Moeheid, fysieke activiteiten en fitheid bij volwassenen met spastische bilaterale cerebrale parese

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Cerebral Palsy

"CP describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior, by epilepsy, and by secondary musculoskeletal problems."

(Rosenbaum et al., 2007)

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Gross Motor Function Classification System (GMFCS)

Gross Motor Function Classification System (GMFCS):

- A five-level classification system graded by the age-related severity of gross motor limitations
- Distinctions between levels of motor functioning are based on functional limitations, the need for assistive devices and, to a lesser extent, quality of movement

(Palisano, 1997)

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Aims today

1. Descriptive:

   Fatigue

   Level of physical activity

   Physical fitness

2. Relationships among physical fitness, level of everyday physical activity, and fatigue

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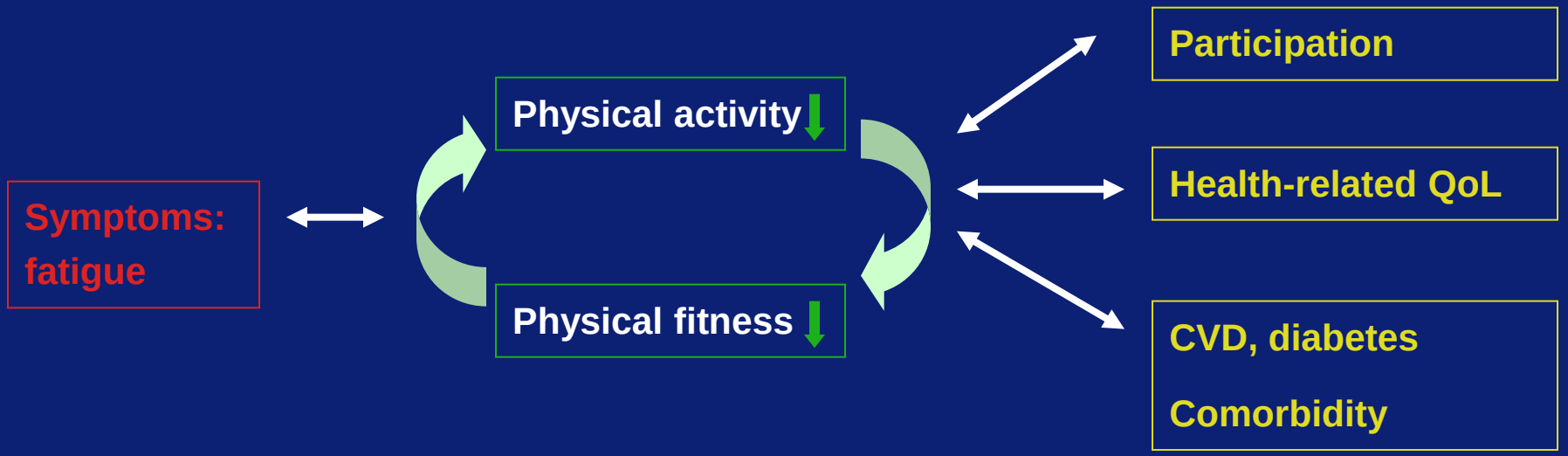
Hypothesis



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Study sample

- Adults with spastic bilateral CP without severe cognitive impairment, aged 25 to 45 years
- Rehabilitation settings (n=10) and the BOSK
- Exclusion criteria
  - Fully dependent on electrical wheelchair
  - Comorbidities interfering with physical activity
  - Contra-indications for maximal ergometer test
  - Inadequate knowledge of the Dutch language
  - Severe cognitive problems and/or legally incapable

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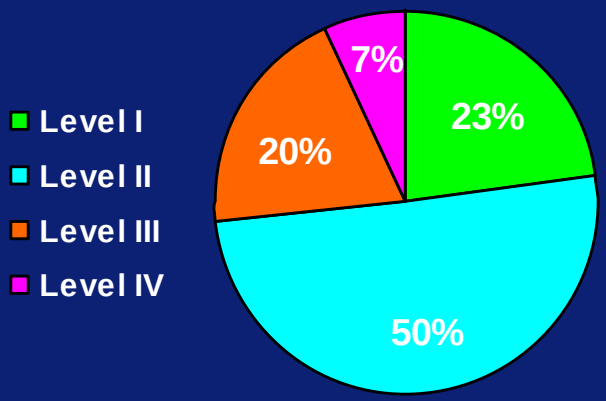
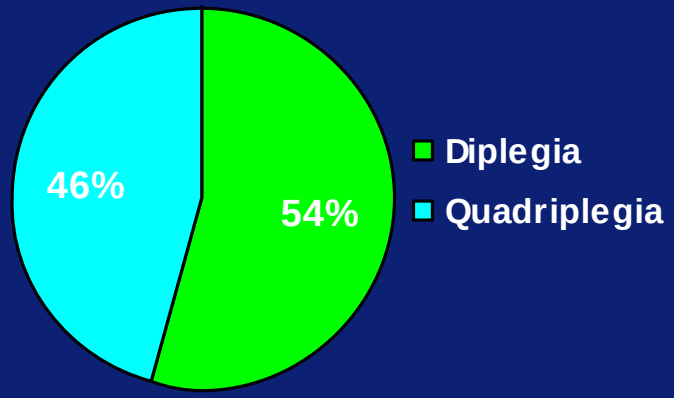
Subject characteristics (1)

