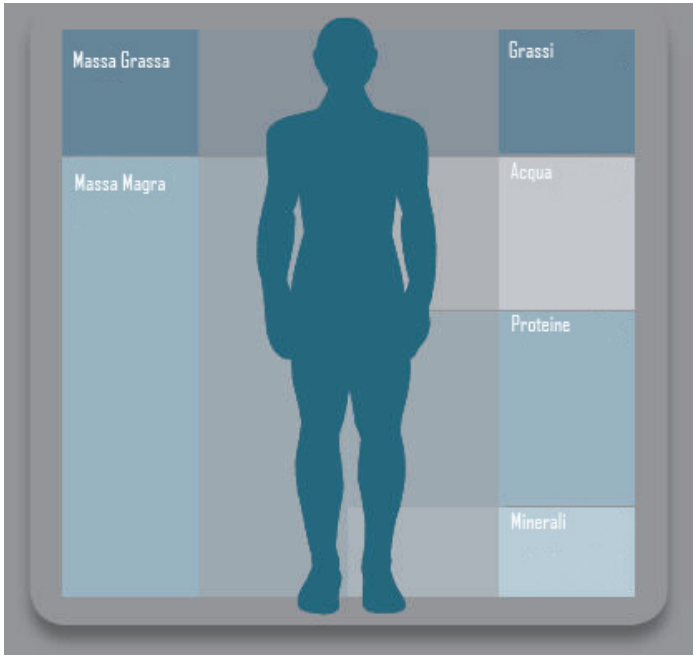
% VO2 max	% FC max
14-21	40-45
28-35	50-55
42-49	60-65
56-63	70-75
70-76	80-85
83-91	90-95
100	100

Classificazione dell'intensità dell'AF Suddivisa per fascia di età

			METs				
INTENSITÀ	% VO_2 max	% FC max	Giovani (20-39)	Mezza età (40-64)	Anziani (65-79)	Grandi vecchi (>80)	Scala di Borg RPE
Molto lieve	< 20	< 35	< 2.4	< 2.0	< 1.6	< 1.0	< 10
Lieve	20-39	35-54	2.4-4.7	2.0-3.9	1.6-3.1	1.1-2.9	10-11
Moderata	40-59	55-69	4.8-7.1	4.0-5.9	3.2-4.7	2.0-2.9	12-13
Severa/vigorosa	60-64	70-89	7.2-10.1	6.0-8.4	4.8-6.7	3.0-4.25	14-16
Molto elevata	> 65	> 90	> 10.2	> 8.5	> 6.8	> 4.25	17-19
Massima	100	100	12.0	10.0	8.0	5.0	20

Modificata da Fletcher G.F. 2001

L'impiego del Bioimpedenziometro nel monitoraggio della composizione corporea



ENTRATA	
STRUTTURA	NORMALE
SESSO	MASCHILE
ETÀ	42
ALTEZZA	180 cm
PESO ABBIGLIAMENTO	1.8kg

RISULTATO	
PESO	74.6kg
M.GRASSA IN %	16.8 %
M.GRASSA	12.5kg
M.MAGRA E ACQUA	62.1kg
MASSA MUSCOLARE	59.0kg
ACQUA	42.1kg
% ACQUA	56.4 %
MASSA OSSEA	3.1kg
MB	7477 kJ 1787kcal
LIVELLO GRASSO VISCERALE	6
BMI	23.0
PESO IDEALE	71.3kg

