Benefici per la salute in età pediatrica?

Giuseppe D'Antona, MD PhD

Consensus intersocietario SIPPS, FIMP, SISMES, Associazione Psicologi dello Sport (PdS), SINUT, SIAIP, SIMA, SITOP, SIPEC.

Il bambino e l'adolescente che praticano sport

Meleleo D, Verga MC (coordinatori)

I benefici dell'attività fisica

Bernardo L, Castronuovo S, Colella D, D'Antona G, Galeone D, Gerin M, Grossi A, Paoli A, Polani D, Pozzobon G, Spinelli A, Susca G

1. Rationale

   A. Physical exercise and longevity

   B. Fundamental knowledge for translation to children and adolescents

2. Consensus questions

Inactivity and (is) mortality

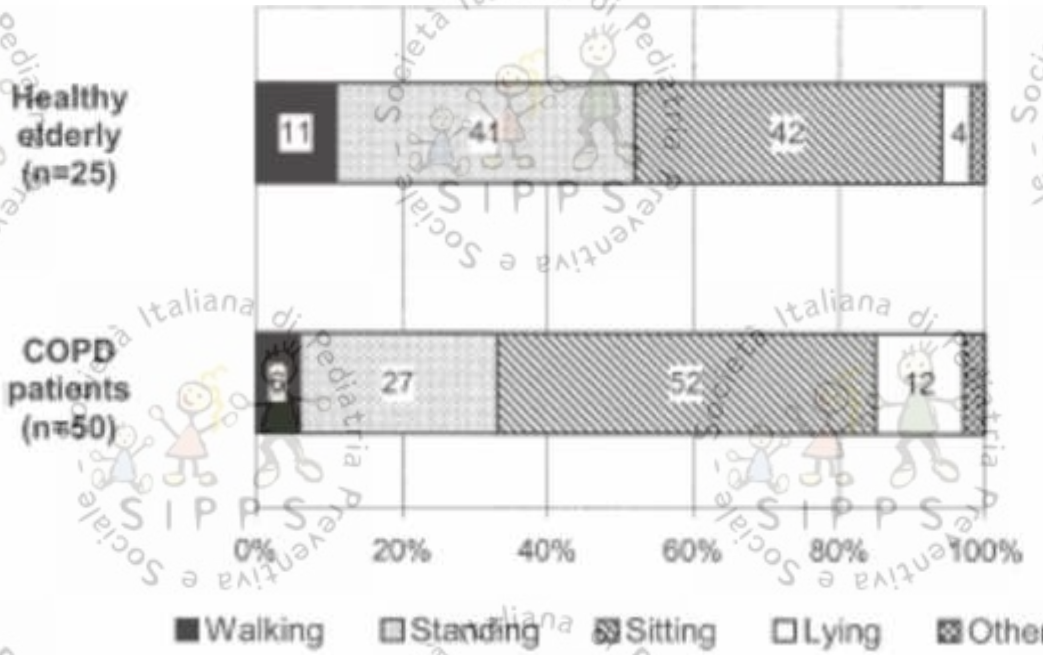


Figure 1. Percentages of time spent in each of the activities or body positions in healthy subjects and patients with chronic obstructive pulmonary disease (COPD) during the day. Others = cycling or undetermined activity (2% in healthy elderly subjects and 3% in patients with COPD).

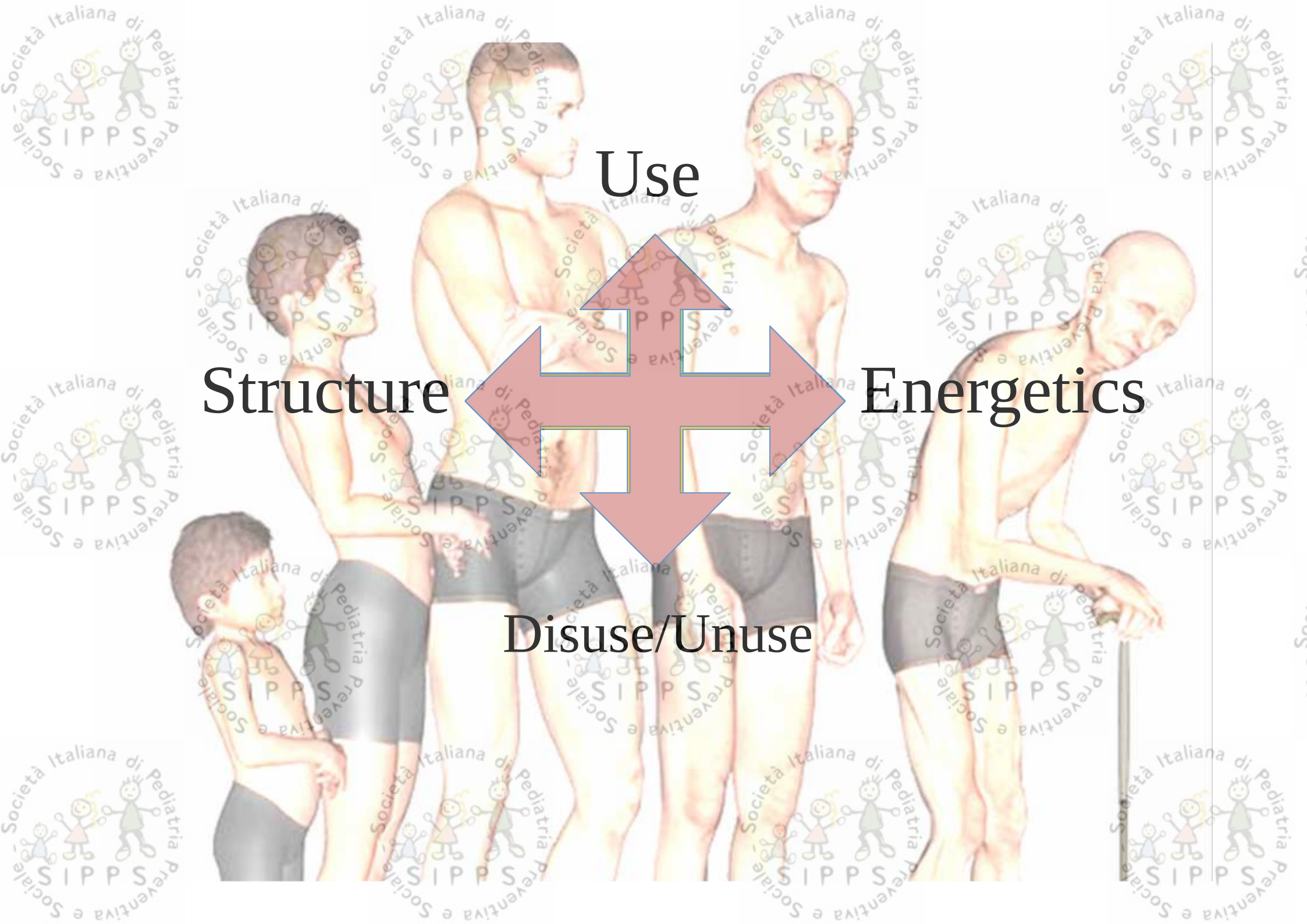
Pitta et al 2005

Television is inactivity and (is) mortality

6 years and younger: 2 hours per day in front of the TV

Adolescents: time spent watching television represents the single greatest source of physical inactivity, second only to sleep.

