Adapted Cycling Physical Health Benefits for Children with Cerebral Palsy

Karen Visser, Dawn Pickering, Gabriela Todd, Lyn Horrocks
Cardiff University, Cardiff, South Wales

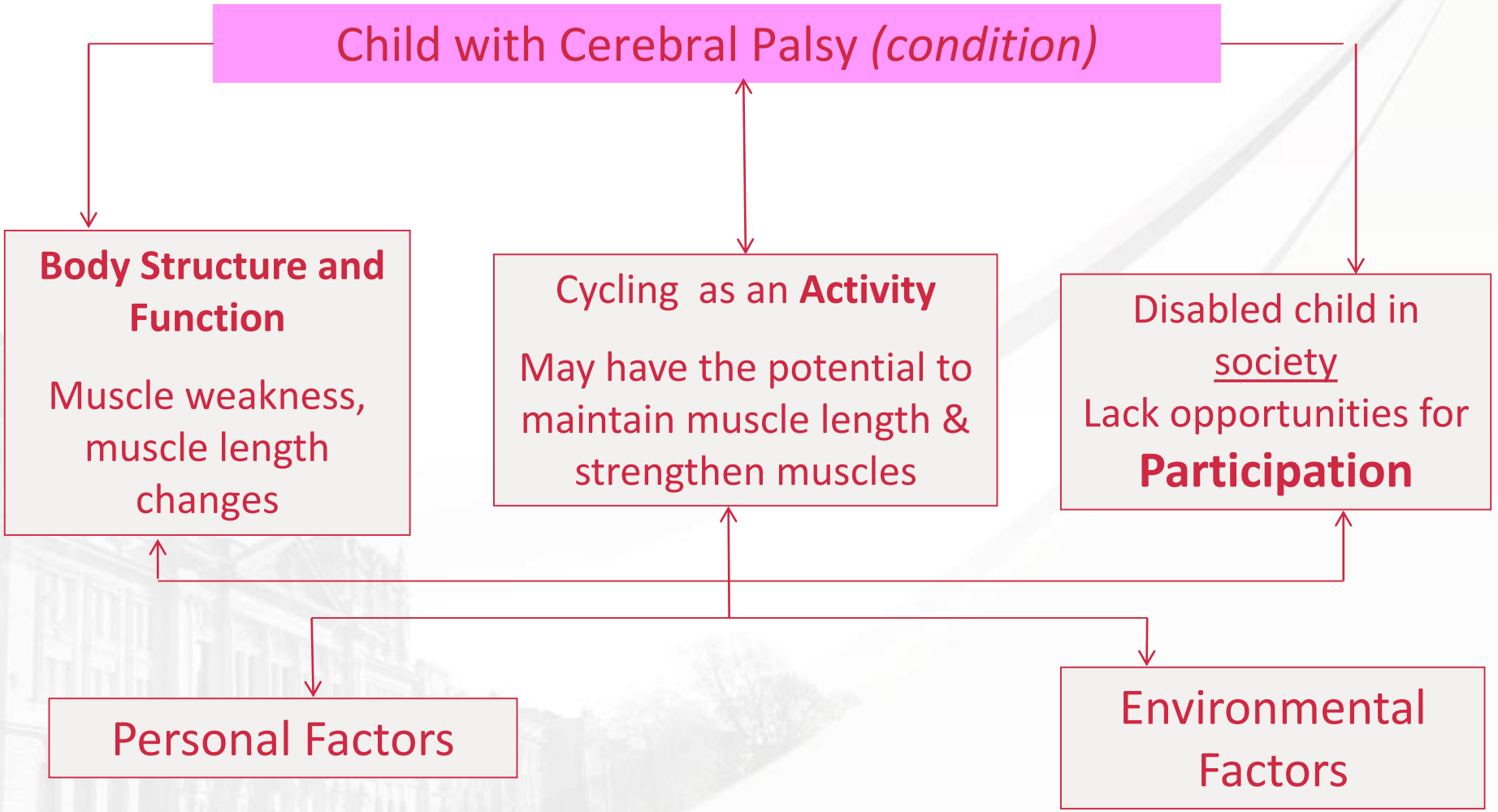
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Outline

- Introduction and Background
- Methods and Participants
- Results
- Conclusion
- Acknowledgements
- References

Pedal Power

ICF (WHO, 2001)


Child with Cerebral Palsy *(condition)*
Body Structure and Function
Muscle weakness, muscle length changes
Cycling as an **Activity**
May have the potential to maintain muscle length & strengthen muscles
Disabled child in society
Lack opportunities for **Participation**
Personal Factors
Environmental Factors