BMI	23.0
PESO IDEALE	71.3kg

VALORI IDEALI	
M.GRASSA IN %	11.0-21.9 %
M.GRASSA	7.7-17.4kg

INDICATORE

*M.GRASSA IN %
- | 0 | + | ++

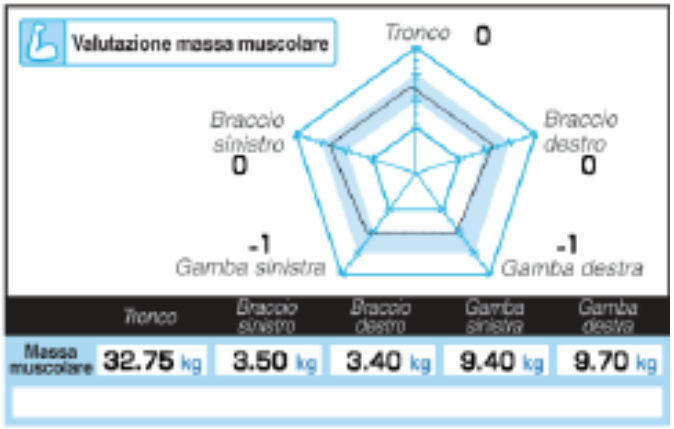
*BMI
- | 0 | + | ++

*GRASSO VISCERALE
| 13

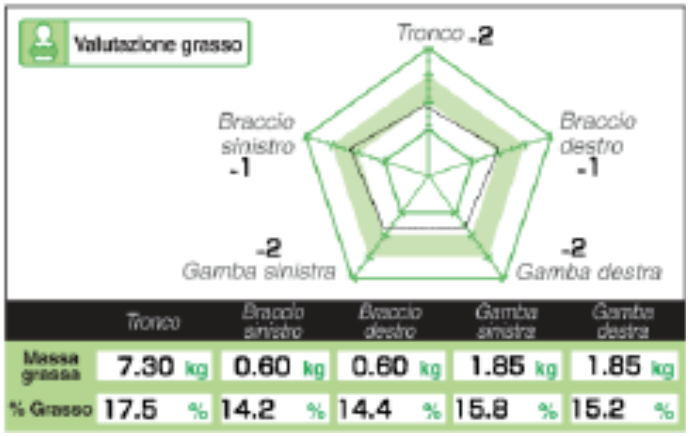
*MASSA MUSCOLARE
- | 0 | +

*MB
- | 0 | +

Analisi segmentale

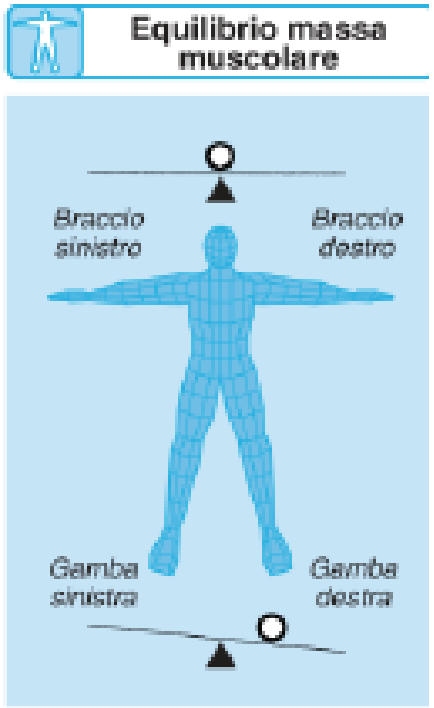


	Tronco	Braccio sinistro	Braccio destro	Gamba sinistra	Gamba destra
Massa muscolare	32.75 kg	3.50 kg	3.40 kg	9.40 kg	9.70 kg



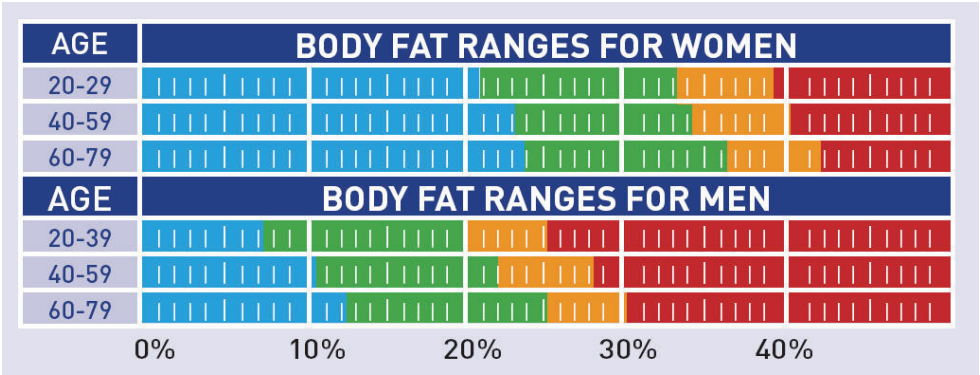
	Tronco	Braccio sinistro	Braccio destro	Gamba sinistra	Gamba destra
Massa grassa	7.30 kg	0.60 kg	0.60 kg	1.85 kg	1.85 kg
% Grasso	17.5 %	14.2 %	14.4 %	15.8 %	15.2 %

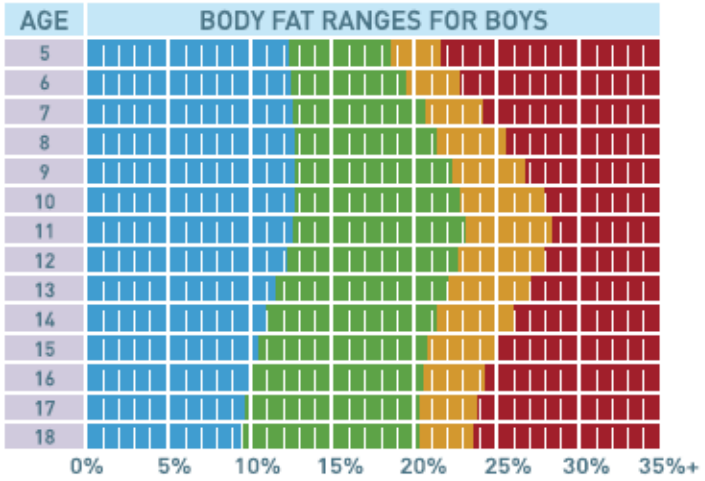
Tabelle di classificazione della massa grassa per adulti e bambini