Dietz WH, 1991


Use
Structure
Energetics
Disuse/Unuse

Budhia Singh,
marathon prodigy

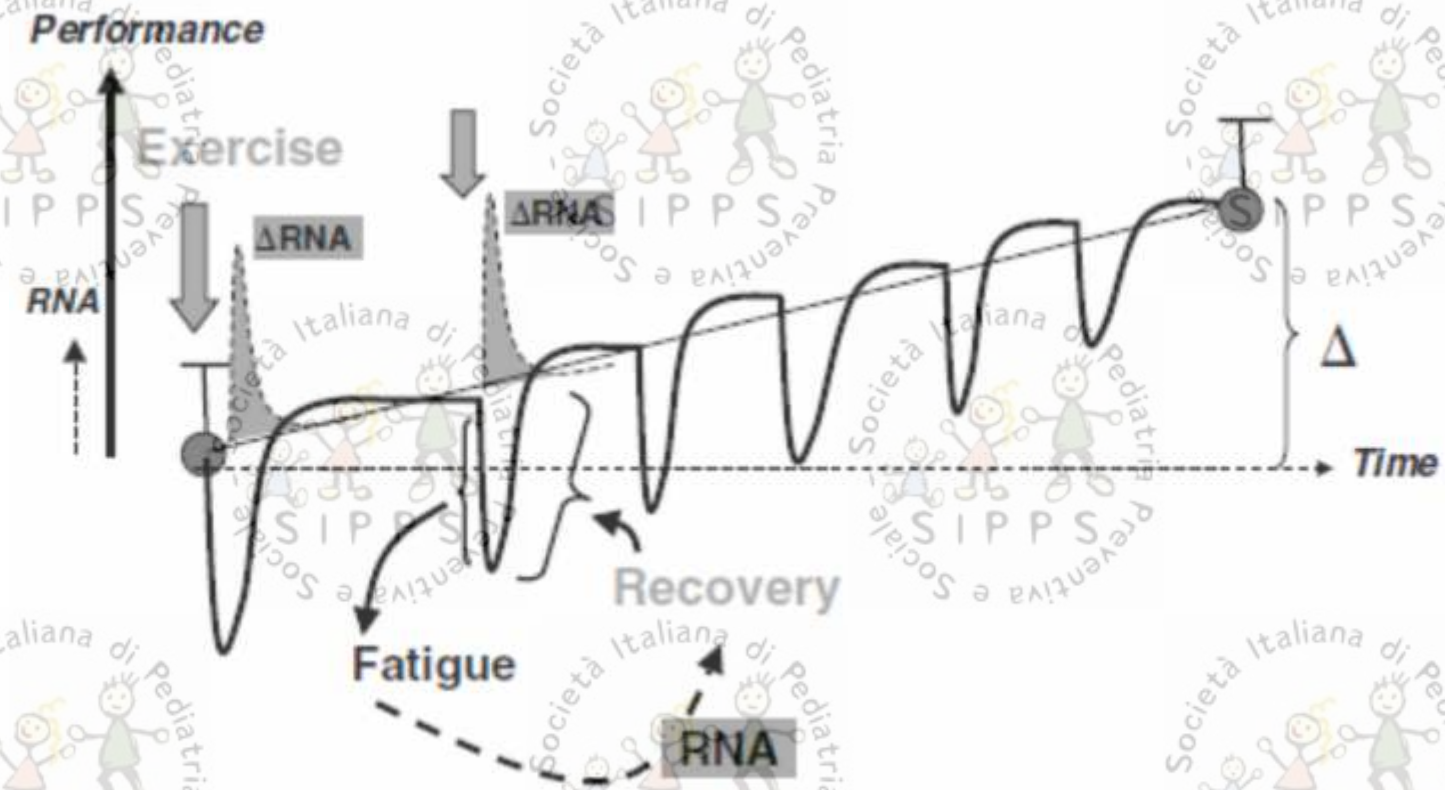
Fauja Singh, 101, finally retires from marathon running

Why exercise/physical activity is **beneficial?**

Because

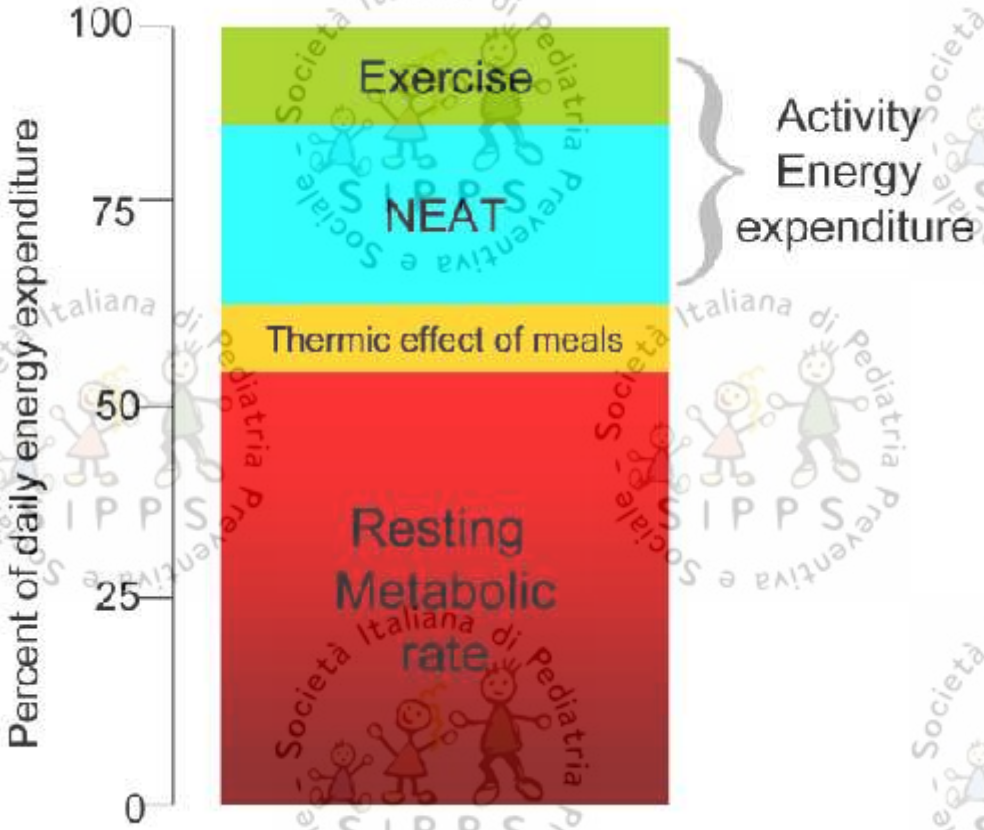
it forces the energy demand leading to **beneficial plasticity**

