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The influence of childhood obesity on spatio-temporal gait parameters

Author: Montes Alguacil, Jesús

Childhood Obesity and Gait Parameters

Overweight and obesity in 6–12 year old children in Switzerland

Michael B. Zimmermann[a], *Carolyn Gübeli*[b], *Claudia Piintener*[b], *Luciano Molinari*[c]

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[b] Institute for Pharmaceutical Science, Swiss Federal Institute of Technology, Zurich, Switzerland
[c] Department of Growth and Development, University Children's Hospital, Zurich, Switzerland

Global prevalence and trends of overweight and obesity among preschool children FREE

Mercedes de Onis ✉, Monika Blössner, Elaine Borghi

The American Journal of Clinical Nutrition, Volume 92, Issue 5, 1 November 2010, Pages 1257–1264, https://doi.org/10.3945/ajcn.2010.29786

Childhood Obesity and Gait Parameters

Changes of intersegment angular motion of the body during gait.
Strutzenberger G. 2011; Shultz SP. 2014; Mahaffey R. 2016

Pogression of angular deformities in varus/valgus of the knee.
Mc Millan AG. 2010

An increased risk of osteoarthritis in adulthood.
Strutzenberger G. 2011; Shultz SP. 2014-Clin.

A less walking stability in obese children than those with normal weight.
Yan S. 2013

Obese children need to produce more energy in the joints of lower limbs.
Shultz SP. 2014

Other...

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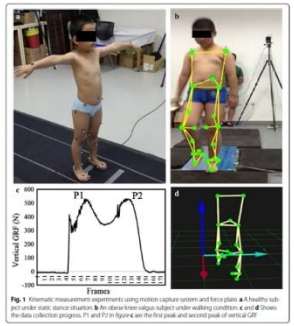


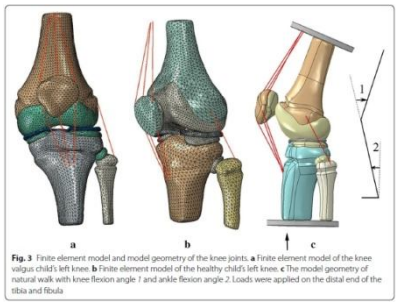
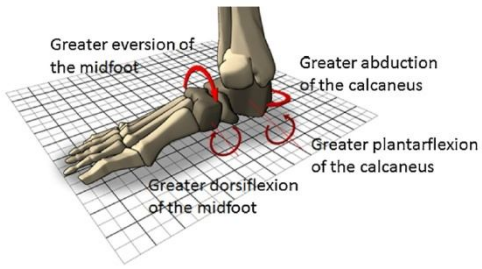
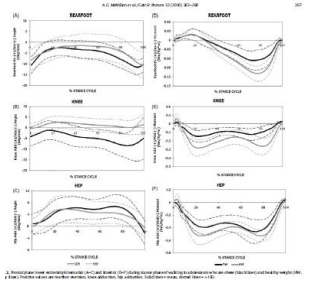


Fig. 3 Finite element model and model geometry of the knee joints. **a** Finite element model of the knee valgus child's left knee. **b** Finite element model of the healthy child's left knee. **c** The model geometry of natural walk with knee flexion angle *1* and ankle flexion angle *2*. Loads were applied on the distal end of the tibia and fibula





Gait & Posture 59 (2018) 65–70

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Full length article

Is the reliability of 3D kinematics of young obese participants dependent on the hip joint center localization method used?

Brian Horsak[a,*], Caterine Schwab[a], Christoph Clemens[b], Arnold Baca[b], Susanne Greber-Platzer[c], Alexandra Kreissl[c], Andreas Kranzl[d]

[a] St. Pölten University of Applied Sciences, Department of Physiotherapy, Austria
[b] University of Vienna, Department of Biomechanics, Kinesiology and Applied Computer Science, Austria
[c] Medical University of Vienna, Department of Pediatrics and Adolescent Medicine, Austria
[d] Orthopaedic Hospital Vienna-Speising, Laboratory of Gait and Movement Analysis, Austria

