Association between climbing and health

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Backround

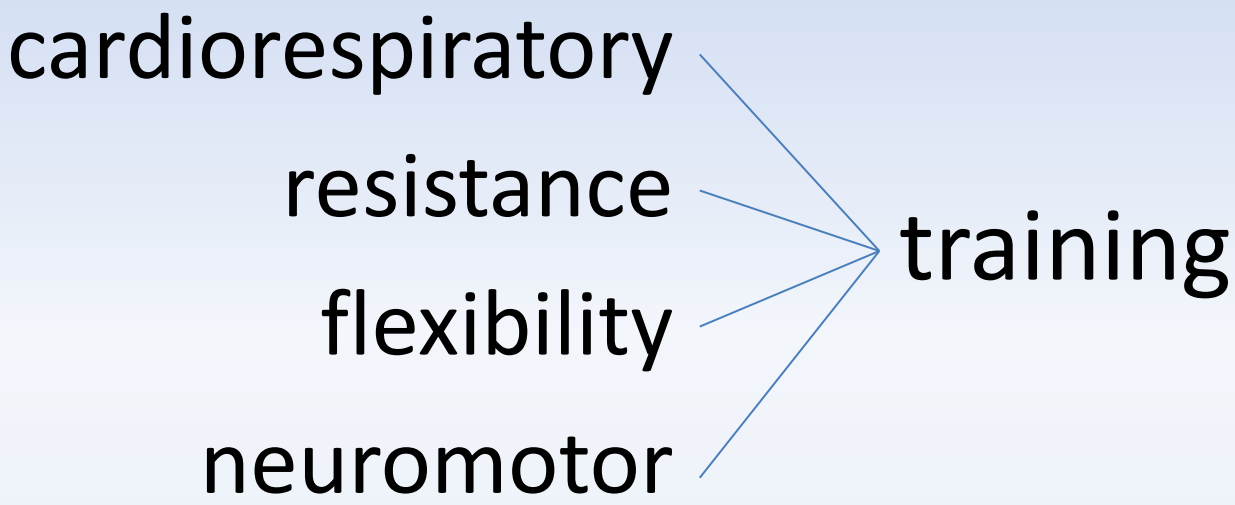
- Physical activity (PA) has been shown to substantially reduce the risk of several controllable and degenerative diseases and to improve both the quality of life and longevity.

- PA reduces the risk of morbidity and mortality from coronary artery disease, hypertension, type 2 diabetes mellitus, several forms of cancer and osteoporosis.

- In 1992, the American Heart Association (AHA) identified physical inactivity as a primary risk factor for the development of CAD, joining hypertension,smoking, and lipid abnormalities.

- In 1993 - it has been estimated that more than 250,000 deaths per year in the United States are directly related to physical inactivity and that hypokinetic diseases substantially contribute to the $900 billion spent annually on health care

General recommendation for physical activity from ACSM (2011)



Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I. M., et al. (2011). Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise. *Medicine and Science in Sports and Exercise, 43*(7), 1334-1359.

Cardiorespiratory fitness

- moderate-intensity cardiorespiratory exercise training for ≥ 30 min·d^{-1} on ≥ 5 d·wk^{-1} for a total of ≥ 150 min.wk^{-1}

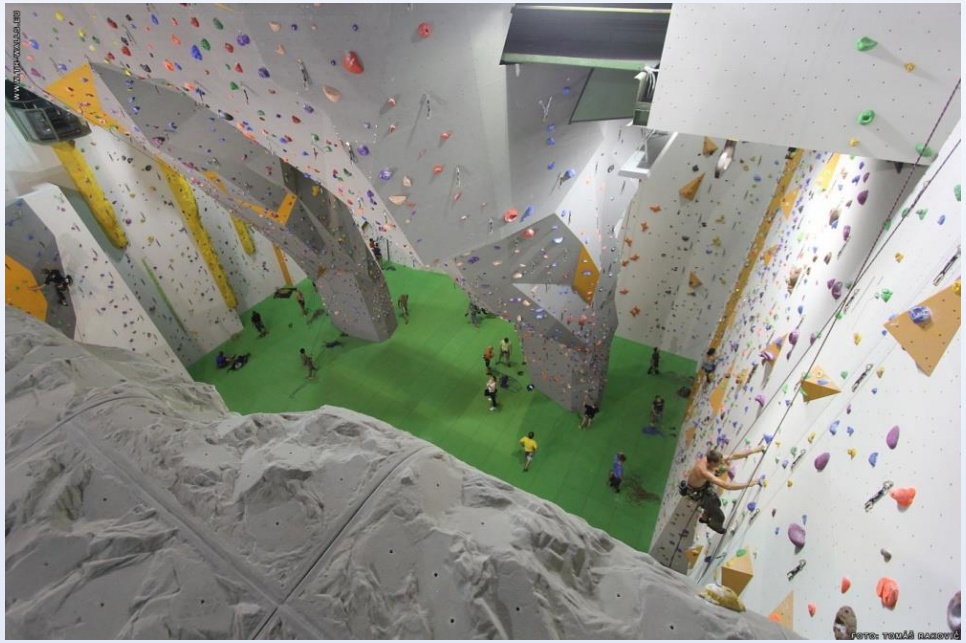
- vigorous-intensity cardiorespiratory exercise training for ≥ 20 min·d^{-1} on ≥ 3 d·wkj1 (≥ 75 min·wk^{-1})