- Of 208 eligible subjects, 56 participated (response rate 27%)
- Mean age (SD): 36.4 (5.8) years, 62% male

Gross Motor Functioning (GMFCS)



Limb distribution



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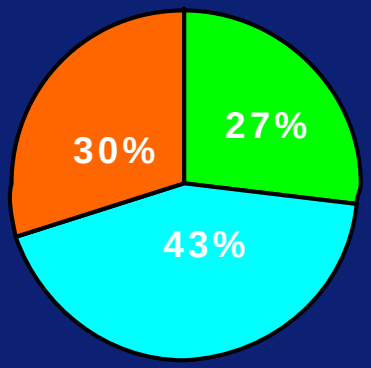
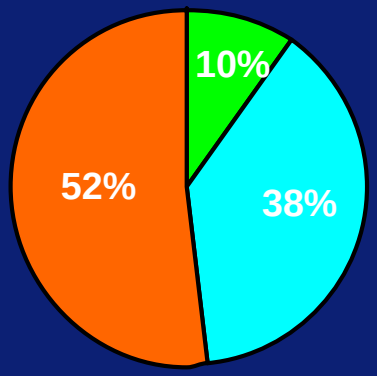
Subject characteristics (2)

Level of education



- Prevocational practical education or less
- Prevocational theoretical and upper secondary vocational education
- Secondary non-vocational, higher education and university

Spasticity in most affected leg



- 2 muscle groups
- 3 muscle groups
- 4 muscle groups

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Statistical analysis (SPSS)

- Descriptive
  - Independent sample T-tests
  - ANOVA
- Relations
  - Pearson correlation coefficients
  - Spearman correlation coefficients

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Fatigue – methods (n=56)

1. Fatigue Severity Scale (FSS)

Severity, frequency and impact on daily life
9 statements; score range 1-7
Mean and fatigue scores

2. **Multidimensional Fatigue Inventory (MFI-20)**

Assessing the nature of fatigue in the previous two weeks
20-items; 5 scale scores range from 4-20
Mean

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Severity of fatigue (FSS)

Fatigue (≥ 4.0-<5.1): 20%

Severe fatigue (≥ 5.1): 41%

Mean fatigue: higher in CP (4.4 ± 1.3) than the reference sample* (2.9 ± 1.1); $P < 0.001$

No difference for sex ($P = 0.72$) or GMFCS level ($P = 0.08$)

** Merkies, n=113, 54.2 ± 14.8*

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Nature of fatigue (MFI-20)

Scales / Mean ± SD	CP (n=56)	Reference* (n=67)	Difference (P)
General fatigue	11.0 ± 4.4	7.0 ± 2.9	<0.001
Physical fatigue	10.0 ± 4.0	6.3 ± 2.4	<0.001
Mental fatigue	9.3 ± 4.4	7.0 ± 2.8	<0.001
Reduction in activities	9.1 ± 3.8	7.0 ± 2.8	<0.001
Reduction in motivation	7.7 ± 3.1	6.5 ± 2.2	0.005

** Minderhout, n=67, 41.4 ± 1.26*

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Nature of fatigue – subgroup analysis

No differences were for found for nature of fatigue between men and women or GMFCS level.