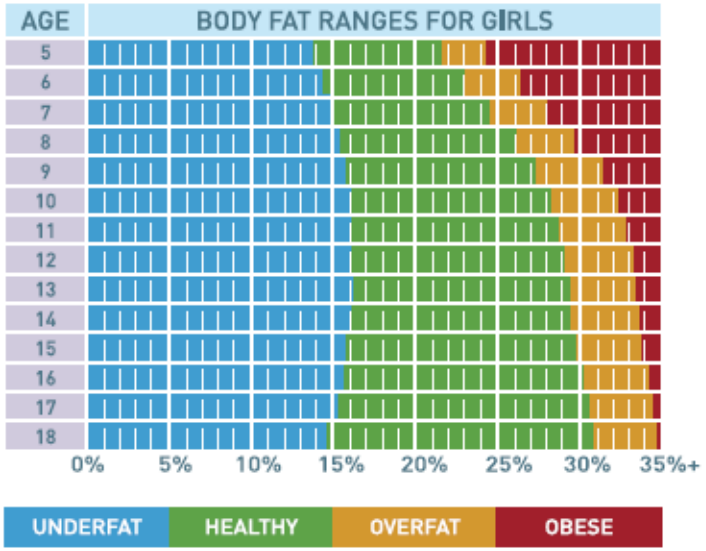


ENTRATA	
STRUTTURA	NORMALE
SESSO	MASCHILE
ETÀ	42
ALTEZZA	180 cm
PESO ABBIGLIAMENTO	1.8kg

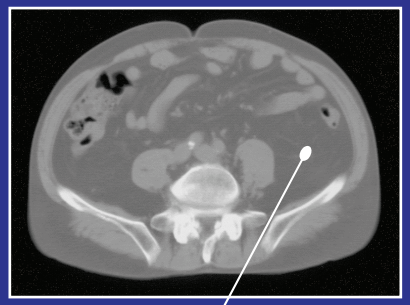
RISULTATO	
PESO	74.6kg
M.GRASSA IN %	16.8 %
M.GRASSA	12.5kg
M.MAGRA E ACQUA	62.1kg
MASSA MUSCOLARE	59.0kg
ACQUA	42.1kg
% ACQUA	56.4 %
MASSA OSSEA	3.1kg
MB	7477 kJ
	1787kcal
LIVELLO GRASSO VISCERALE	6
BMI	23.0
PESO IDEALE	71.3kg