How physical exercise is beneficial



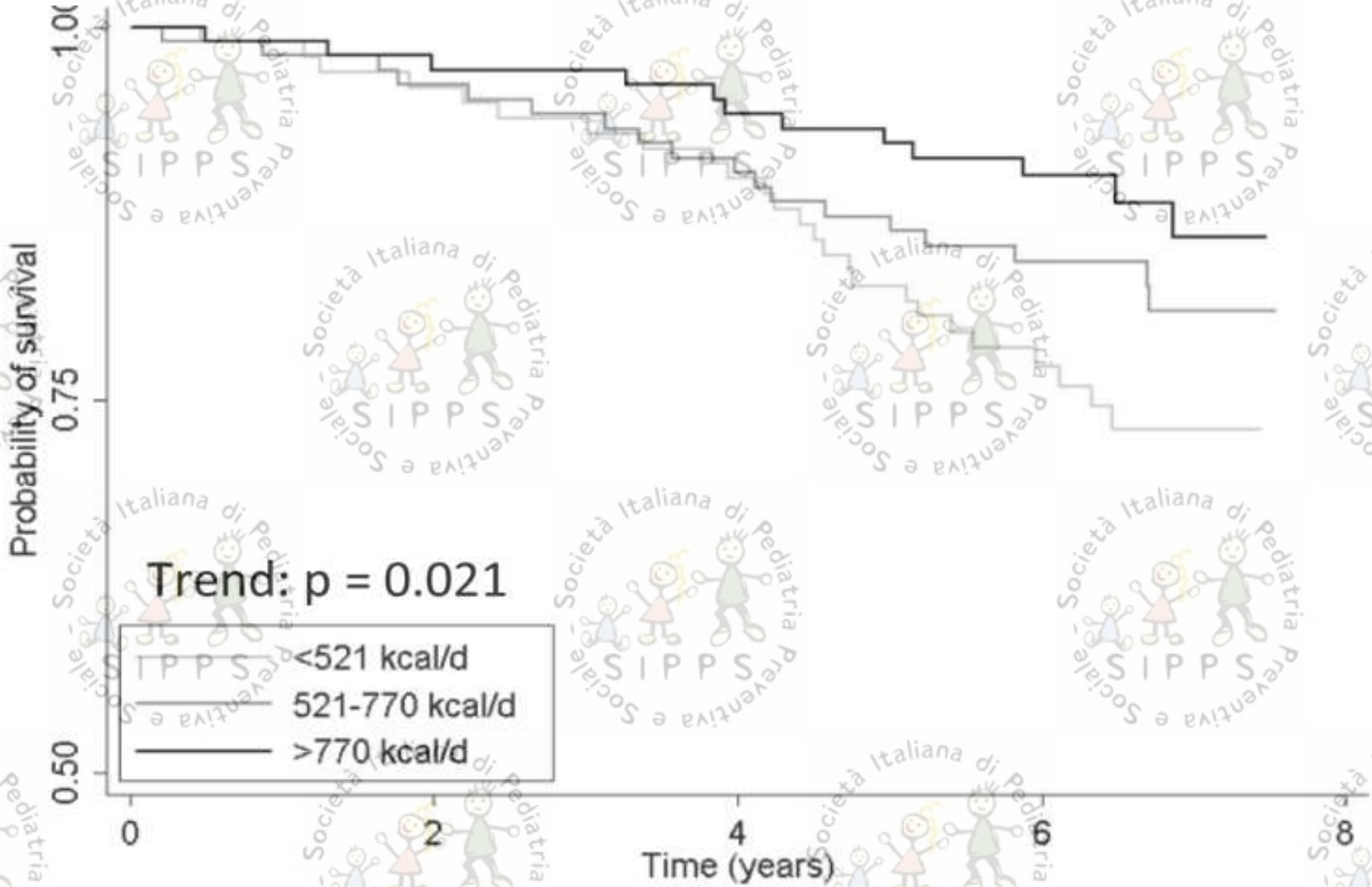
M. Fluck, 2006

Fundamental knowledge for translation

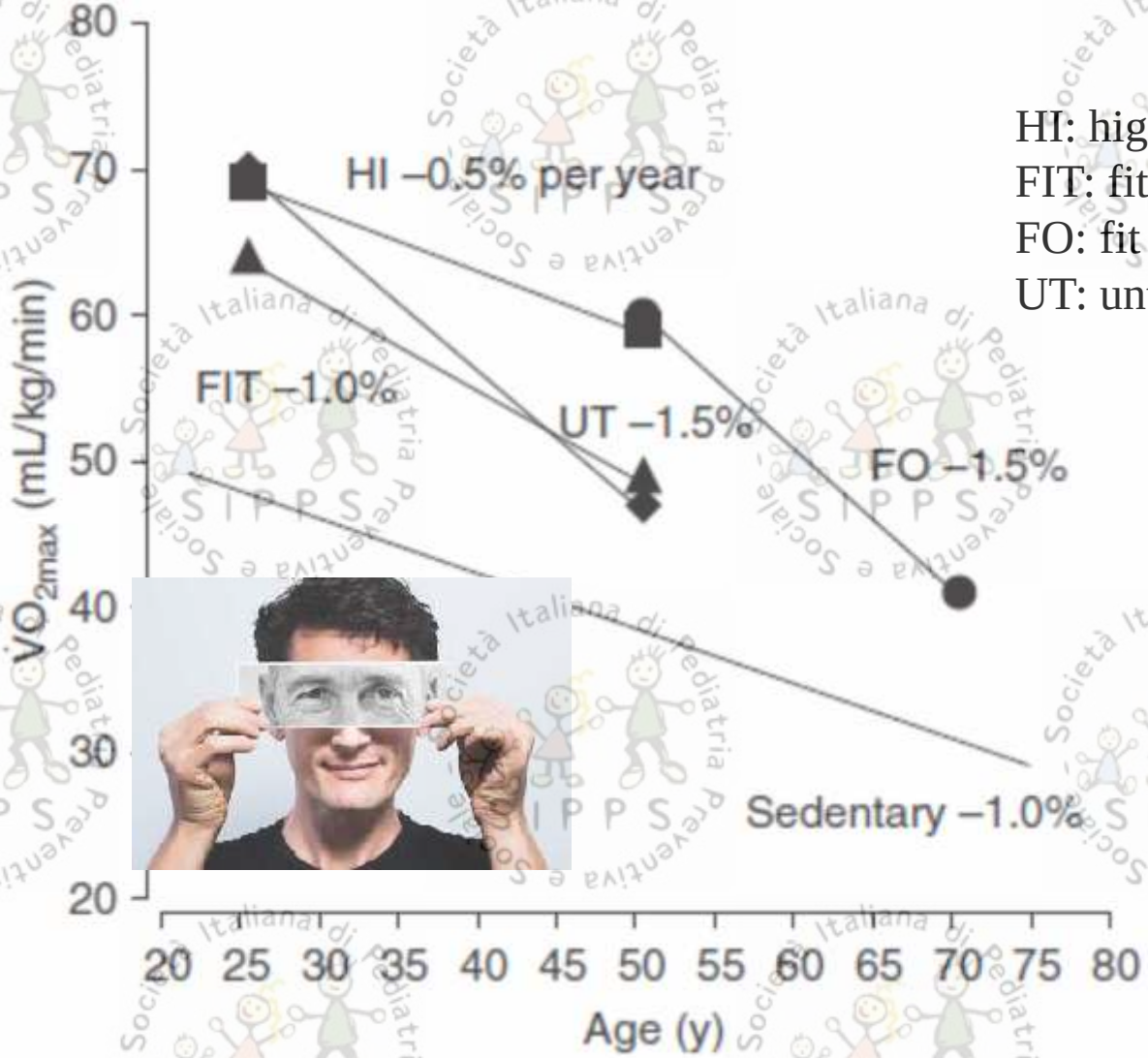


$$RMR = \sum (Met_i \times Mass_i)$$

Fundamental knowledge for translation

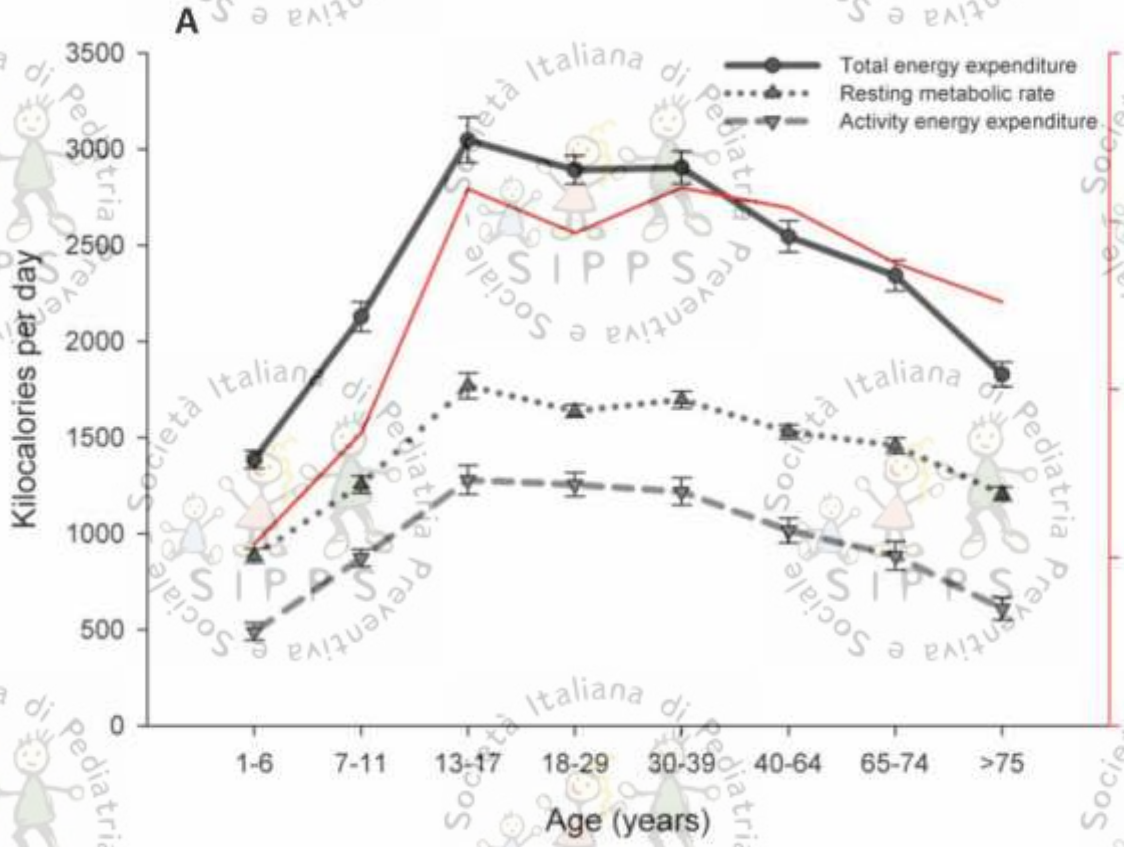


Fundamental knowledge for translation



HI: highly trained
FIT: fitness trained
FO: fit older men
UT: untrained

Trappe et al. 1995



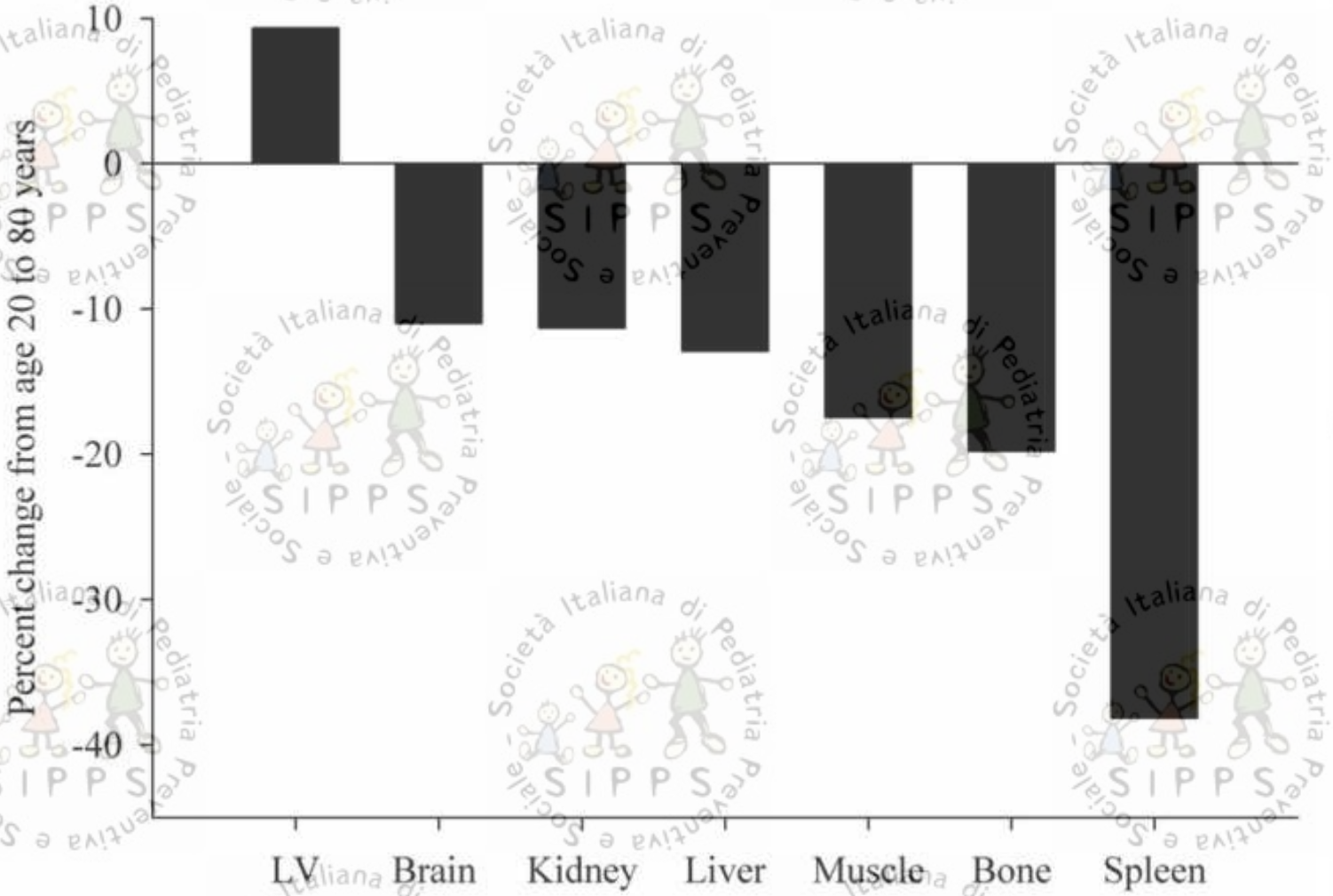
Black et al. 1996

Be careful!