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Level of everyday physical activity - methods

Accelerometry-based

Activity Monitor (AM)

48-h measurement

Level of everyday physical activity - methods

Outcome measures

Duration (% of 24-h period or min/day)

- Dynamic activities: composite measure walking, running, stairs, cycling, wheelchair-driving, general movement

Mean body motility (intensity of dynamic activity; gravitational acceleration [g])

Number of transitions

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Level of everyday PA in CP (n=56)

	Adults with CP (n=56) (mean SD)
Duration of dynamic activities (% of 24-h)	8.1 3.7 = 1 h 57 min
Mean body motility (g)*	0.020 0.007
Motility during walking (g)*	0.155 0.037
Motility during wheelchair propulsion (g)**	0.034 0.011
Number of transitions (n)	123 45
Periods of continuous dynamic activities 1-5 minutes (n)	16 11
Periods of continuous dynamic activities > 5 minutes (n)	1 1

** Mean body motility and motility during walking were assessed for ambulators only (n=49)*

*** Motility during wheelchair propulsion was assessed for non-ambulators only (n=7)*

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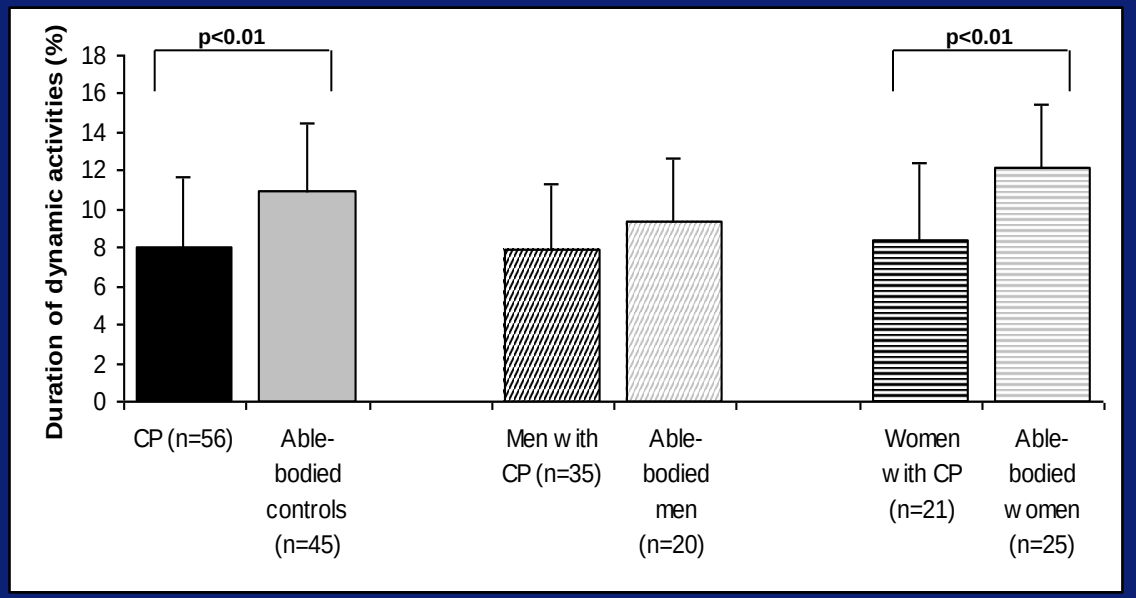
Duration of dynamic activities in CP (n=56) versus healthy controls (n=45)

Total: 8.1% versus 10.9% (p < 0.01)

Men: 7.8% versus 9.4% (p = 0.11)

Women: 8.4% vs 12.2% (p < 0.01)



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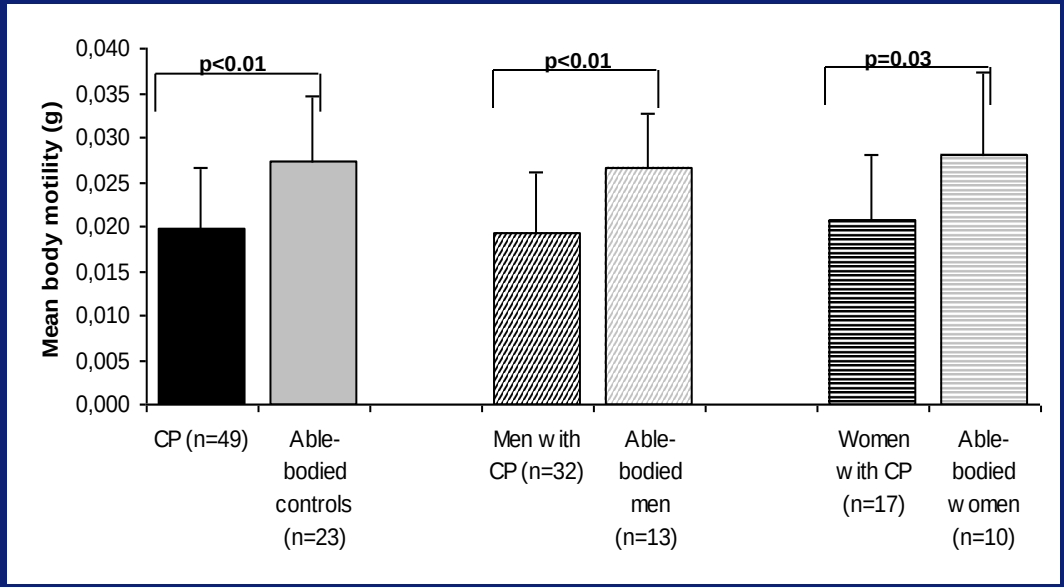
Mean body motility in CP (n=49) and healthy controls (n=23)