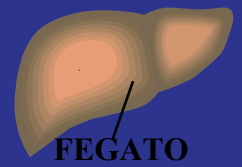


Indice di grasso viscerale



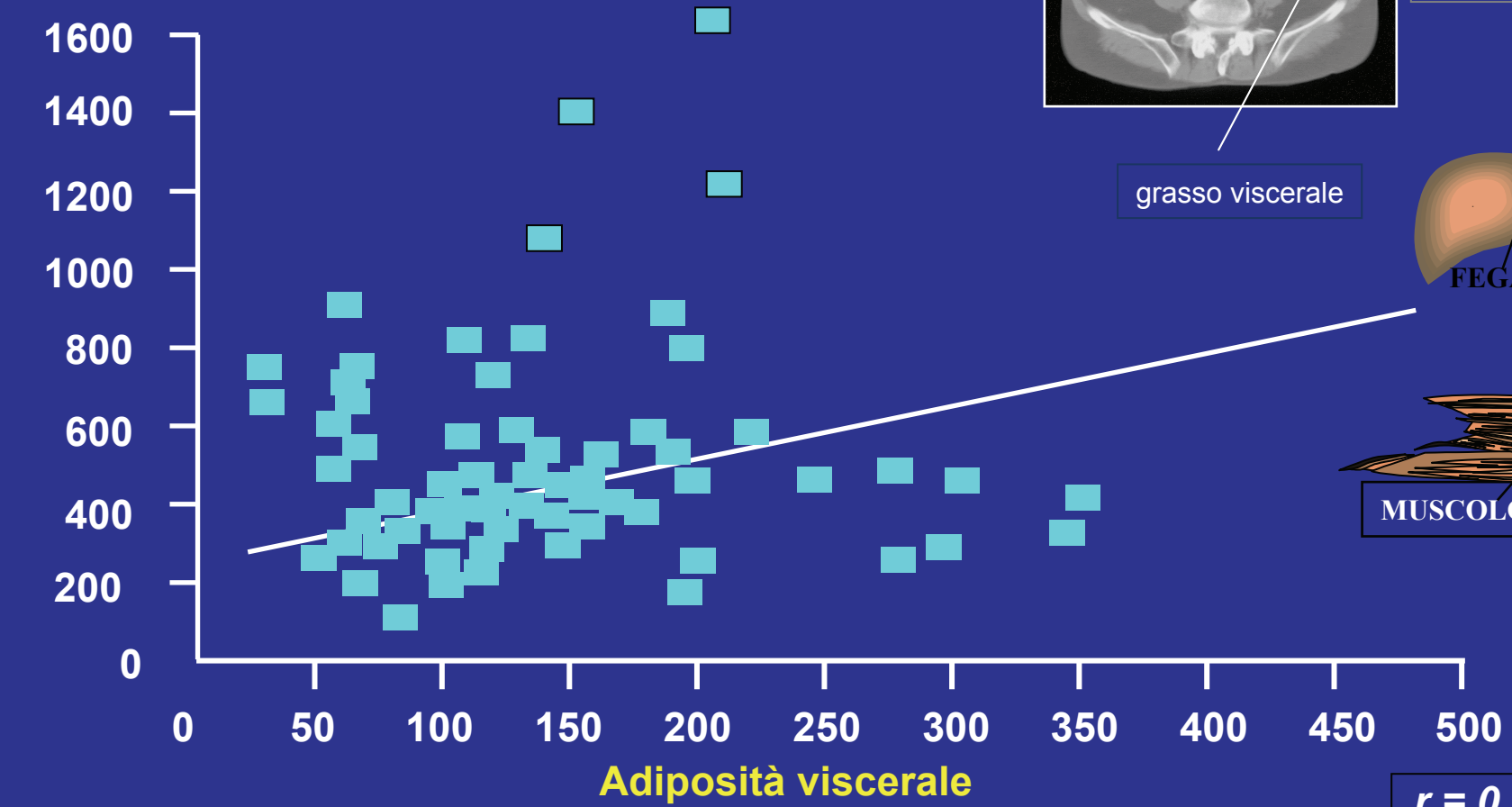
M 61aa, BMI 25

grasso viscerale



FEGATO

MUSCOLO



r = 0.315
p < 0.001

L'impiego dell'Armband per monitorare le condizioni ipocinetiche, prescrivere il giusto dosaggio di AF e verificarne l'efficacia

Temperatura cutanea
misura della temperature della superficie cutanea

Risposta galvanica della cute
misura l' impedenza della pelle che riflette il contenuto idrico cutaneo e la costriz-ione o dilatazione dei vasi periferici

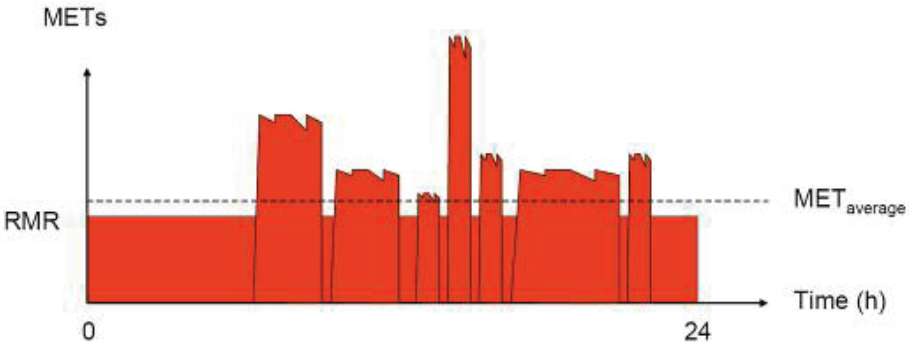
Calore dissipato
misura la frequenza di dissipazione del calore dal corpo

Accelerometro a 2 assi
misura del movimento

- Dispendio Energetico Totale (kcal)
- Dispendio Energetico Attivo (kcal)
- Dispendio Energetico a Riposo (kcal)
- METs
- Numero totale dei passi
- Durata dell' attivita' fisica (PAD)
- Durata del sonno
- Tempo sdraiato

