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Motivatie en Transpiratie

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Voorwoord

De Vereniging voor Kinesiologie (VK) organiseert dit jaar voor de 15de keer het jaarlijkse VK symposium.

De gastuniversiteit dit jaar is Universiteit Antwerpen en het thema luidt “Motivatie en Transpiratie”. Het thema van dit symposium kan effectief breed worden geïnterpreteerd. We hebben opnieuw onze succesvolle formule gehanteerd waarbij vier key-note speakers hun onderzoek komen toelichten, gecombineerd met twee sessies waar traditiegetrouw onze jonge Vlaamse onderzoekers hun eigen scriptie- of doctoraatsonderzoek toelichten in de hoop de “prijs voor de jonge onderzoeker” in de wacht te slepen.

Twee buitenlandse gastsprekers belichten hun onderzoek naar motivationele aspecten in de sportprestatie enerzijds in “hete” omstandigheden, anderzijds als een effect of een gevolg van “sensaties in de mond”. Beide onderwerpen bekijken de motivationele aspecten in de sportprestatie vanuit een fysiologische bril. De twee binnenlandse gastsprekers bekijken “motivatie en transpiratie” vanuit een didactische en educatieve bril. Enerzijds wordt de rol van de ouders belicht in de motivatie tot beweging bij kleuters, en anderzijds wordt de motiverende leeromgeving van jongeren uit de doeken gedaan.

Zoals daarnet aangehaald, is het tevens één van de hoofddoelstellingen van de Vereniging voor Kinesiologie om jonge onderzoekers de kans te geven hun werk voor te stellen in een wetenschappelijk, doch gemoedelijk forum. Opnieuw hebben tal van jonge onderzoekers zich ingeschreven voor de “VK-prijs voor de jonge onderzoeker”. De jonge competitiebeesten dingen traditiegetrouw voor de beste mondelinge presentatie en de beste posterpresentatie. In tegenstelling tot vorige jaren heeft het bestuur beslist om vanaf nu alle nog niet-gedoctoreerden de mogelijkheid te geven om mee te dingen voor deze competitie. Beide prijzen worden ook dit jaar gesponsord door RSscan International waarvoor onze gewaardeerde dank! Een bijkomende nieuwigheid in de competitie is de organisatie van een 3de prijs (voor zowel mondelinge als posterpresentaties). Zo zal er vanaf dit jaar een speciale” VTS-prijs” georganiseerd worden. De “VTS-prijs” beloont de jonge onderzoeker waarvan het onderzoek een directe toepassing bewijst naar de sportpraktijk en de prestatieverbetering en dit vanuit de meest denkbare standpunten (training, inspanning, didactiek, techniek, coaching, …). Deze prijs zal eveneens beloond worden met een geldprijs die gesponsord wordt door de VTS. De VK wenst hiermee ook de reeds jarenlange en hechte band met de Vlaamse Trainersschool te bestendigen en de VTS te bedanken voor hun jarenlange (financiële) steun.

Het symposium wordt opnieuw georganiseerd onder de OVUNOLO-koepel met de steun van de Vlaamse Trainerschool (VTS-BLOSO) en RSscan International, wiens financiële steun erg geapprecieerd wordt. De Vereniging voor Kinesiologie bedankt ook de Universiteit Antwerpen, als jarenlange medepartner in het verhaal van de kinesiologie, in het bijzonder Kristiaan D’Aout en Josie Meaney-Ward, voor de organisatie van het symposium 2010.

Wij zijn verheugd ook dit jaar een groot aantal deelnemers te mogen verwelkomen in Antwerpen. Wij hopen dat het voor iedereen een stimulerende en leerrijke dag wordt.

Vanuit persoonlijk standpunt wens ik de VK ook te bedanken voor de vele jaren van fijne samenwerking met de gewezen en huidige bestuurscollega’s, voor de leuke momenten en voor de rijkdom aan ervaringen. De nieuwe voorzitter wens ik een boordevol vat met nieuwe ideeën en uitdagingen. Dank ook aan collega Wim Derave (uittreden secretaris) en collega Katrien De Bock (editor nieuwsbrief) die de afgelopen jaren hun steentje hebben bijgedragen tot de VK-werking.

Renaat Philippaerts

Welkom in Antwerpen!

In de estafette wordt met teams van vier gewerkt. Zo ook bij de Vereniging voor Kinesiologie – de stok voor de organisatie van het jaarlijkse symposium wordt immers tussen Brussel, Gent, Leuven en Antwerpen doorgegeven.

We zijn verheugd om jullie dit jaar terug te mogen verwelkomen in Antwerpen, na de editie "Spieren" van 2006.