Total: 0.020g versus 0.027g (p < 0.01)

Men: 0.019g versus 0.027g (p < 0.01)

Women: 0.021g vs 0.028g (p = 0.03)



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Level of everyday PA – GMFCS

Level of gross motor functioning was significantly related to the level of PA

	All (n=56)		GMFCS I (n=13)	GMFCS II (n=28)	GMFCS III-IV (n=15)
Duration of dynamic activities (% of 24-h)	8.1 3.7		10.3 2.6	8.3 3.7	5.7 3.1
Mean body motility (g)*	0.020 0.007		0.024 0.006	0.020 0.007	0.015 0.005
Periods of continuous dynamic activities 1-5 minutes (n)	16 11		21 7	17 13	12 9
Periods of continuous dynamic activities > 5 minutes (n)	1 1		2 2	1 2	1 1

** Mean body motility was assessed for ambulators only (n=49): GMFCS level I (n=13), GMFCS level II (n=24), GMFCS level III-IV (n=12)*

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Level of PA in GMFCS I

PA in adults with GMFCS level I seems to be comparable to:

- healthy controls (same age):

  duration of dynamic activities 10.3% in GMFCS level I versus 10.9% in controls (*P* = 0.55)

- adults with unilateral CP (25-35 y): 10.6%

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Physical fitness - methods

- Progressive maximal aerobic test on a cycle ergometer

  (Jaeger ER 800)

- McMaster All-Out progressive continuous protocol

- Gas exchange and HR

  K4b2; Cosmed

  Polar electro

Physical fitness

- N = 42 ambulatory adults

  (56 minus arm crank ergometry and missing values)

- VO2peak in L/min: mean oxygen uptake during the last 30s of exercise
- VO2peak as % of reference sample *(Vos, 2001)*
- VO2peak (ml/kg/min)

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Physical fitness in CP

- Lower than age-based and gender-based reference values for sedentary Dutch men (3.18 0.25 L/min, P = 0.03) and women (2.15 0.30 L/min, $P < 0.01$) [Vos]

- Men had higher levels of physical fitness than women, also after correction for body mass ($P < 0.01$)

- Physical fitness was not related to GMFCS level

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Physical fitness (n=42)

	Total (n=42)	**Men (n=29)**	**Women (n=13)**	*P*-value
Peak VO2 (L/min)	2.19 ± 0.48	2.40 ± 0.39	1.73 ± 0.32	<0.01
% of reference values [Vos]	*77 ± 13%*	*76 ± 13%*	*81 ± 12%*	
Peak VO2 (ml/kg/min)	31.5 ± 6.3	33.2 ± 6.2	27.9 ± 4.8	<0.01

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Physical fitness (n=42)

	Total (n=42)	**Men (n=29)**	**Women (n=13)**	*P*-value
Peak power output (W)	144 ± 30	153 ± 26	124 ± 30	0.003
Peak Heart Rate (bpm)	175 ± 17	172 ± 117	184 ± 13	
% of predicted values (220-age)	96 ± 9%	94 ± 5%	100 ± 7%	
Peak Respiratory Exchange Ratio (RER)	1.19 ± 0.12	1.16 ± 0.11	1.26 ± 0.12	
Perceived exertion (Borg scale)	9.0 ± 1.7	9.2 ± 1.8	8.5 ± 1.3	

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Relationships among physical fitness, level of everyday physical activity, and fatigue

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Relationships - methods

- N = 42

- Fatigue: FSS

- Physical activity: also self-reported level →
  Physical Activity Scale for individuals with Physical Disabilities: **PASIPD**
  - 12 items, past 7 days
  - MET h/day

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Descriptives (n=42)