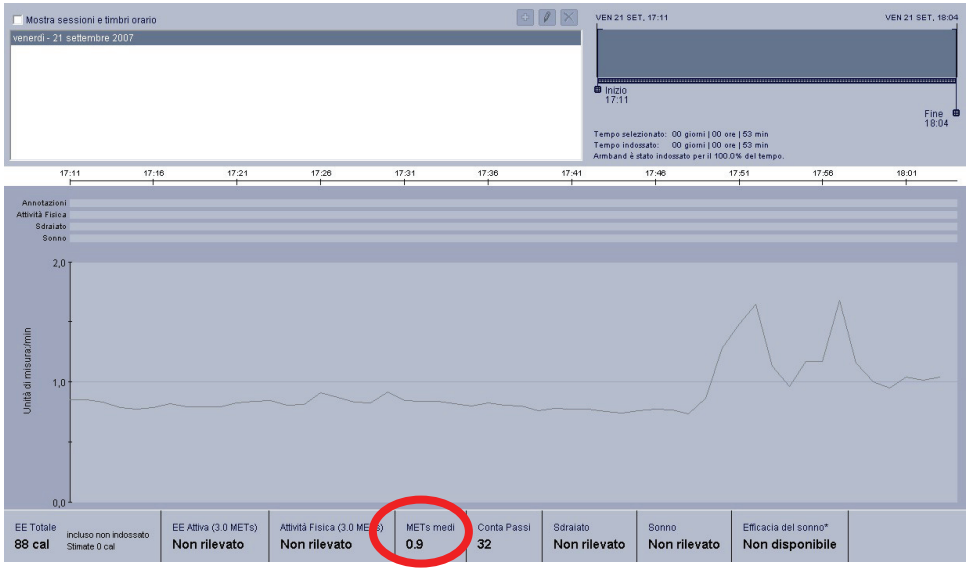
Tipo	MET
Soggetto ipo-attivo, soprappeso, obeso	0.7 – 0.9
Soggetto Normale	1.0 (0.9 – 1.1)
Soggetto iper-attivo Sottopeso, Cachettico	1.1 – 1.3
Atleta, Bodybuilder	1.3 – 1.7