Sun et al. BioMed Eng OnLine 2016, 15(Suppl 2):158
DOI 10.1186/s12938-016-0253-3

BioMedical Engineering OnLine

RESEARCH Open Access

Finite element analysis of the valgus knee joint of an obese child

Jun Sun[1,2], Songhua Yan[1,2], Yan Jiang[1], Duo Wai-chi Wong[3], Ming Zhang[3], Jizhou Zeng[4] and Kuan Zhang[1,2*]

Gait & Posture 32 (2010) 263–268

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Sagittal and frontal plane joint mechanics throughout the stance phase of walking in adolescents who are obese

A.G. McMillan[a,*], A.M.E. Pulver[a], D.N. Collier[b], D.S.B. Williams[a]

[a] Department of Physical Therapy, 2410E Health Sciences Building, East Carolina University, Greenville, NC 27834, United States
[b] Department of Pediatrics, Brody School of Medicine at East Carolina University, Greenville, NC, United States

Gait & Posture 44 (2016) 155–160

Contents lists available at ScienceDirect

Gait & Posture

journal homepage: www.elsevier.com/locate/gaitpost

Full length Article

The impact of body fat on three dimensional motion of the paediatric foot during walking

Ryan Mahaffey[a,*], Stewart C. Morrison[b], Paul Bassett[c], Wendy I. Drechsler[a], Mary C. Cramp[d]

[a] School of Health, Sport and Bioscience, University of East London, Stratford, London E15 4LZ, England
[b] School of Health Sciences, University of Brighton, Brighton, UK
[c] Statsconsultancy Ltd. 40 Longwood Lane, Amersham, Bucks HP7 9EN, England
[d] Department of Allied Health Professions, Glenside Campus, University of West England, Blackberry Hill, Bristol BS16 1DD, England

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Childhood Obesity and Gait Parameters

Optogait Photoelectric System

Medical Engineering & Physics 35 (2013) 500–504

Contents lists available at SciVerse ScienceDirect

Medical Engineering & Physics

journal homepage: www.elsevier.com/locate/medengphy

ELSEVIER

Validity of the Optogait photoelectric system for the assessment of spatiotemporal gait parameters

Karin Lienhard, David Schneider, Nicola A. Maffiuletti*

Neuromuscular Research Laboratory, Schulthess Clinic, Zurich, Switzerland

Gait & Posture

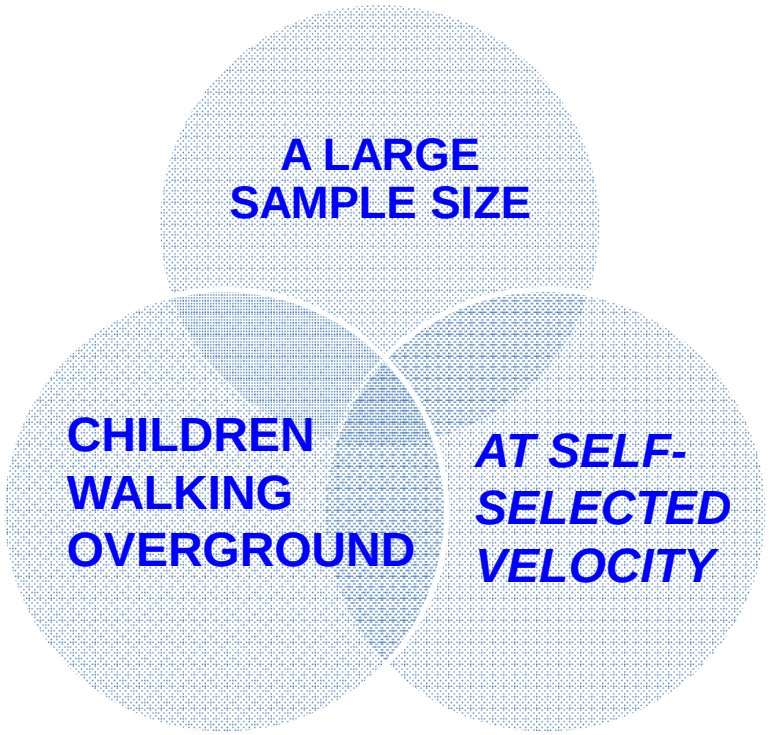
Volume 50, October 2016, Pages 196-200

ELSEVIER

Full length article

Reliability of the OptoGait portable photoelectric cell system for the quantification of spatial-temporal parameters of gait in young adults