- Physical activity level is the major determinant of EE in all ages

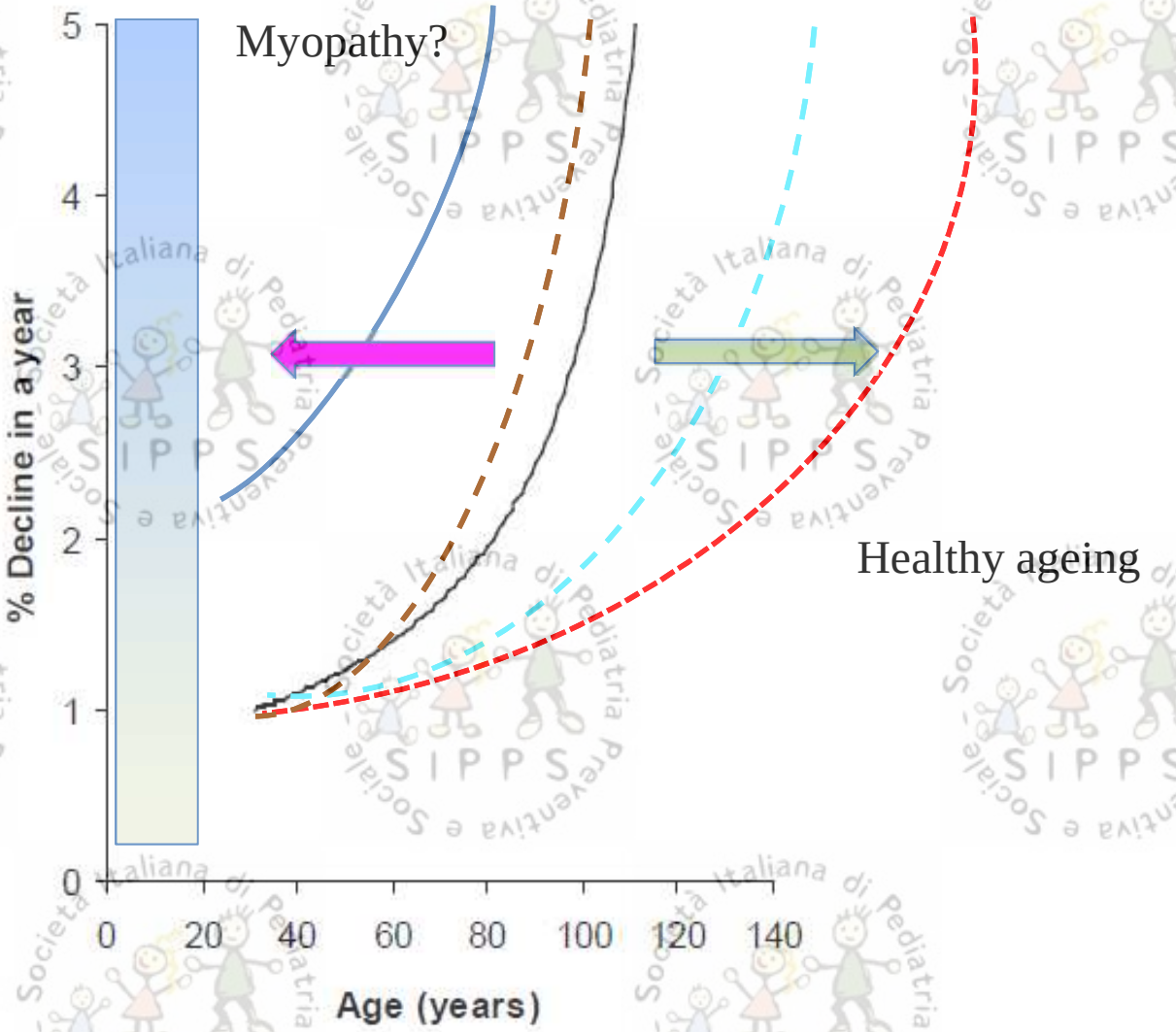
- From 262 kcal/d (elderly dement) a 6333 kcal/d (professional cyclists in Tour de France)