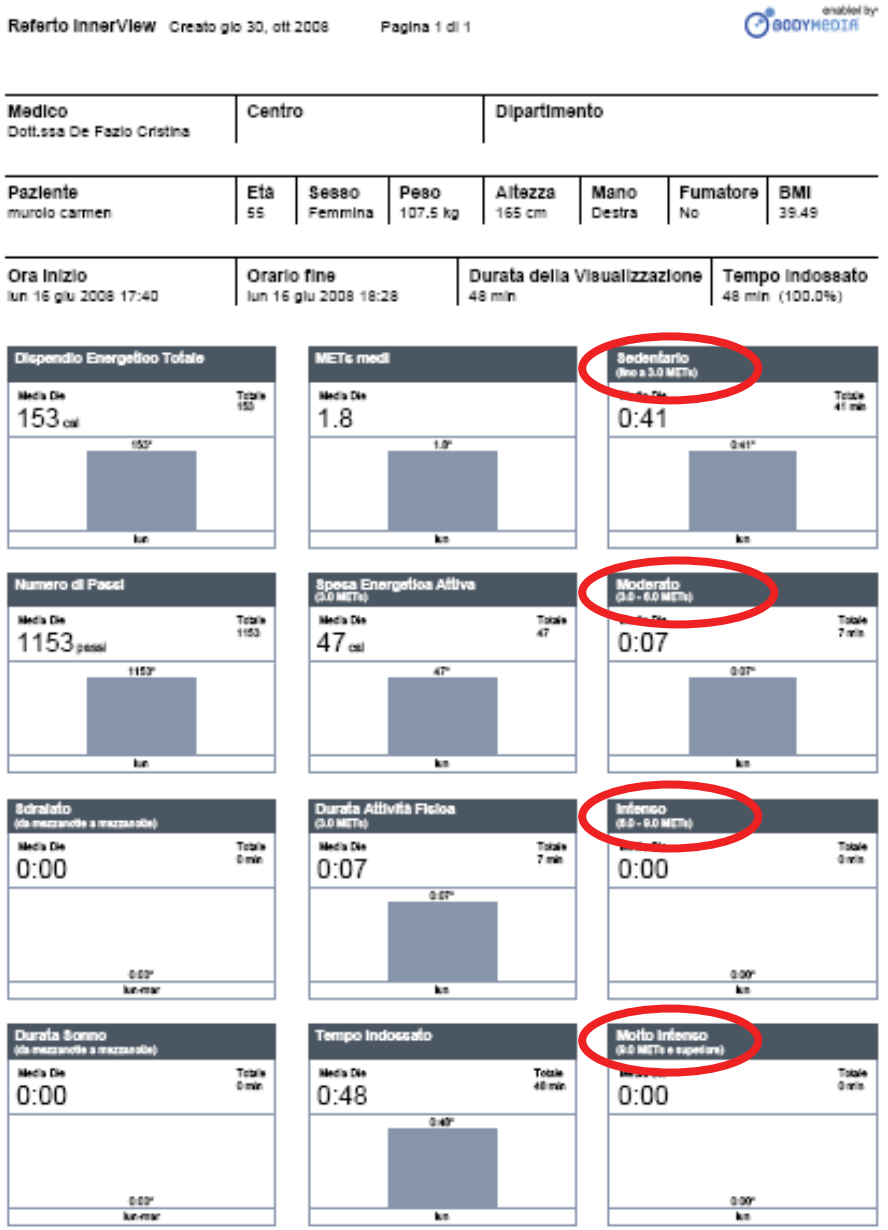
INDICE DI INTENSITÀ METABOLICA



MET medi giornalieri di riferimento

Obesità	0,8 - 1,0
Normale	1,4 - 1,6
Sedentario	1,2 - 1,3
Sportivo Attivo	> 1,7





Variabili da misurare: indici di efficienza motoria

Giorno	29/02/08	01/03/08	02/03/08
Ora inizio	6:00	6:00	6:00
TEE (kcal)	2.671	2.759	2.756
TEEh (kcal)	111	115	115
EEAM (kcal)	1.567	1.655	1.652
%EEAM	59%	60%	60%
%EEA ≥ 3 METs	61%	65%	64%
Steps	30.636	32.797	35.200
%Steps ≥ 3 METs	90%	93%	91%
PAD ≥ 3 METs (ore)	8:49	9:26	9:17
LAF	2,42	2,50	2,50
LAM ≥ 3 METs	4,03	4,16	4,16
LAS < 3 METs	1,76	1,73	1,84
TD (ore)	6:55	6:32	7:13
TS (ore)	5:30	6:08	6:52
IR%	80%	94%	95%
ore di Armband	24:00	24:00	24:00

LAF

LAF<1.4	Stile ipocinetico/ AF molto leggera
LAF 1.4-1.69	Stile sedentario/AF leggera
LAF 1.70-1.99	Stile attivo/AF moderata
LAF 2.00-2.40	Stile attivo/AF vigorosa

LE ATTIVITÀ MODERATE

A) presenza: %EEA≥3 METs, %STEPS≥ 3METs

B) durata: PAD≥3METs

C) intensità: LAM≥3METs

LAS ≤ 3METs

Analisi cronobiologica

Analisi della distribuzione nello stesso giorno (fasce orarie: 4,6,8h)

Analisi della distribuzione confronto fra i giorni

Diabetes and Exercise: The Role of the Athletic Trainer

Carolyn C. Jimenez, MS, ATC

Objective: To identify the role that exercise plays in the management of diabetes mellitus and to provide the reader with guidelines for preventing and treating exercise-related complications.

Data Sources: MEDLINE was searched from 1985 to 1996 using the key words "diabetes," "exercise," "Type I diabetes," and "athlete."

Data Synthesis: Diabetes mellitus is a chronic metabolic disorder characterized by an abnormally elevated blood glucose level. It is a disease that has long-term ramifications for the body's organ systems. The primary goal of diabetes management is to normalize the blood glucose level. Exercise, along with dietary modifications and insulin, is an important component of the management scheme. While exercise is not consistently associated with improvements in long-term blood glucose control, it does lead to other benefits that may reduce the severity and number of diabetes-related complications.

Conclusions/Recommendations: The athletic trainer can help athletes with diabetes to compete safely by understanding their unique physiologic responses to exercise, as well as the risks and benefits of exercise.

Key Words: diabetes mellitus, blood glucose control, Type I diabetes

Whether an individual is diabetic or not, physical exercise is an important component of a healthy lifestyle. There are many benefits of regular exercise: decreased body fat, increased lean body mass, a better-functioning cardiovascular system, and an improved sense of psychological well-being. These exercise-related benefits are especially important for people with diabetes, who are at greater risk for coronary artery disease, arteriosclerosis, cerebral vascular diseases, renal diseases, ocular diseases, and other health problems.[1,2] Therefore, along with dietary modifications and oral diabetes medications or insulin therapy, regular exercise is an important component of diabetes management.[3]

While there are several types of diabetes, the focus of this article will be Type 1 diabetes mellitus, previously known as insulin-dependent diabetes mellitus and previously identified as Type I.[4] Type 1 diabetes is one of the most common chronic childhood diseases.[5,6] The prevalence of Type 1 diabetes among children, adolescents, and young adults means that this is the form most certified athletic trainers will encounter. It is important that the athletic trainer understand the role of exercise in the management of diabetes, including the diabetic's physiologic response to exercise and how it differs from the nondiabetic's, and the risks and benefits of exercise. In this article, I will discuss these issues and how the athletic trainer can work with the diabetic to make physical exercise a safe, valuable, and enjoyable part of life.