	Men (n=29)	Women (n=13)
Physical fitness		
VO2peak (L/min)	2.4 0.4	1.7 0.3 *
% of reference values	*76 13%*	*81 12%*
Level of everyday PA		
% of 24 h active	8.4 3.4	9.1 3.7
% of reference values	*89 36%*	*75 31%*
Self-reported (MET hr/day)	14.4 13.3	15.8 11.1
Fatigue		
FSS score (mean SD)	4.1 1.2	4.0 1.5
% fatigue / severe fatigue	21% / 31%	15% / 31%

** P < 0.01*

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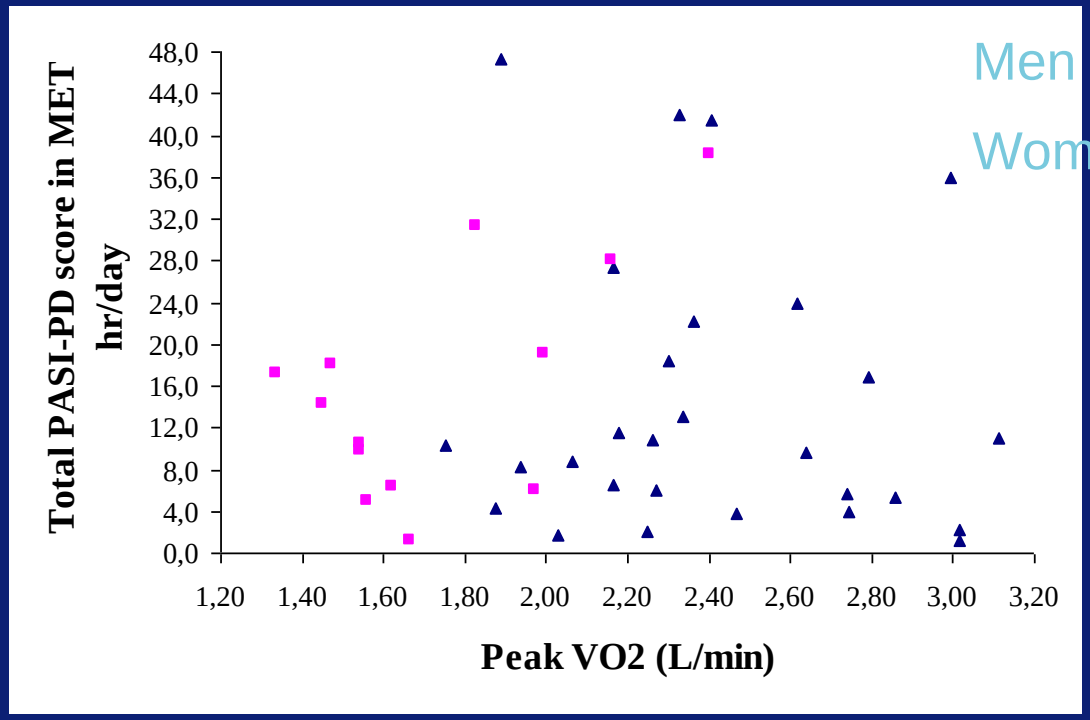
Relationships physical fitness and self-reported level of PA



Men : *R*p = -0.05, *P* = 0.82

Women : *R*p = 0.61, *P* = 0.03

For women: significant relationship between physical fitness and self-reported level of everyday PA (*R*p = 0.61, *P* = 0.03)