Methods

- Ethical Approval: School of Healthcare Studies Research Ethics Committee, Cardiff University
- Mixed Methods: Different Subject Experimental Design
- Pre- & Post- Intervention assessment
- Mean of 4 bilateral quadriceps & hamstrings within session strength measures (Hand-held dynamometer)
- Mean of 4 Bilateral popliteal angle measures (silicon coach)

Participants

- 35 children participated
- 18 control group (non cycling group)
- 17 Intervention group (cycling group)
- Inclusion criteria: aged 2-18, GMFCS levels I – V, Cerebral Palsy, volunteered, informed consent / assent
- Exclusion criteria: ORTHOPAEDIC intervention and / or Botulinum toxin injections within the past 6 months

Participants: Cycle Assessment

Measurements


Figure 1

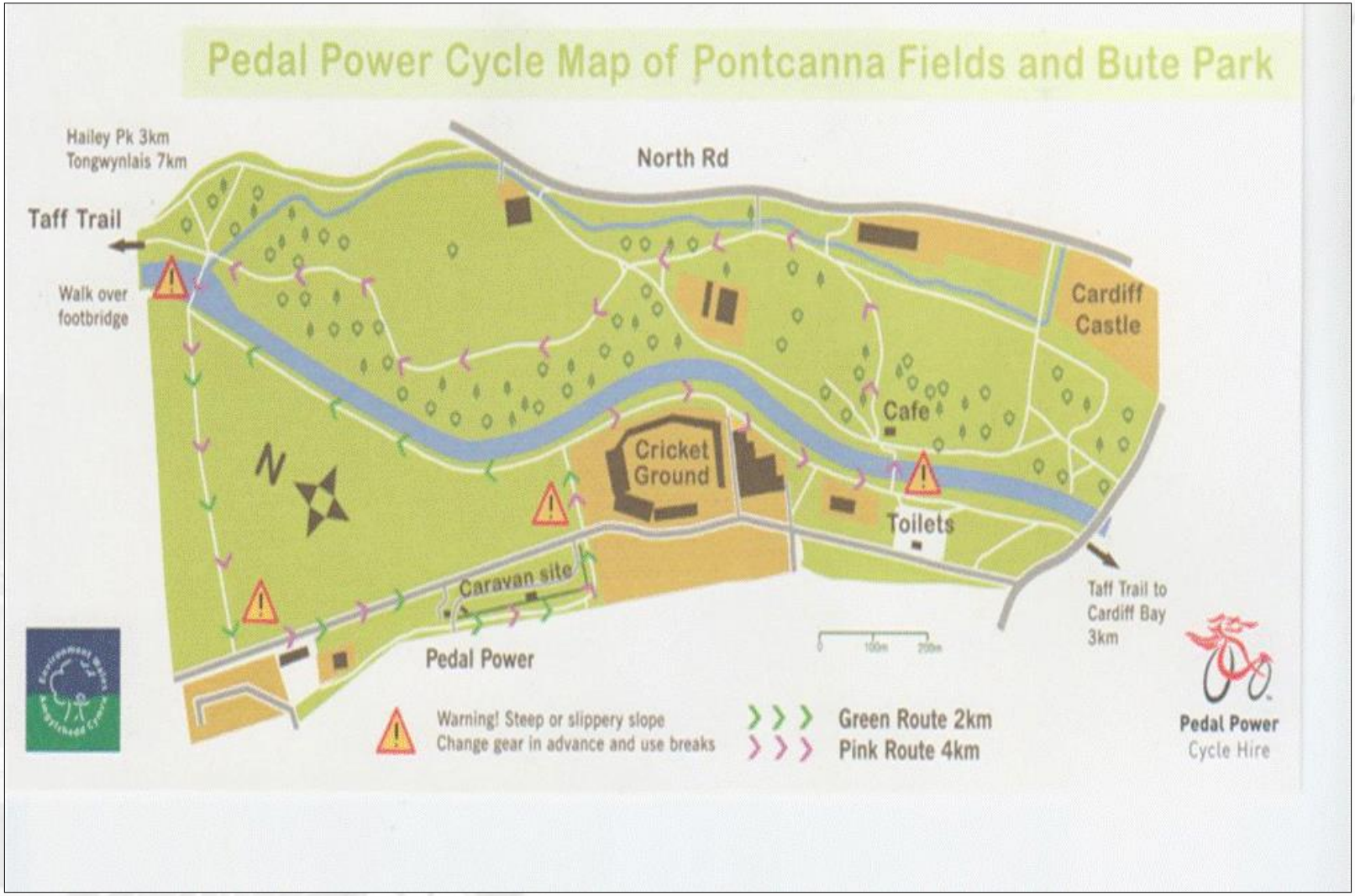

Figure 2

Figures 1 & 2: Quadriceps Strength measured with the Hand-held Dynamometer

Figure 3: Popliteal Angle measured with Silicon Coach


Figure 3

Intervention



Participants: Demographics

Age	Min	Max	Mean (SD)	Female	Male
Cycling Group	2	17	7.12 (4.69)	10	8
Control Group	2	13	7.67 (3.41)	5	13

GMFCS	I	II	III	IV	V
Cycling Group	4	4	2	6	1
Control Group	3	8	4	3	0

CP	Hemiplegia	Diplegia	Quadriplegia
Cycling Group	1	8	8
Control Group	7	4	7

Results: Popliteal Angles

Groups	Right Baseline	Right Post-Intervention	Left Baseline	Left Post-Intervention
Cycling Group	44.87° ± 14.47	44.21° ± 9.95	39.64° ± 13.57	42.2° ± 10.32
Control Group	50.53° ±9.06	49.57° ±10.64	49.14° ±12.72	46.73° ±11.83

Data: No significant difference in baseline measures between group

An unpaired samples T-Test:

R: p=0.233

L: p=0.067

No significant difference between groups

Results: Strength Measures

Baseline Mean Strength Measures and Standard Deviations

Group	R Quadriceps	L Quadriceps	R Hamstrings	L Hamstrings
Cycling Group	39.73 N (± 22.78)	33.41 N (± 17.06)	33.77 N (± 18.44)	33.69 N (± 15.00)
Control Group	60.56 N (± 30.03)	59.74 N (± 34.57)	45.16 N (± 21.07)	48.76 N (± 25.54)

Quadriceps Strength Changes

	R Leg	L Leg
Cycling Group	Increased by 12.14 N (± 6.50)	Increased by 15.56 N (± 13.87)
Control Group	Decreased by 3.62 N (± 4.73)	Decreased by 0.41 N (± 1.40)

Hamstring Strength Changes