DIABETES MELLITUS DEFINITION

Diabetes mellitus is a chronic metabolic disorder in which the body either does not produce adequate amounts of insulin or does not use it properly.[3] Insulin, a hormone created in the pancreas, is necessary for carbohydrate metabolism. Insulin allows glucose to enter the cell, where it is converted to energy. In addition, insulin plays important roles in protein synthesis and fat storage.[3]

Diabetes is characterized by an abnormally high blood glucose level and the inability to properly metabolize and store ingested dietary "fuels." Chronically elevated levels of blood glucose eventually damage the body's systems. As a result, diabetes is a disease with long-term negative effects on the body's renal, neurologic, ocular, cardiovascular, and musculoskeletal systems.[5]

TYPE 1 DIABETES MELLITUS

Type 1 diabetes affects approximately 10% of the diabetic population.[5,7] It is an autoimmune disorder in which the insulin-secreting beta cells of the pancreas are destroyed over time. The immune response can be triggered by hereditary factors or environmental conditions, such as a virus.[5] When approximately 80% of the beta cells are destroyed, the individual no longer produces sufficient insulin to facilitate the uptake of ingested fuels.[5] Subsequently, the individual develops the signs and symptoms associated with diabetes, which may include fatigue, visual changes, excessive hunger, extreme thirst, frequent urination, and weight loss. In addition, the Type 1 diabetic is at risk for developing ketoacidosis. Ketoacidosis is caused by the buildup of ketones, acid by-products that poison the blood.[3] It is commonly referred to as diabetic ketoacidosis (DKA) and occurs almost exclusively in the Type 1 diabetic.[3,5]

IMPACT OF DIABETES

Diabetes is a disease associated with many acute and chronic complications. The acute complications include DKA and hypoglycemia (low blood sugar). Chronic complications affect the eyes, nervous system (especially the peripheral and autonomic nerves), kidneys, and cardiovascular system. It is

Carolyn C. Jimenez is an instructor and athletic trainer in the Department of Sports Medicine, West Chester University, West Chester, PA 19383.

nno ottenuto i
ollo metabolico
qualificati per
nare programmi
oni .
sistematica ha
he quando la
interrotta la
llo glicemico si

Castaneda C Diabete
Dunstan DW Diabete
Mourier A Diabetes (
Gordon BA Diabetes

Clinical Care/Education/Nutri

BRIEF REPORT

Supervised Exer Counterbalances Insulin Therapy i Subjects With Ty

Stefano Balducci, md[1,2,3]
Silvano Zanuso, phd[4]
Patrizia Cardelli, phd[1,5]
Gerardo Salerno, bs[1,5]
Sara Fallucca, phd[1,5]
Antonio
Giuseppe
for the
(IDES

OBJECTIVE—To examine the effect of supervised exerc cardiovascular risk factors in sedentary, overweight/obese diabetes from the Italian Diabetes Exercise Study.

RESEARCH DESIGN AND METHODS—The st patients to twice weekly supervised aerobic and resistan counseling (EXE) or to counseling alone (CON) for 12 mont were assessed at baseline and at the end of the study.

RESULTS—The volume of physical activity was signific CON group. Values for hemoglobin A_{1c}, BMI, waist circu protein, blood pressure, LDL, and the coronary heart disease only in the EXE group. No major adverse events were obser

CONCLUSIONS—In insulin-treated subjects with type and effective in improving glycemic control and markers counterbalancing the adverse effects of insulin on these pa

Atherosclerosis has been increasingly recognized as an inflammatory disease characterized by systemic, central fat-driven and local low-grade inflammation, which is involved in all stages of its natural history (1). Several proinflammatory mediators have been associated with cardiovascular disease (CVD), independent of traditional CVD risk factors (2). In particular, high-sensitivity C-reactive protein (hs-CRP) has been shown to be a strong independent predictor of CVD in patients with type 2 diabetes (3). More recently, clinical t reductio marked (4) and mixed (training, activity (significa subjects Whe secondar agents (ment, al

From the [1]Department of Clinical and Molecular Medicine, "La Sa abetes Unit, Sant'Andrea Hospital, Rome, Italy; the [2]Metabolic F Italy; the [3]School of Science, University of Greenwich, London, U Sant'Andrea Hospital, Rome, Italy; and the [4]Department of Cl Consorzio Mario Negri Sud, S. Maria Imbaro, Chieti, Italy.
Corresponding author: Stefano Balducci, MD, sbalducci@tesinet.it.
Received 1 August 2011 and accepted 26 September 2011.
DOI: 10.2337/dc11-1450. Clinical trial registration: ISRCTN0425
This article contains Supplementary Data online at http://care. .2337/dc11-1450/-/DC1.
*A complete list of the IDES Investigators can be found in the Sup

Diabetologia
DOI 10.1007/s00125-011-2425-9

ARTICLE

Relationship of exercise volume to improvements of quality of life with supervised exercise training in patients with type 2 diabetes in a randomised controlled trial: the Italian Diabetes and Exercise Study (IDES)