CIRCUMSTANCES OF THE STUDY



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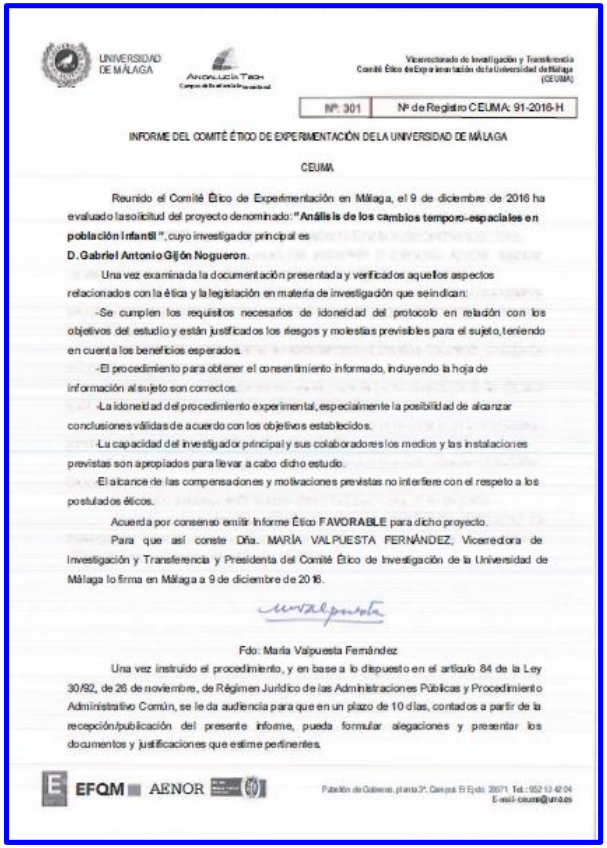
Childhood Obesity and Gait Parameters



UNIVERSIDAD DE MÁLAGA

Vicerrectorado de Investigación y Transferencia
Comité Ético de Experimentación de la Universidad de Málaga (CEUMA)

Nº: 301 | Nº de Registro CEUMA: 91-2016-H

INFORME DEL COMITÉ ÉTICO DE EXPERIMENTACIÓN DE LA UNIVERSIDAD DE MÁLAGA

CEUMA

Reunido el Comité Ético de Experimentación en Málaga, el 9 de diciembre de 2016 ha evaluado la solicitud del proyecto denominado: **"Análisis de los cambios temporo-espaciales en población infantil"**, cuyo investigador principal es **D. Gabriel Antonio Gijón Nogueron**.

Una vez examinada la documentación presentada y verificados aquellos aspectos relacionados con la ética y la legislación en materia de investigación que seindican:

-Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio y están justificados los riesgos y molestias previsibles para el sujeto, teniendo en cuenta los beneficios esperados.

-El procedimiento para obtener el consentimiento informado, incluyendo la hoja de información al sujeto son correctos.

-La idoneidad del procedimiento experimental, especialmente la posibilidad de alcanzar conclusiones válidas de acuerdo con los objetivos establecidos.

-La capacidad del investigador principal y sus colaboradores los medios y las instalaciones previstas son apropiados para llevar a cabo dicho estudio.

-El alcance de las compensaciones y motivaciones previstas no interfiere con el respeto a los postulados éticos.

Acuerda por consenso emitir Informe Ético **FAVORABLE** para dicho proyecto.

Para que así conste Dña. MARÍA VALPUESTA FERNÁNDEZ, Vicerrectora de Investigación y Transferencia y Presidenta del Comité Ético de Investigación de la Universidad de Málaga lo firma en Málaga a 9 de diciembre de 2016.

Fdo: María Valpuesta Fernández

Una vez instruído el procedimiento, y en base a lo dispuesto en el artículo 84 de la Ley 30/92, de 26 de noviembre, de Régimen Jurídico de las Administraciones Públicas y Procedimiento Administrativo Común, se le da audiencia para que en un plazo de 10 días, contados a partir de la recepción/publicación del presente informe, pueda formular alegaciones y presentar los documentos y justificaciones que estime pertinentes.

EFQM AENOR

Pabellón de Gobierno, planta 3ª. Campus El Ejido 29071. Tel.: 952 13 42 04
E-mail: ceuma@uma.es

Ethical Issues:

Parents provided signed consents.