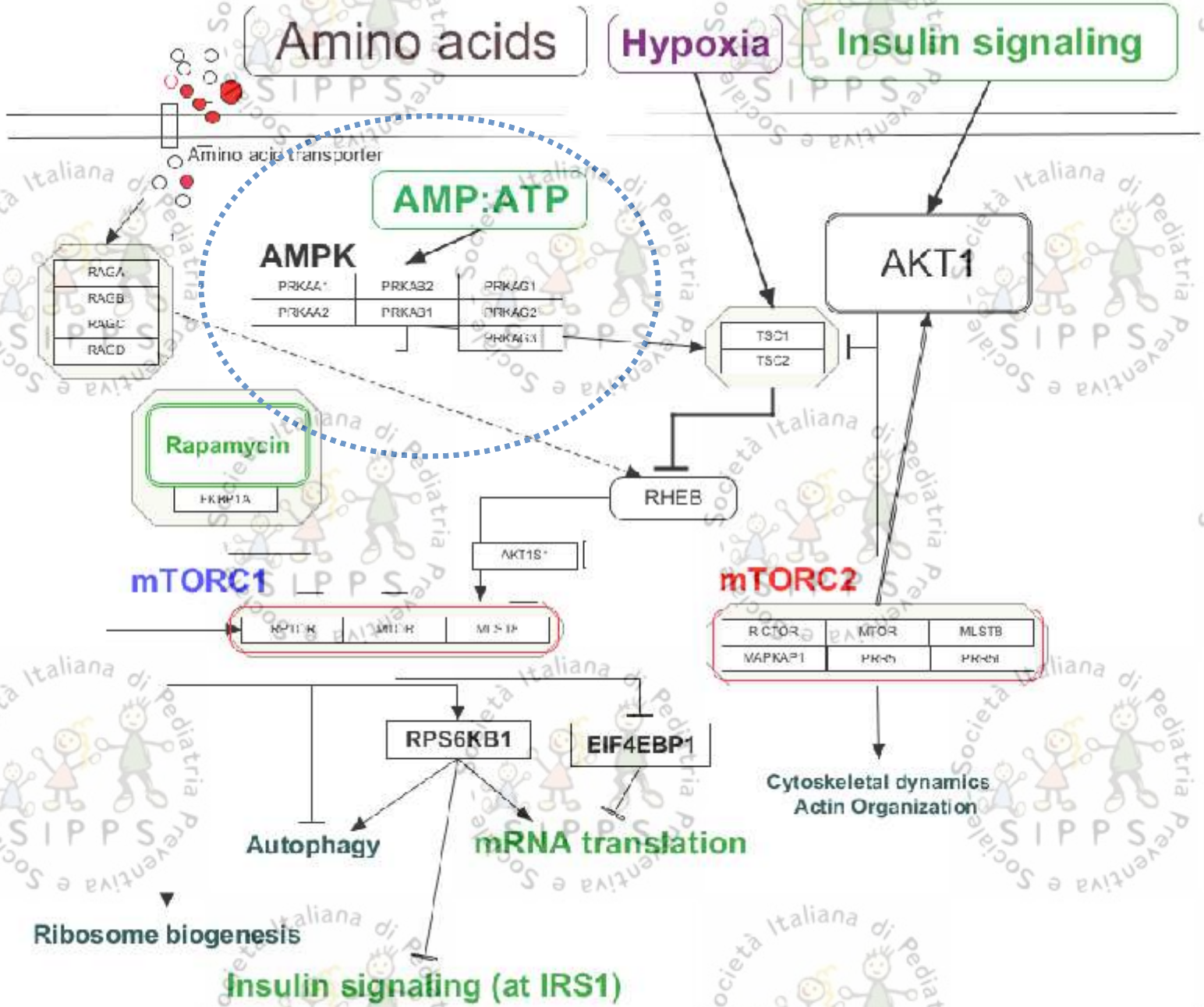
Fundamental knowledge for translation



Manini 2011

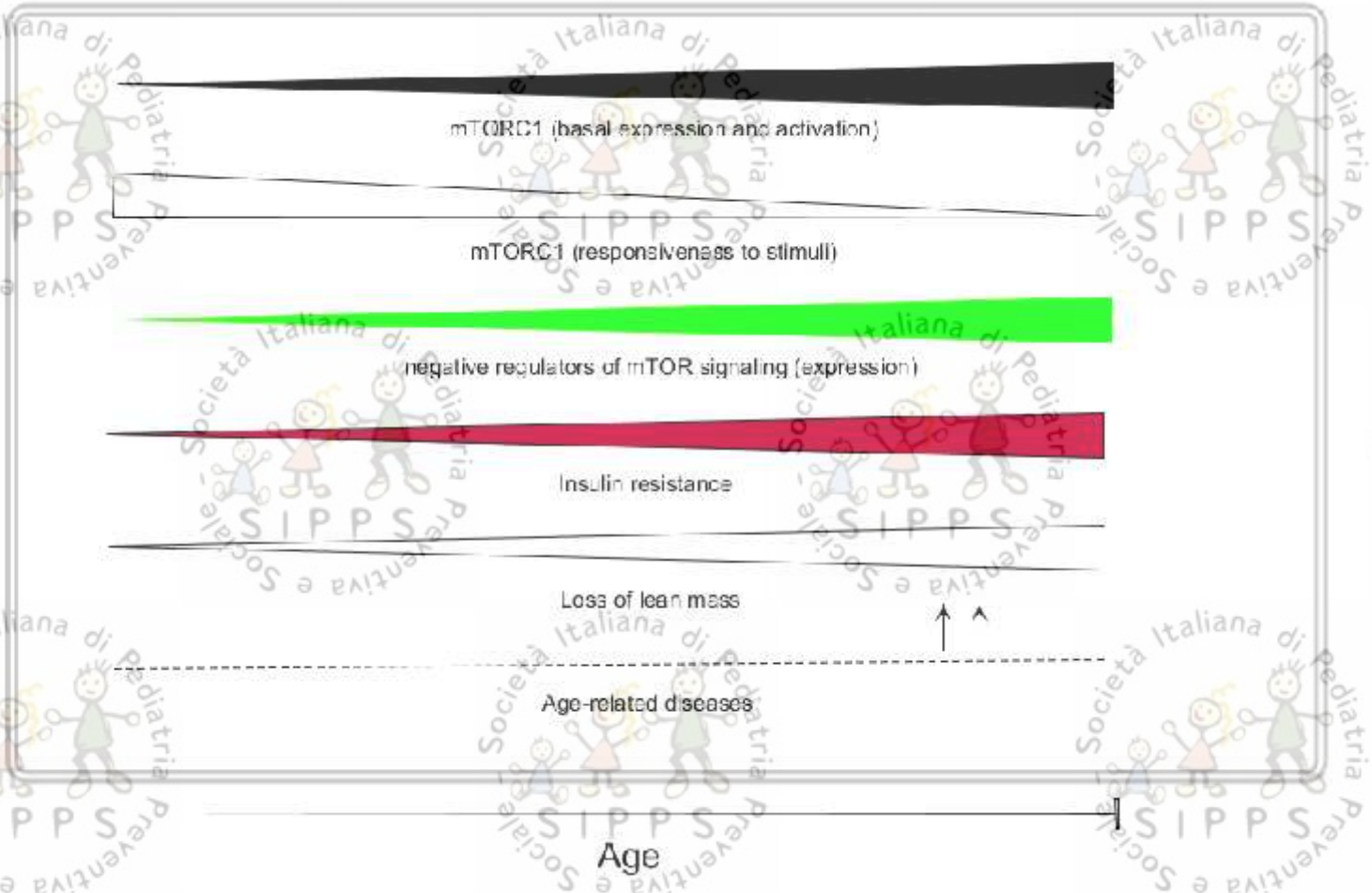
Fundamental knowledge for translation





D'Antona 2016

Fundamental knowledge for translation



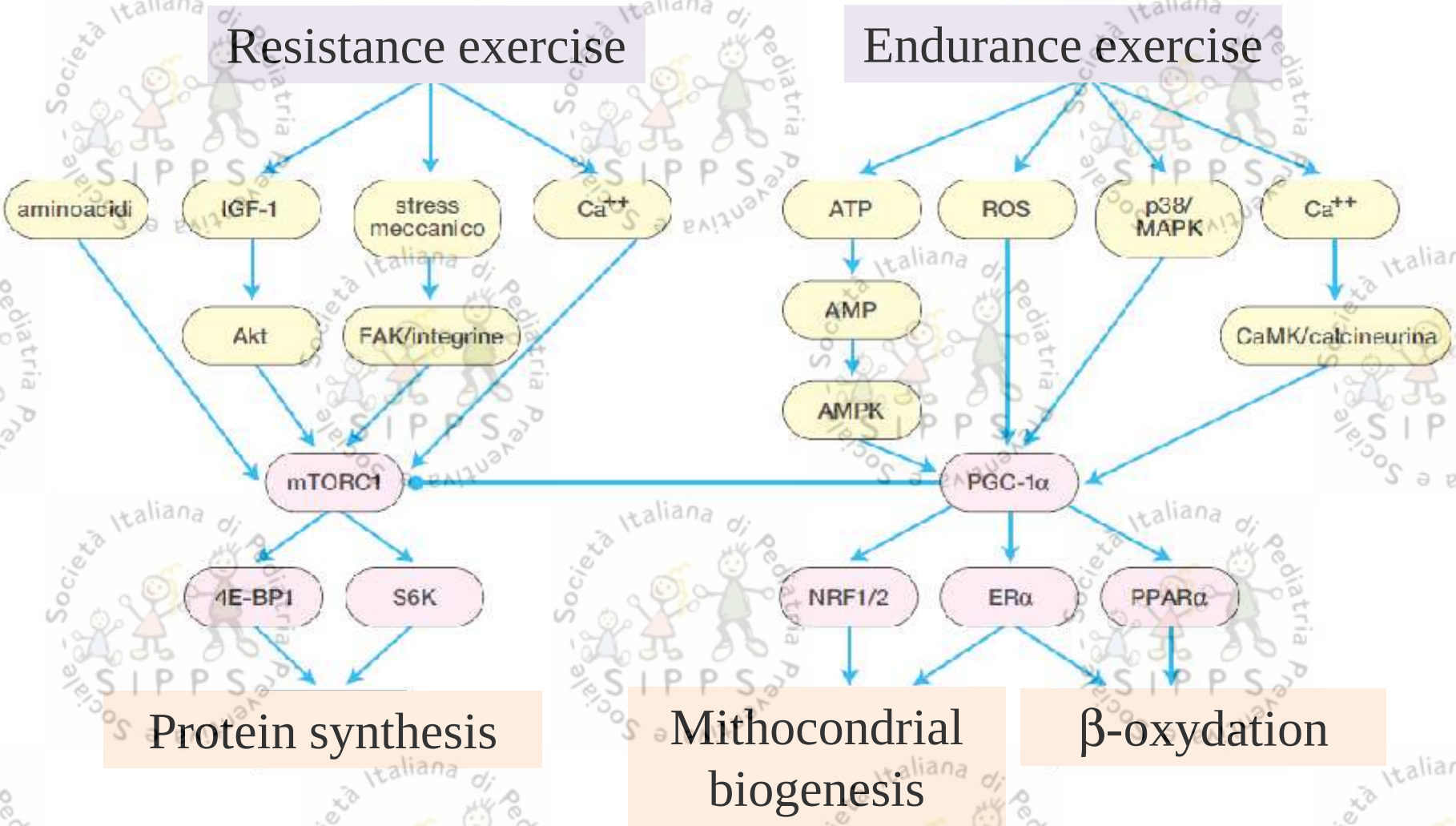
D'Antona 2016

Fundamental knowledge for translation

adattamento muscolare	esercizio di *endurance*	esercizio di forza
ipertrofia	↔	↑↑↑
forza e potenza	↔ o ↓	↑↑↑
area della sezione trasversa	↔	↑↑↑
adattamento neurale	↔↑	↑↑↑
capacità anaerobica	↑	↑↑
tolleranza al lattato	↑↑	↔ o ↑
sintesi proteica miofibrillare	↔ o ↑	↑↑↑
mitocondriogenesi, densità mitocondriale e funzione ossidativa	↑↑↑	↔ o ↑
resistenza alla fatica	↑↑↑	↔ o ↑
capillarizzazione	↑↑↑	↔

D'Antona 2019

Fundamental knowledge for translation



D'Antona 2019

Fundamental knowledge for translation

↑ATP turnover → ↑AMP:ATP →
AMPK *→ NRF-1, MEF2, HDACs,*
PGC-1α

→mitochondrial biogenesis and protein synthesis blockade

In physiological conditions 6 weeks of endurance exercise almost duplicate the mithocondrial content in all types muscle fibres