A. Nicolucci · S. Balducci · P. Cardelli · S. Cavallo · S. Fallucca · A. Bazuro · P. Simonelli · C. Iacobini · S. Zanuso · G. Pugliese · for the Italian Diabetes Exercise Study (IDES) Investigators

Received: 27 October 2011 / Accepted: 28 November 2011

Abstract
Aims/hypothesis A positive impact of exercise intervention programmes on quality of life (QoL) may be important for long-term patient compliance to exercise recommendations. We have previously shown that QoL improves significantly with supervised exercise, whereas it worsens with counselling alone, in patients with type 2 diabetes from the Italian Diabetes and Exercise Study (IDES). Here, we report data on the relationship between changes in QoL and volume of physical activity/exercise in these individuals.

Methods This multicentre parallel randomised controlled, open-label, trial enrolled sedentary patients with type 2 diabetes (n=606 of 691 eligible) in 22 outpatient diabetes clinics. Patients were randomised by centre, age and diabetes treatment using a permuted-block design to twice-a-week supervised aerobic and resistance training plus exercise counselling (exercise group) versus counselling alone (control group) for 12 months. Health-related QoL was assessed by the 36-Item Short Form (SF-36) Health Survey.
Results In the exercise group (n=268 of 303 randomised), there was a trend for increasing QoL with increasing

A. Nicolucci and S. Balducci contributed equally to this study.

Electronic supplementary material The online version of this article (doi:10.1007/s00125-011-2425-9) contains a peer-reviewed but unedited complete list of the IDES Investigators; this is available to authorised users.

A. Nicolucci
Department of Clinical Pharmacology and Epidemiology,
Consorzio Mario Negri Sud,
S. Maria Imbaro, Chieti, Italy

S. Balducci · P. Cardelli · S. Cavallo · S. Fallucca · A. Bazuro · P. Simonelli · C. Iacobini · G. Pugliese (✉)
Department of Clinical and Molecular Medicine,
"La Sapienza" University of Rome,
Via di Grottarossa, 1035-1039
00189 Rome, Italy
e-mail: giuseppe.pugliese@uniroma1.it

S. Balducci · A. Bazuro · P. Simonelli · G. Pugliese
Diabetes Unit, Sant'Andrea Hospital,
Rome, Italy

S. Balducci
Metabolic Fitness Association,
Monterotondo, Rome, Italy

P. Cardelli · S. Cavallo · S. Fallucca
Laboratory of Clinical Chemistry,
Sant'Andrea Hospital,
Rome, Italy

S. Zanuso
School of Science,
University of Greenwich,
London, UK

Published online: 11 January 201

ervised Exercise
us

ed physical activity that was still above
r later, modest improvements in glycemic
significant improvements in blood pres-
d with a usual care control group.[9] How-
quent larger trial by the same investiga-
no difference between counseling and
s in physical activity, glycemic control, or
e.
Diabetes and Exercise Study (IDES),[11] pub-
issue of the *Archives*, is an important ad-
iterature. In this multicenter trial, 606 pa-
T2DM were randomized to either an
group, which also performed aerobic and
ning in exercise facilities under the super-
sonal trainers twice weekly, or a control
upervised session lasted 75 minutes and in-
c exercise plus 4 resistance exercises with
f 15 repetitions or 3 sets of 8 repetitions.
s (intervention and control) received struc-
l activity counseling by trained physicians
s, along with guidelines-based usual medi-
pliance was excellent in this 1-year trial;
ibed exercise sessions were completed and
jects withdrew. Total self-reported physi-
reased substantially compared with base-
ntervention and control groups, confirm-
eness of the structured exercise counseling.
pared with the counseling plus usual care
, the group receiving facility-based train-
icantly better results in essentially all out-
ng HbA_{1c} level (the primary outcome), aero-
ength, blood pressure, lipid levels, waist
:, markers of systemic inflammation, and
year cardiovascular risk.
nportant trial for several reasons. With over
IDES was larger than previous exercise in-
als in T2DM, allowing greater statistical
ct small but clinically significant changes
important outcomes. Its multicenter de-
generalizability, since results were less de-
cal factors such as the charisma of a local
r or investigator. The duration of the study
r, whereas most previous trials had inter-
ng 6 months or less. Sustaining a behav-
on in a large number of subjects with T2DM
od, with high compliance and over many
mportant demonstration of feasibility and

ee of HbA_{1c} level reduction (0.30–
oints difference between intervention and

RCHINTERNMED.COM

November 11, 2010
reserved.

"Gli uomini ascoltano più con i loro occhi che con le loro orecchie"

Seneca (lettera a Lucilio)

grazie