- or a combination of moderate- and vigorous-intensity exercise to achieve a total energy expenditure of **1000 kCal**.

Muscular strength and endurance, neuromotor training

On 2–3 $d \cdot wk^{-1}$, adults should also perform resistance exercises for each of the major muscle groups, and neuromotor exercise involving balance, agility, and coordination.

Sport climbing



~~Sport climbing~~ - mountaineering

Climbing in EU

- **France** around 1 mil. (1,5 %) regular and occasional climbers; 166 000 climbers organized FFME (82 000), CAF or FFCAM (84 000) - 0,25 % of the French population

- **Great Britain** regular climbers 132 000 (0,21 %) organized 56 000 - 0,09 % of the GB population

- **Germany** regular climbers 315 00 (0,39 %), organized - 0,29 % - of the German population

- **Italy** – organized climbers CAI (320 00), AVS (59 000) 0.6 % of the Italian population

Climbing in CZ

- Regular climbers in the CZ population 0,3 %

- In Prague approx. 4100 regular climbers (at least once a week), males 69 % -females 31 %
  - > 90 % younger than 40 years
  - 68 % economically active, 32 % students
  - 34 % organized in the federation
  - Sum spent for entry and equipment 1.2 mil €

How does an elite climber looks like?

How is the low body fat and upper body strength related to amount of climbing training ?

The aim of the study was to determine the association between climbing volume and the health oriented fitness.

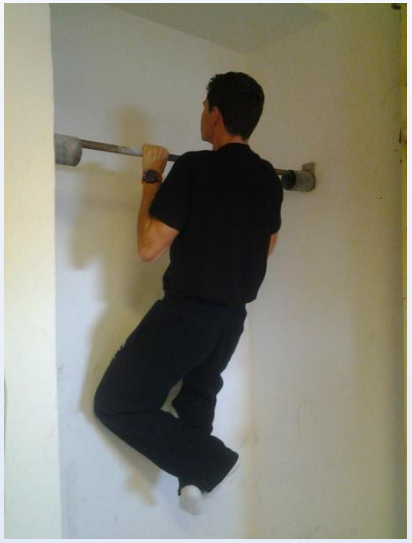
Methods - participants

- 257 male and 126 female climbers in the strength testing and completing a questionnaire

- 27 males and 14 females from these subjects took part in the energy expenditure assessment

Methods – strength assessment

- Grip strength – handgrip dynamometry
- Upper body strength/endurance – bent-arm hang



Energy expenditure

- Two routes at vertical (90°) and overhanging (105°) wall for 2 x 4 minutes
- The dificulty of vertical route 4 UIAA and overhanging route 6 UIAA