Ethics Committee of the University of Malaga. CEUMA 91/2016-H)

Declaration of Helsinky.

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Childhood Obesity and Gait Parameters

Participants:

N=238 participants, 7 to 11 years old

Inclusion/Exclusion criteria

Primary schools.

Data Collection:

Anthropometrics variables.

Body Mass Index. Classification. *Sobradillo 2004*

BMI classifications by age

Age(y)	n (%)	Underweight (n/%)	Normalweight (n/%)	Overweight (n/%)	Obese (n/%)
7	35/14.70	-	28/11.70	07/02.94	-
8	45/18.90	1/0.42	25/10.50	06/02.52	13/05.46
9	44/18.48	-	22/09.24	11/04.62	11/04.62
10	57/23.94	2/0.84	32/13.44	09/03.78	14/05.88
11	57/23.94	-	29/12.18	12/05.04	16/06.72

Data Collection:

Spatio-temporal variables were collected by Optgait system

Stance phase Swing phase Single support Double support

Step length Step time Load response phase Pre-swing phase

Contact phase Foot flat phase Propulsive phase Gait cycle

Stride length Speed Acceleration Cadence Total distance.

Statistical Analysis:

Exploratory analysis by Kolmogorov-Smirnov

Bivariante analysis by Student`s Test

Multivariante by ANOVA

In addition…

Levene Test
Browne-Forsythe Test (Robustness)
Bonferroni Test (Post-hoc)

Childhood Obesity and Gait Parameters

Anthropometric characteristics of the sample by gender .

			95% Confidence Interval					
		Mean	Lower	Upper	SD	Min.	Max.	S. Err.
Age (years)	Female	9,29	9,03	9,55	1,40	7	11	0,1310
	Male	9,19	8,94	9,43	1,38	7	11	0,1240
Height (m)	Female	1,3701	1,3454	1,3948	0,1332	1,10	1,69	0,0124
	Male	1,3539	1,3341	1,3736	0,1111	1,09	1,59	0,0099
Weight (kg)	Female	39,30	36,92	41,67	12,78	19	82	1,197
	Male	38,55	36,30	40,81	12,68	19	86	1,139
Body Mass Index (kg/m^2)	Female	20,41	19,69	21,13	3,89	14,75	32,55	0,3646
	Male	20,54	19,77	21,31	4,33	13,77	36,18	0,3895

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Childhood Obesity and Gait Parameters

No statistical differences related to spatial parameters.

Temporal parameters with $p<0.05$ in obese and overweight children.

Stance phase Swing phase Single support Double support

Step length Step time Load response phase Pre-swing phase

Contact phase Foot flat phase Propulsive phase Gait cycle

Stride length Speed Acceleration Cadence Total distance.

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Childhood Obesity and Gait Parameters

No statistical differences related to spatial parameters.

Temporal parameters with $p<0.05$ in obese and overweight children.

Stance phase *Swing phase* *Single support* *Double support*
Step length *Step time* ***Load response phase*** ***Pre-swing phase***
Contact phase *Foot flat phase* *Propulsive phase* *Gait cycle*
Stride length *Speed* *Acceleration* *Cadence* *Total distance*.

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Childhood Obesity and Gait Parameters

Phases of gait with significant differences in relation to BMI

Dependent Variables			Mean Difference	p	95% Confidence Interval	
					Lower Bound	Upper Bound
Load Response_t	Normalweight	Overweight	-.021	0.468	-.05	.01
		Obese	-.032	0.016	-.06	.00
Load Response_l	Normalweight	Overweight	-.014	0.011	-.03	.00
		Obese	-.024	0.000	-.03	-.01
Load Response_r	Normalweight	Overweight	-.023	0.383	-.06	.01
		Obese	-.034	0.011	-.06	-.01
Stance Phase_t	Normalweight	Overweight	-.029	0.080	-.06	.00
		Obese	-.044	0.000	-.07	-.02
Stance Phase_l	Normalweight	Overweight	-.027	0.136	-.06	.00
		Obese	-.045	0.000	-.07	-.02
Stance Phase_r	Normalweight	Overweight	-.032	0.050	-.06	.00
		Obese	-.044	0.000	-.07	-.02
Pre Swing_t	Normalweight	Overweight	-.014	0.007	-.03	.00
		Obese	-.025	0.000	-.04	-.02
Pre Swing _l	Normalweight	Overweight	-.015	0.005	-.03	.00
		Obese	-.026	0.000	-.04	-.02
Pre Swing _r	Normalweight	Overweight	-.013	0.019	-.03	.00
		Obese	-.024	0.000	-.03	-.01