Fundamental knowledge for translation

Redox balance → ↑ NAD+:NADH
*→ **sirtuins** → p53, FOXO,*
PGC-1α

*→ **oxydative capacity***

Acute low load and recovery

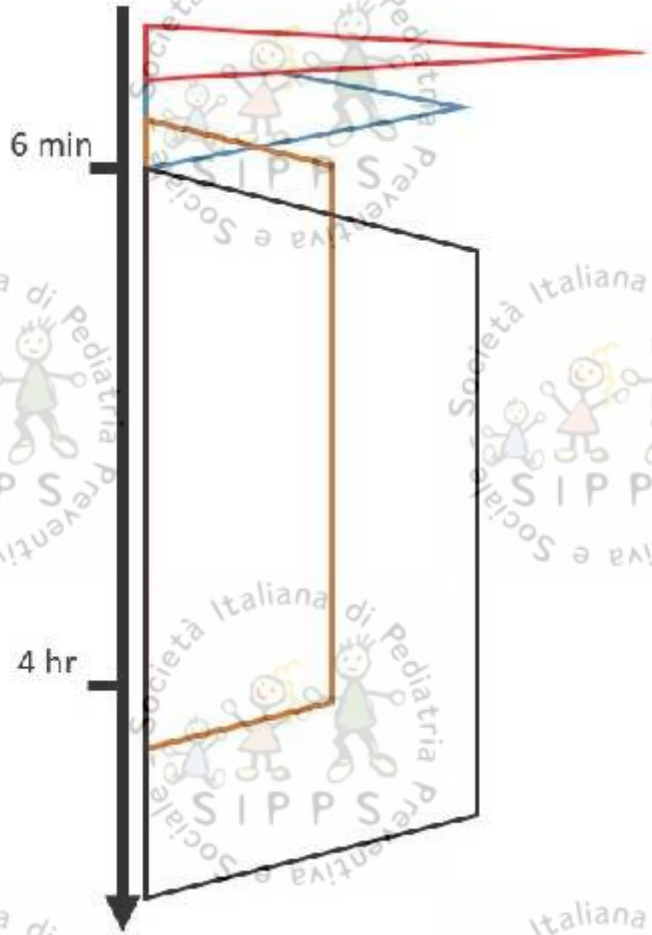
Fundamental knowledge for translation

↑ *Intracellular Calcium* →
CaMKs → *CREB, HDAC, SRF*

→ ***glucose and lipids transportation***

Bouts repetition

Fundamental knowledge for translation



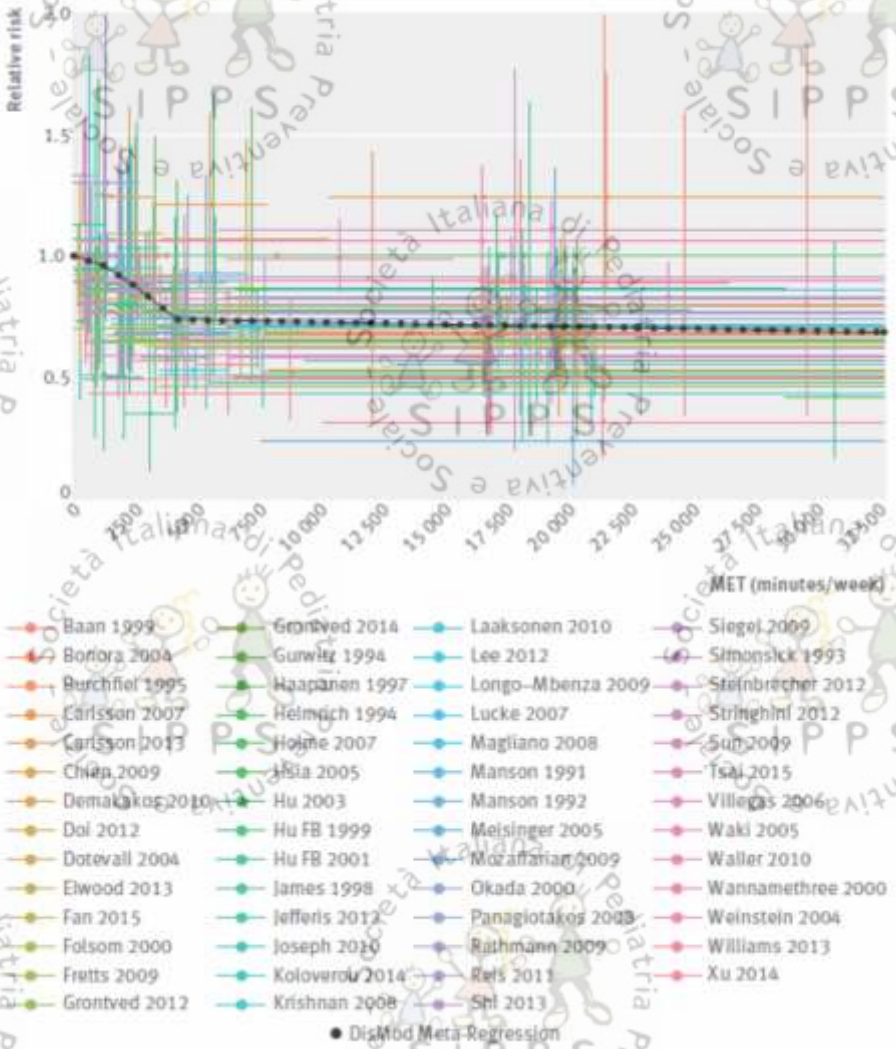
free ATP and phosphocreatine/ creatine system

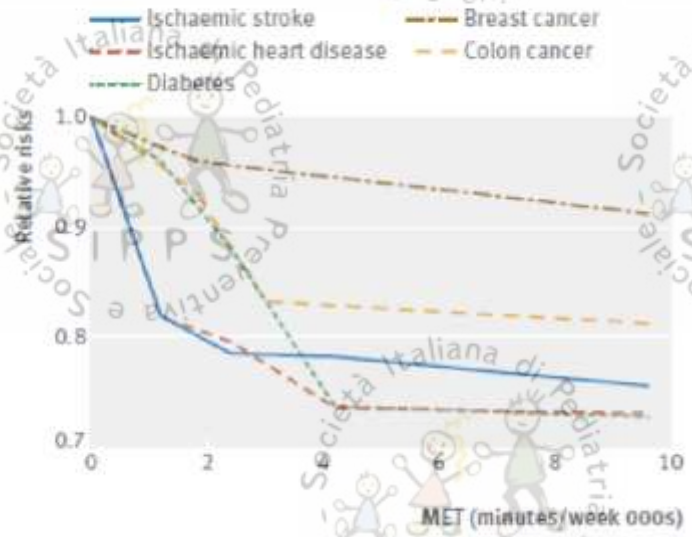
anaerobic glycolysis

aerobic oxidation

METs (metabolic equivalents) are used to express the energy costs of different physical activities being multiples of resting energy consumption

“The continuous risk curves for the associations between total physical activity and breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke show that although the risks of these diseases decrease with increasing level of total activity, most health gains occur at relatively lower levels of activity (up to 3000-4000 MET minutes/week), with diminishing returns at higher levels of activity”





Kyu 2016

Compendium of Physical Activities

Search this site

Home | Activity Categories | References | Tracking Guide | Compendia | Submit Research | Corrected METs | Help | Contact Us

This project was supported by:

Arizona State University

and

National Cancer Institute

Purpose of this Website

This site is designed to provide the updated 2011 Adult Compendium of Physical Activities and additional resources. The 2011 update identifies and updates MET codes that have published evidence to support the values. In addition, new codes have been added to reflect the growing body of knowledge and popular activities.

Foreign Language Translations: Foreign language translations of the 2011 Compendium can be found under the 'Compendia' tab at the top of the page. The Compendium is currently available in 7 languages:

English	French	Japanese	Turkish
Spanish	Italian	Chinese	Thai

Website Search Tips: Enter keywords into the search box found on the upper right hand corner of the page. This will search and return results from the entire site including PDF files. Oftentimes keywords are found on multiple pages (e.g., tractor can be found on Lawn & Garden, Occupation, and Transportation). Once you have selected a specific page, use CTRL + F to bring up another search box that will search the entered keyword only on that page.

New Activity Updates: A new page has been created to provide new information about activities that were not published in the 2011 Compendium. These activities can be found on the Activity Categories page.

History

The Adult Compendium of Physical Activities was developed for use in epidemiologic studies to standardize the assignment of MET intensities in physical activity questionnaires. Dr. Bill Haskell from Stanford University conceptualized the Adult Compendium and developed a prototype for the document. The Adult Compendium was used first in the Survey of Activity, Fitness, and Exercise (SAFE study - 1987 to 1989) to code and score physical activity records. Since then, the Compendium has been used in studies worldwide to assign intensity units to physical activity questionnaires and to develop innovative ways to assess energy expenditure in physical activity studies. Version 1 of the Adult Compendium was published in 1993. An updated version was published in 2000. References for the publications are below.