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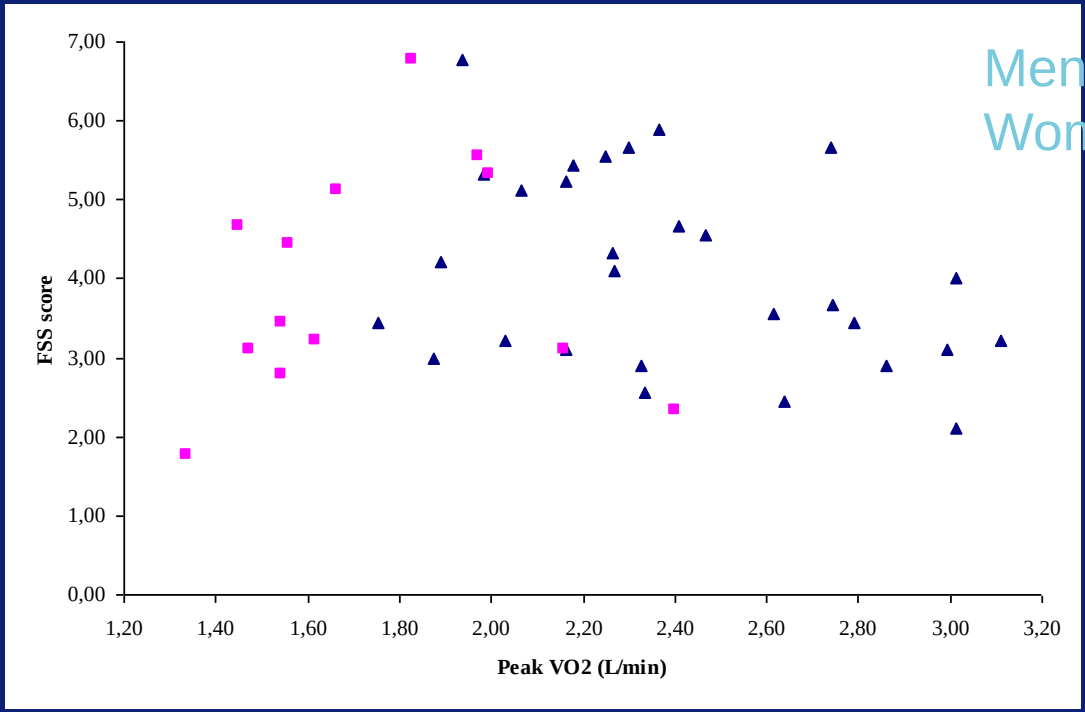
Relationships physical fitness and fatigue



Men : *R*p = -0.37, *P* = 0.05
Women : *R*p = 0.13, *P* = 0.69

Men with higher levels of physical fitness reported less fatigue

(*R*p = -0.37, *P* = 0.05)

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Relationships level of PA and fatigue

No significant relationships for:

Objective level of PA and fatigue:

- Men: *R*p = -0.16, *P* = 0.42
- Women: *R*p = 0.29, *P* = 0.34

Self-reported level of PA and fatigue:

- Men: *R*p = -0.15, *P* = 0.44
- Women: *R*p = -0.13, *P* = 0.66

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Conclusions

Adults with spastic bilateral CP without severe cognitive impairment, aged 25-45 years, have compared to healthy controls:

- More fatigue complaints
- An inactive life-style, especially those with GMFCS level III/IV
- Low level of physical fitness

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Conclusions - relationships

Moderate relationships between:

- physical fitness and self-reported level of PA in women
- physical fitness and fatigue in men

No relation between fatigue and PA (objective or self-reported)

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Discussion - previous studies adults CP

- Fatigue: 1 study [Opheim, 2009]:

  fatigue severity at a comparable level

- PA: self-report studies

  Gaskin, 2008: lower level of PA (age 19-66 y)

  Jahnsen, 2003

- Fitness: in different studies a lower level of fitness

  [Fernandez, 1990; Tobimatsu, 1998]

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Discussion - previous studies relationships

- Fatigue and PA: Jahnsen, 2003; Santiago, 2004: no associations

No other studies available

- Physical fitness and PA
- Fatigue and physical fitness

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Discussion – Limitations/hypothesis no relationships

- Cross sectional study, small sample, among ambulators
- Imbalance between PA and physical fitness might have a stronger influence on fatigue than PA and fitness itself?
- Other measures (physical strain/energy expenditure) more important
- Other factors more important

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Discussion - implications physical training?

- Inconclusive evidence for physical origin of fatigue
- No support for deconditioning

→ physical training?

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Discussion - implications low level fitness?

- RCT children with CP [v.d. Berg-Emons, 2003; Unnithan, 2007; Verschuren, 2007] and a study among adults [Fernandez, 1993] support aerobic training

  → Improve fitness

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Discussion - implications low level PA?

Improve level of everyday PA according to ACSM guidelines?

CP, including GMFCS I and II: fail to achieve the recommended activity levels →

Based on clinical experience: adapt activities in time and type

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Discussion – implications fatigue

Preventative / global treatment

- Minimizing physical load / physical load capacity discrepancy
- Cognitive Behavioral Therapy
- Starting young (young adult teams)

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Discussion - treatment fatigue

- Other factors:

  Medication: anti-spastic

  Sleep problems: nocturnal hypoventilation

  Depressive symptoms

  Pain

  Other diseases: anemia

  Diet

- Problem to patient?

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Current and future research and actions

Current:

- Interventions aiming to improve PA and fitness (L2M)
- Physical strain/energy expenditure in daily life

Future:

- Longitudinal research on physical training/CBT
- Preventative treatments

Education health care workers

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