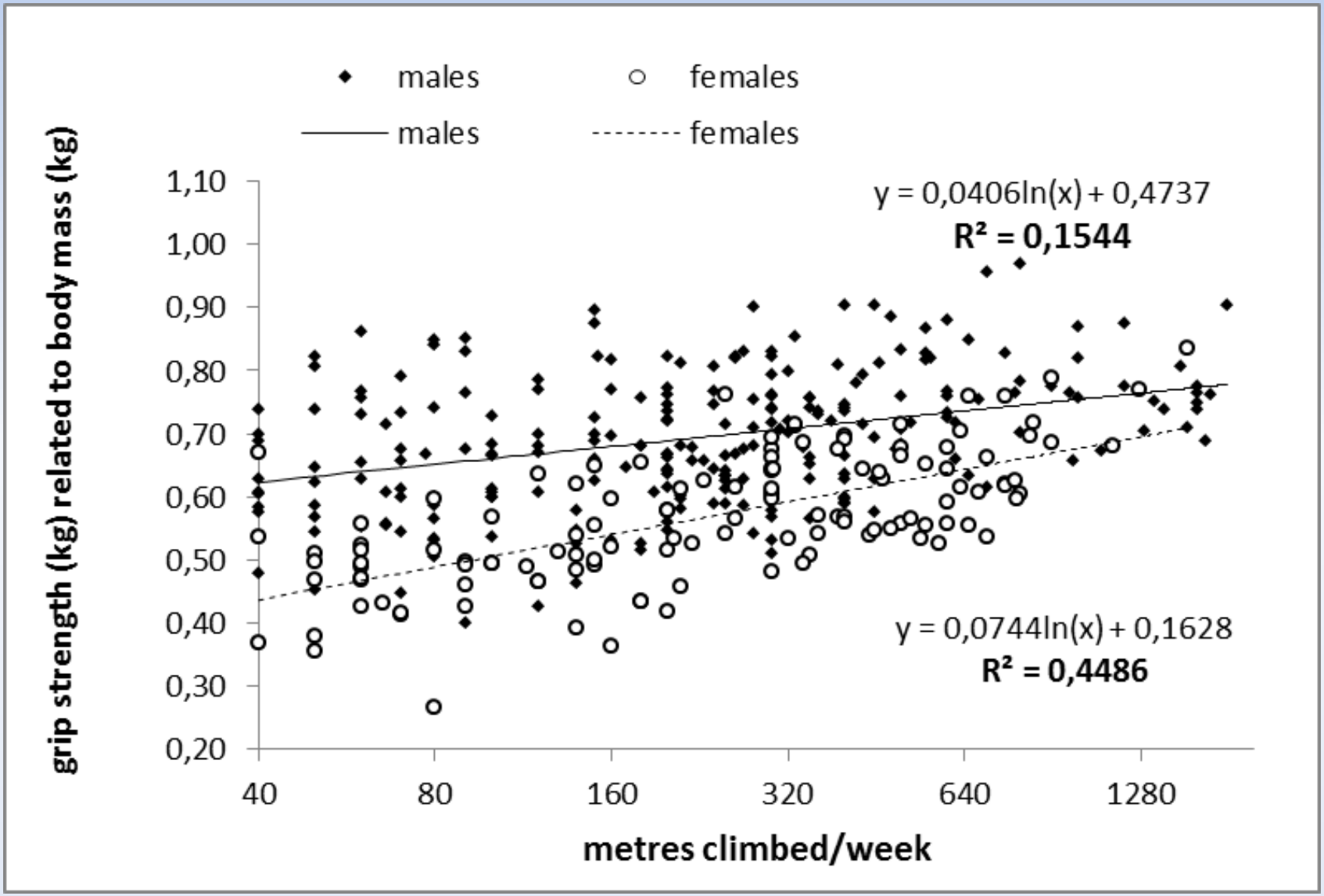
These difficulties are most representing of climbing routes at commercial walls.

Indirect calorimetry with portable gas analyser (MetaMax®, Cortex Biophysic, Germany) used to assess ventilation, O_2 consumption and CO_2 exhaustion.