Definition of Terms used in the Adult Compendium

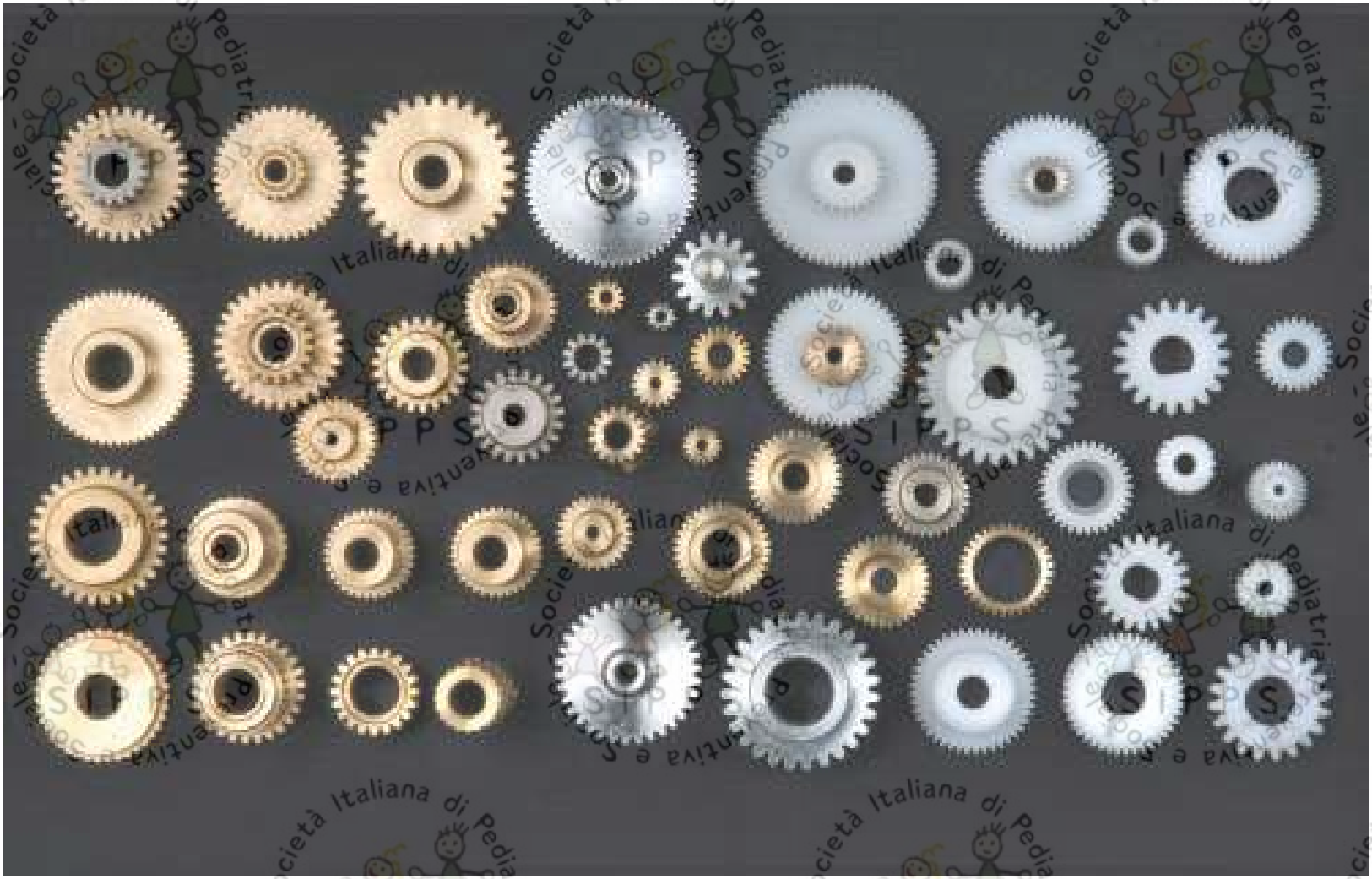
MET (Metabolic Equivalent): The ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly. A MET also is defined as oxygen uptake in ml/kg/min with one MET equal to the oxygen cost of sitting quietly, equivalent to 3.5 ml/kg/min.

5-Digit Code: Adult Compendium activities are classified by a 5-digit code that identifies the category (heading) as the first 2 digits and type (description) of activity as the last three digits. Example:

Code	Heading	Description
01010	01 - Bicycling	010 - Bicycling, < 10 mph, bicycling to work or for pleasure (Taylor code 115)

“The values in the Compendium **do not estimate the energy cost of physical activity in individuals in ways that account for differences in body mass, adiposity, age, sex, efficiency of movement, geographic and environmental conditions** in which the activities are performed.”

Physical activity and risk of disease: dose response is unkonwn in children and adolescents



Kettner et al. BMC Public Health 2013, 13:895
http://www.biomedcentral.com/1471-2458/13/895

BMC Public Health

RESEARCH ARTICLE Open Access

Objectively determined physical activity levels of primary school children in south-west Germany

Sarah Kettner[1*], Susanne Kobel[1], Nanette Fischbach[1], Clemens Drenowatz[1], Jens Dreyhaupt[2], Tamara Wirt[1], Benjamin Koch[1] and Jürgen Michael Steinacker[1]

808 sedentary < 1.5 METS
497 light activity 1.5-3 METS
128 moderate activity 3-6 METS
8 high intensity >6 METS

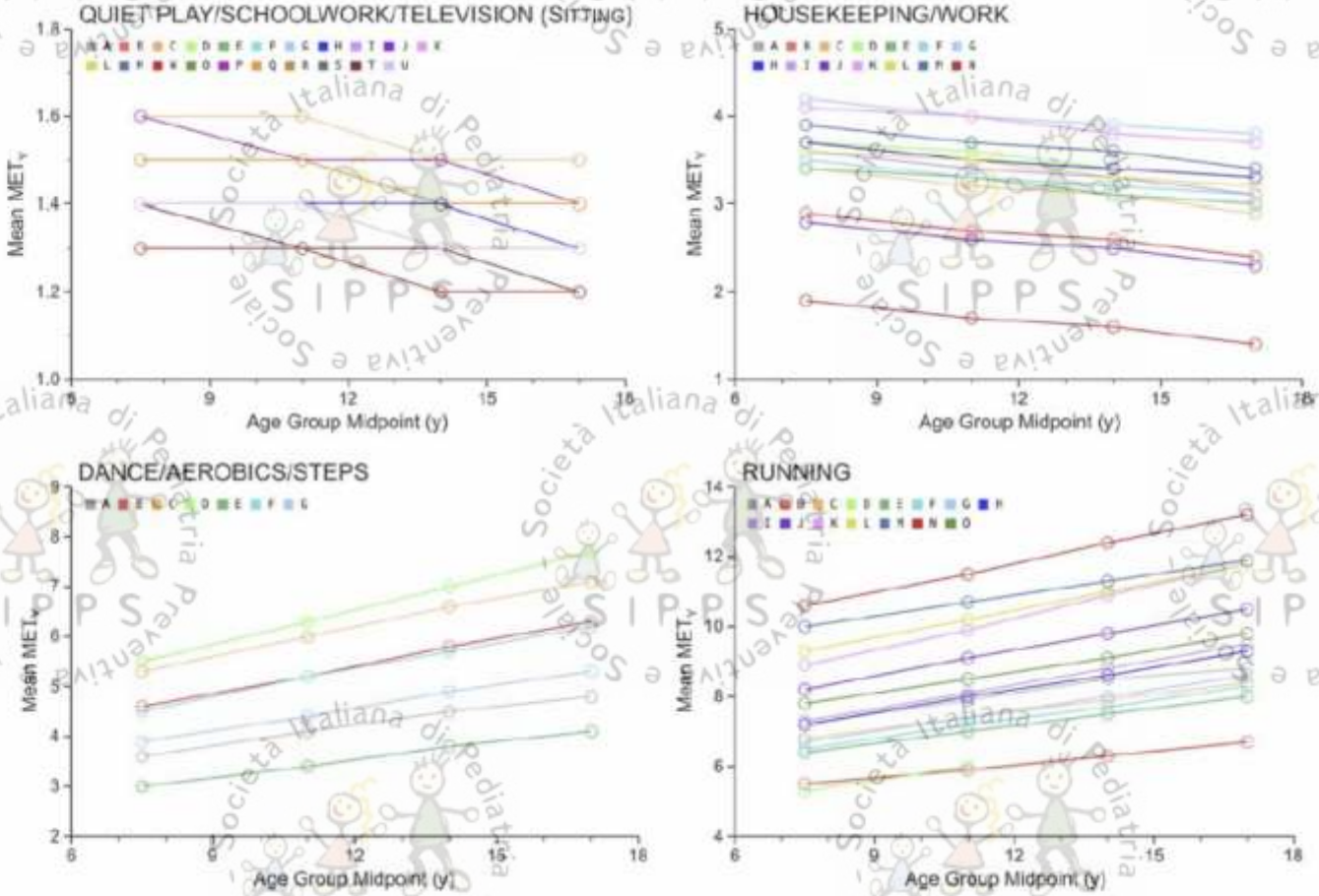
The METs values of the adult are not applicable in childhood and juvenile age as these are characterized by higher basal metabolic rates per unit of body mass compared to adults who gradually decrease while the children grow and mature