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Childhood Obesity and Gait Parameters

PREVIOUS STUDIES. SIGNIFICANT RESULTS:

3-D Analysis and Force platforms:

Stance phase, Step width, Pre-swing phase

Mahaffey R. 2016, Mc Millan AG. 2010, Cimolin V. 2015, Huang L. 2013, Hung Y-C. 2013

Photoelectric systems:

Stance phase, Pre-swing phase

Beulertz J. 2016, Galli M. 2015

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Childhood Obesity and Gait Parameters

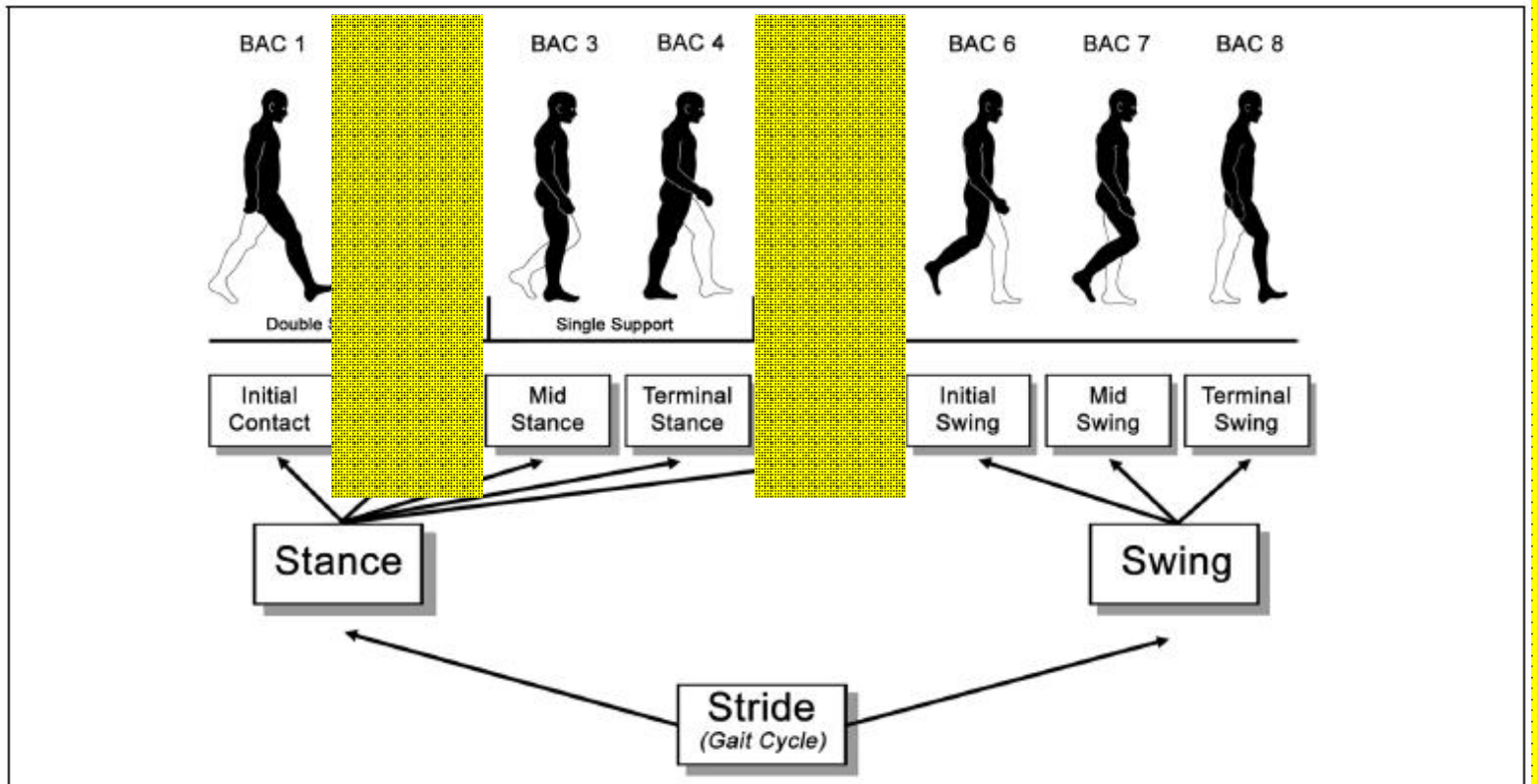

FIGURE 1 | Functional divisions of the gait cycle according to Perry and Burnfield (2010).