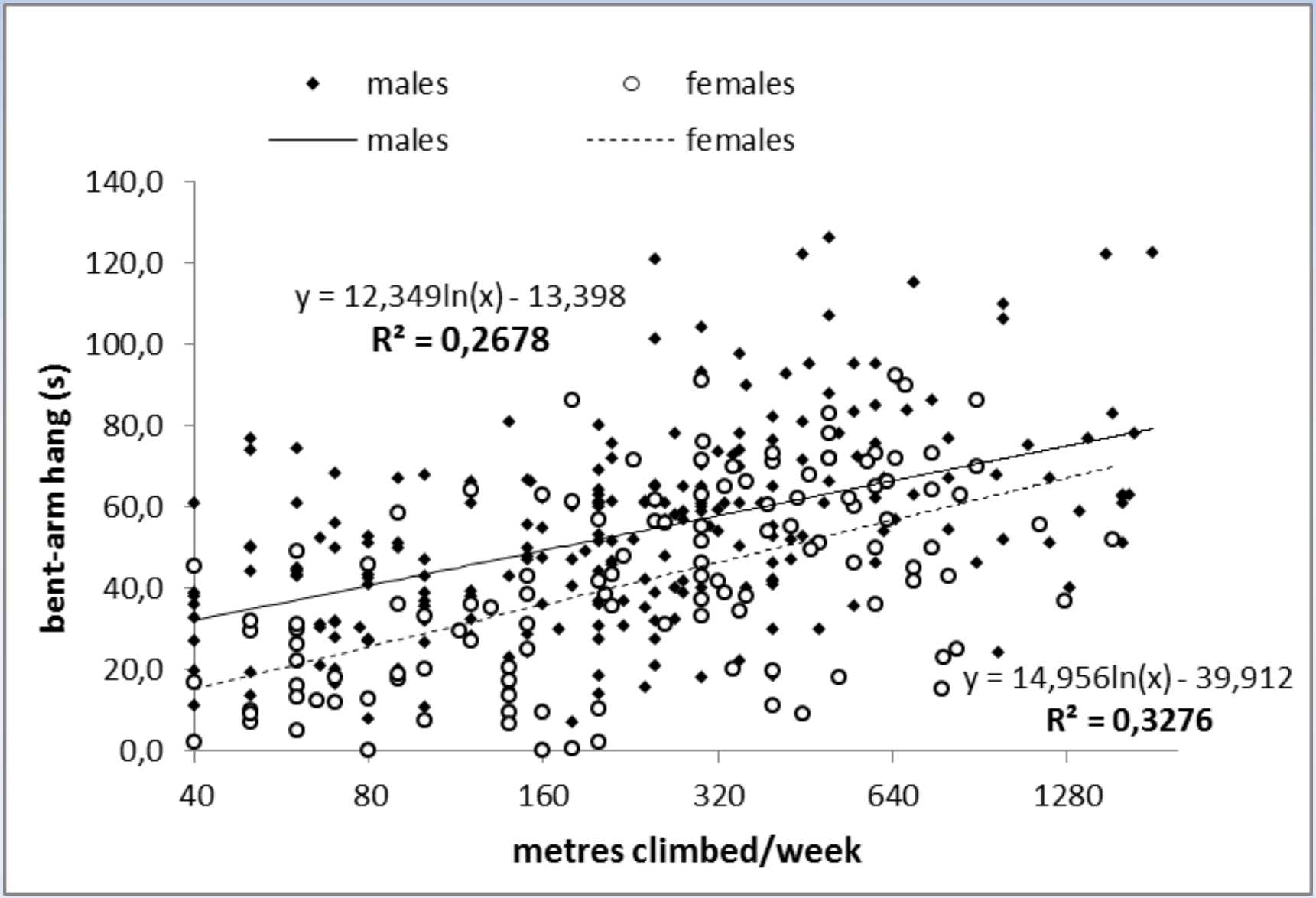
Data analysis

Simple regression analysis - R^2 as a tool to assess the association between two climbing and strength tests (0.04 minimum association, 0.25 moderate association, 0.64 strong association).