	R Leg	L Leg
Cycling Group	Increased by 5.19 N (± 3.50)	Increased by 4.23 N (± 5.94)
Control Group	Decreased by 1.03 N (± 0.06)	Decreased by 1.05 N (± 3.05)

Results: Cycling Group

Within cycling group strength changes

- Wilcoxon ranks sign Test
- Statistically significant increase in quadriceps strength
- Right: $p = 0.018$
- Left: $p = 0.021$
- No significant change in hamstring strength

Results: Between Groups

- Significant differences in baseline measures between groups
- Comparisons made using ANCOVA (SPSS18)
- No significance in Quadriceps strength between groups
- Right: p = 0.08
- Left: p = 0.79

Conclusion

- Adapted cycling has potential health benefits
- Strength increased with cycling and decreased in the group not cycling
- Strength trends deserve further investigation with larger sample sizes and longer intervention periods
- Therapists, educators and policy makers should consider providing adapted cycling opportunities for children with disabilities

References

- Lauer et al (2008) Lower extremity muscle activity during cycling in adolescents with and without cerebral palsy *Clinical Biomechanics* 23: 442 – 449
- Williams and Poutney (2007) Effects of a static bicycling programme on the functional ability of young people with cerebral palsy who are non-ambulant *Developmental medicine and Child Neurology* 49: 522 – 527
- Bottos et al (2001) Functional status of adults with cerebral palsy and implications for treatment of children *Developmental medicine and Child Neurology* 43: 516 - 528
- Colver et al (2010) Study protocol: Determinants of participation and quality of life of adolescents with cerebral palsy: a longitudinal study (SPARCLE 2) *BMC Public Health* 10:280
- Palisano et al (1997) Development and reliability of a system to classify gross motor function in children with cerebral palsy *Developmental Medicine and Child Neurology* 39: 214 - 223

Acknowledgements

thank you * danke * thank you * danke * thank you * danke

- Children, young People and families
- Nancie Finnie Charitable Trust
- Pedal Power Voluntary Organisation
- SOHCS, Cardiff University
- Jenx, Ltd
- Fellow Researchers

Karen Visser: visserks@cardiff.ac.uk