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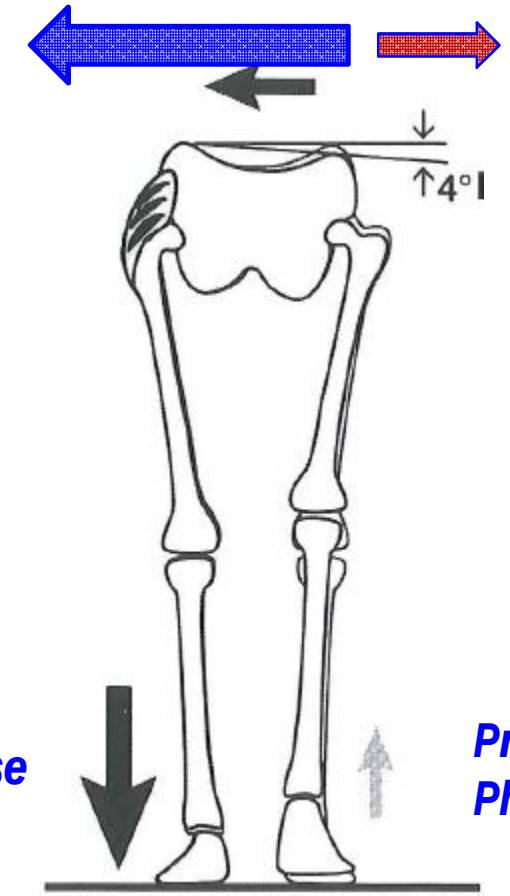
Childhood Obesity and Gait Parameters



Gait strategy with obesity:

Optimization of energy consumption

Balance stabilization

Prevention of falls.

D'Hondt E. 2011

Pau M. 2012

Yan S. 2013

Pathare N. 2015

Villarrasa-Sapiña I. 2016

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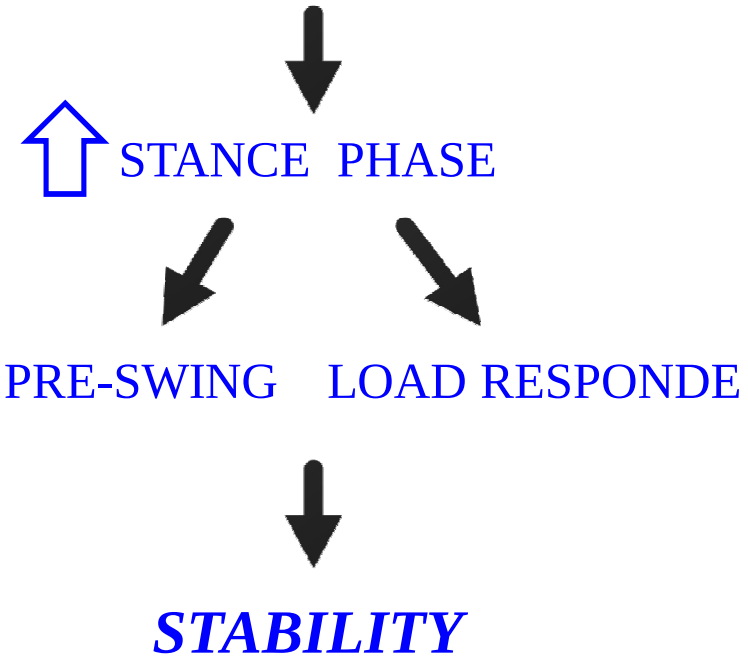
Childhood Obesity and Gait Parameters

Obesity influences Spatio-temporal Gait Parameters of Children



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Thank you!

Childhood Obesity and Gait Parameters