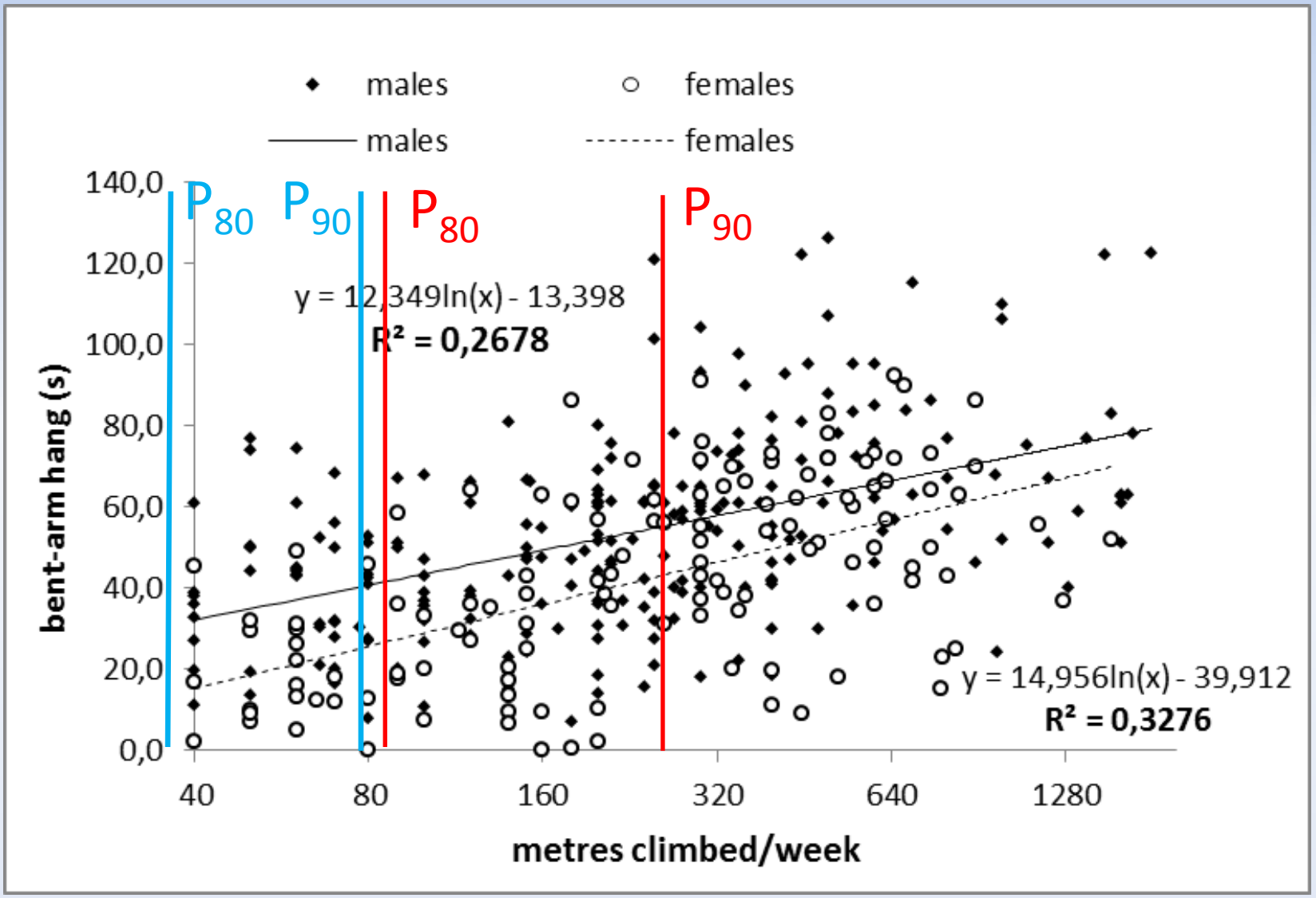
Grip strength



Upper body strength/endurance



Upper body strength/endurance and EU standards of 17 years old girls and boys



How much do I climb to fulfill expected level of upper body strength ?

- Short term studies have shown upper body strength increase in children after 80 vertical metres climbed per week (Balas at al., 2009).

- Amount of 80 vertical metres climbed is associated with a high level of upper body strength

Balas, J., Strejcova, B., Maly, T., Mala, L., & Martin, A. J. (2009). Changes in upper body strength and body composition after 8 weeks indoor climbing in youth. *Isokinetics and Exercise Science, 17*(3), 173-179.

Energy expenditure

	Wall inclination	VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	RER	SF ($beats \cdot min^{-1}$)	EE ($kJ \cdot kg^{-1} \cdot min^{-1}$)
Males (N=27)	90 °	28,4 ± 3,7	0,79 ± 0,06	130 ± 17	**0,594 ± 0,077**
	105°	32,4 ± 4,5	0,86 ± 0,06	147 ± 19	**0,678 ± 0,094**
Females (N=14)	90 °	25,2 ± 2,3	0,80 ± 0,06	134 ± 13	**0,527 ± 0,048**
	105°	27,7 ± 2,7	0,86 ± 0,05	149 ± 17	**0,579 ± 0,056**

How much do I climb to fulfill ACSM standards ?

- Man of 70 kg has to climb 100 minutes on the vertical or 90 minutes on the overhanging wall to attain 1000 kCal.

- It corresponds to 400-500 vertical metres climbed per week.

Injuries

- 0.2-4.2 per 1000 climbing hours (Backe et al., 2009, Neuhof et al., 2011)

- → low compared to football (31 per 1000 hours), handball (50 per 1000 hours) ice-hockey (83 injuries per 1,000 hours) or rugby (286 injuries per 1,000 hours of sport)

Backe, S., Ericson, L., Janson, S., & Timpka, T. (2009). Rock climbing injury rates and associated risk factors in a general climbing population. *Scandinavian Journal of Medicine & Science in Sports, 19*(6), 850-856.

Neuhof, A., Hennig, F. F., Schoffl, I., & Schoffl, V. (2011). Injury Risk Evaluation in Sport Climbing. *International Journal of Sports Medicine, 32*(10), 794-800.

Conclusions

- Sport climbing is an activity which maintain or develop upper body strength and endurance by 80 vertical metres climbed per week.

- In recreational context, the energy expenditure of climbing is similar to brisk walking, swimming or cycling.

- To maintain or develop cardiovascular fitness, the minimum of 400-500 vertical metres climbed or 90-100 minutes week is expected.