EPIDEMIOLOGY

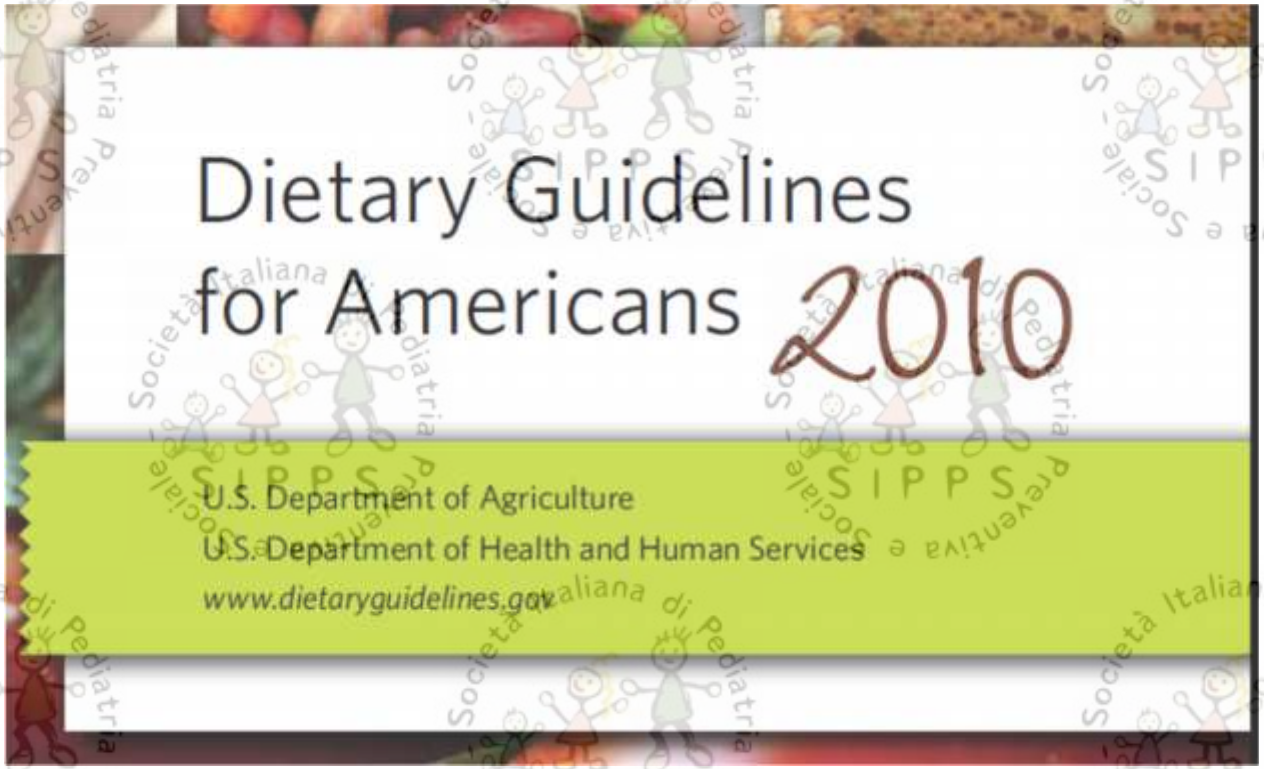
OPEN

A Youth Compendium of Physical Activities: Activity Codes and Metabolic Intensities

NANCY F. BUTTE[1], KATHLEEN B. WATSON[2], KATE RIDLEY[3], ISSA F. ZAKERI[4], ROBERT G. MCMURRAY[5], KARIN A. PFEIFFER[6], SCOTT E. CROUTER[7], STEPHEN D. HERRMANN[8], DAVID R. BASSETT[9], ALEXANDER LONG[4], ZHARIAS BHEMANE[4], STEWART G. TROST[10], BARBARA E. AINSWORTH[11], DAVID BERRIGAN[12], and JANET E. FULTON[2]



METy is a promising index recently proposed to express the metabolic equivalent in children that requires further study in the future



….children and adolescents at least **60 minutes of moderate to vigorous physical activity** on most days of the week, preferably daily…..

BOX 2

Age-Appropriate Physical Activities

Age	Motor Skills Being Developed	Appropriate Physical Activities
5-6 years	Fundamental (eg, running, galloping, jumping, hopping, skipping, throwing, catching, striking, or kicking)	• Activities that focus on having fun and developing motor skills rather than on competition • Simple activities that require little instruction • Repetitive activities that do not require complex motor and cognitive skills (eg, running, swimming, tumbling, or throwing and catching a ball)
7-9 years	Fundamental Transitional (eg, throwing for distance or throwing for accuracy)	• Activities that focus on having fun and developing motor skills rather than on competition • Activities with flexible rules • Activities that require little instruction • Activities that do not require complex motor and cognitive skills (eg, entry-level baseball or soccer)
10-11 years	Transitional Complex (eg, playing basketball)	• Activities that continue to focus on having fun and developing motor skills rather than on competition • Activities that require entry-level complex motor and cognitive skills • Activities that continue to emphasize motor skill development but that begin to incorporate instruction on strategy and teamwork

Società Italiana di Pediatria Preventiva e Sociale SIPPS

AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness and Committee on School Health

Physical Fitness and Activity in Schools

ABSTRACT. Schools are in a uniquely favorable position to increase physical activity and fitness among their students. This policy statement reaffirms the American Academy of Pediatrics' support for the efforts of schools to include increased physical activity in the curriculum, suggests ways in which schools can meet their goals in physical fitness, and encourages pediatricians to offer their assistance. The recommendations in this statement are consistent with those published in 1997 by the Centers for Disease Control and Prevention.[1]

1. Consensus questions

Tema 0: Definizione di attività fisica, esercizio fisico e sport

Tema 1: Ricadute sulla salute fisica

Tema 2: Benefici psicologici e ricadute sulle funzioni cognitive

Tema 3: Ricadute pedagogiche e sull’inclusione sociale

Tema 0: Definizione di attività fisica, esercizio fisico e sport

conclusioni preliminari:

Attività fisica è un termine generico che comprende sia le forme strutturate che non strutturate di attività ricreative, di trasporto, domestiche e lavorative. L'attività fisica comporta un movimento del corpo che aumenta il dispendio energetico rispetto al riposo. Infatti l'attività fisica, spesso caratterizzata, in termini di intensità, da moderata a vigorosa, determina la quota percentualmente maggiore del dispendio energetico totale in ogni fascia di età, con estrema variabilità in età giovanile.

Tema 0: Definizione di attività fisica, esercizio fisico e sport

conclusioni preliminari:

L'esercizio fisico è definito come un sottoinsieme di attività fisiche strutturate che sono più specificamente progettate per migliorare la forma cardiorespiratoria, la funzione cognitiva, l'equilibrio della flessibilità, la forza e / o il potere. Questa affermazione presenta il consenso sugli effetti dell'attività fisica sulla forma, la salute, il funzionamento cognitivo, la capacità funzionale, l'impegno, la motivazione, il benessere psicologico e l'inclusione sociale degli adulti più anziani. Copre anche il consenso sulle strategie di implementazione dell'attività fisica.

Tema 0: Definizione di attività fisica, esercizio fisico e sport

conclusioni preliminari:

Con il termine Sport si indicano tutte le discipline fisiche in tutte le sue forme e fini, e inoltre fa riferimento pure a tutto ciò che riconduce allo sport, ad esempio l'abbigliamento. Lo Sport è un fenomeno sociale ed economico d'importanza crescente che contribuisce in modo significativo agli obiettivi strategici di solidarietà e prosperità perseguiti dall'Unione europea, è fonte di valori importanti come lo spirito di gruppo, la solidarietà, la tolleranza e la correttezza e contribuisce così allo sviluppo e alla realizzazione personali, aiutando in tal modo a rafforzare la cittadinanza attiva.

Tema 2: Benefici psicologici e ricadute sulle funzioni cognitiveconclusioni preliminari:

a. Sono necessari lavori sperimentali più accurati per dimostrare con chiarezza che l'introduzione dell'esercizio fisico possa avere un effetto preventivo sullo sviluppo di sintomi di disagio mentale nei giovani.

b. Allo stato attuale delle conoscenze non è possibile definire una relazione causale e un nesso temporale fra attività fisica, partecipazione sportiva e benessere psicologico.

c. L'attività fisica è in grado di ridurre i sintomi depressivi e l'ansia e aspetti sintomatici della bulimia nervosa

d. Allo stato attuale delle conoscenze non è possibile definire una relazione causale e un nesso temporale fra attività fisica e funzionamento cognitivo nel bambino e nel giovane.

e. Allo stato attuale delle conoscenze non è possibile definire una relazione chiara tra livello di intensità e durata dell'attività fisica, e rendimento scolastico

(Hagel 2016, Motl 2004, Crews 2004, Wiles 2012, Sibold 2015, Biddle 2011, Parfitt 2009, Badura2015, Ekeland 2004, Donaldson 2006, Eime 2013, Carter 2016, Cerrillo 2015, Sundgot and Borgen 2002, Blakemore 2003, Hillman 2005, Maeda 2004, Biddle 2011, Chang 2013, Hillman 2009, Palmer 2013, Vanhelst 2016, Webster 2015, Zach 2015, Coe 2006, Coe 2013, Tyler 2019, Santos 2016)

Future directions:

Consensus on theme 1 and 3.

Journal of Physical Activity and Health, 2013, 10, 289-308
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JOURNAL OF
Physical Activity & Health
Official Journal of ISPAH
www.JPAH-Journal.com
SPECIAL REPORT

Physical Activity: An Underestimated Investment in Human Capital?

Richard Bailey, Charles Hillman, Shawn Arent, and Albert Petitpas

I risultati dell'attività fisica possano essere definiti come "***capitali***" differenziali che rappresentano investimenti in attività specifiche del dominio: emotivo, finanziario, individuale, intellettuale, fisico e sociale.

Questi investimenti,se fatti all'inizio del corso della vita, possono produrre ricompense significative, nell'età evolutiva, adulta ed anziana.