Traditiegetrouw is het VK Symposium dé plek waar Vlaamse kinesiologen, in de breedste betekenis, elkaar ontmoeten. Studenten zetten hier veelal hun eerste stappen in het naar buiten brengen van resultaten, anciens vinden er een jaarlijkse update over wat er reilt en zeilt in bewegend Vlaanderen (en daarbuiten!).

We hopen dat, dankzij jullie actieve bijdrage, het symposium ook dit jaar een wetenschappelijk en sportief topevenement wordt!

Kristiaan D'Août
Josie Meaney
Peter Aerts

Word gratis lid van de VK op:

www.verenigingkinesiologie.be

Inhoud

Programma:

15de VK-symposium: "Motivatie en Transpiratie"

9u00 **Registratie en onthaal**

9u25 **Verwelkoming en opening**, Renaat Philippaerts (voorzitter)

9u30 **Inspanningsfysiologie**
Exercise in the heat: Challenges and the search for solutions
Phillip Watson (Loughborough University, UK)

10u00 **Sessie 1 : VK-prijs** (chairperson : Kristiaan D'Août)
6 Mondelinge mededelingen

11u00 **Koffiepauze**

11u20 **Sessie 2 VK-prijs** (chairperson: Peter Aerts)
6 Mondelinge mededelingen

12u20 **Broodjeslunch**

13u00 **Sessie 3 : Posters**
Posterpresentaties voor de VK-prijs
Vrije postermededelingen

14u30 **Sportprestatie**
Oral carbohydrate sensation affects motivation and exercise performance
Edward Chambers (Imperial College London, UK)

15u00 **Fysieke activiteit**
De rol van de ouders in de motivatie tot bewegen bij kleuters
Wouter Cools (VUB)

15u25 **Didactiek**
Moetivatie of Motivatie: Het ABC van een motiverende leeromgeving
Leen Haerens (UGent)

15u50 **Uitreiking VK-prijs voor jonge onderzoekers**
Algemene Ledenvergadering

16u00 **Receptie**

Prijzen voor jonge onderzoekers

Iedere jonge onderzoeker die zijn doctoraat nog niet verdedigd heeft, kan deelnemen aan de presentatiewedstrijd. De jury selecteert vooraf uit de ingezonden abstracts maximaal 12 mondelinge presentaties (elk 10 min). De anderen geven een posterpresentatie. De winnaar bij de mondelinge en de winnaar bij de posterpresentaties krijgen elk 150 euro. De tweede en derde laureaten worden enkel geproclameerd. De abstracts van de 6 laureaten worden gepubliceerd in het tijdschrift Sport en Geneeskunde.
Bijkomend, en nieuw dit jaar is de VTS prijs. Die wordt uitgereikt aan een presentatie die direct bijdraagt tot de sportpraktijk en prestatieverbetering.

Deelnemers voordrachten:
Aelterman, Nathalie (UGent)
Baguet, Audrey (UGent)
Decottignies, Robin (UGent)
D'Hulst, Gommaar (KULeuven)
Galle, Samuel (UGent)
Huyben, Floris (VUBrussel)
Oosterlinck, Maarten (UGent)
Reints, Anke (VUBrussel)
Rutten, Cindy (KULeuven)
Scheers, Tineke (KULeuven)
Van Oosterwijck, Jessica (VUBrussel)

Deelnemers postermededelingen
Broos, Siacia (KULeuven)
Buelens, Evi (VUBrussel)
De Craemer, Marieke & De Decker, Ellen (UGent)
Fransen, Job (UGent)
Fransen, Katrien (KULeuven)
Gentier, Ilse (UGent)
Matthys, Stijn (UGent)
Michilsens, Fana (UAntwerpen)
Pattyn, Nele (KULeuven)
Vandendriessche, Joric (UGent)
Willems, Catherine (UGent)

Lijst van voorgaande VK Symposia

"Kinesiology in Flanders: Brain Drain versus Brain Gain"
17 December 2009, Katholieke Universiteit Leuven.
"Technologie in beweging"
13 November 2008, Vrije Universiteit Brussel.
"Bewegen in extreme condities"
30 November 2007, Universiteit Gent.
"Spieren"
20 September 2006, Universiteit Antwerpen.
"50 Years of Physical Activity, Physical Fitness and Health in Belgium"
22 September 2005, Katholieke Universiteit Leuven.
"From Science to Medals"
5 November 2004, Universiteit Gent.
"Ouderen en bewegen: kinesiologie op leeftijd"
22 November 2003, Vrije Universiteit Brussel.
"Locomotie"
29 November 2002, Katholieke Universiteit Leuven.
"Sport in de begeleiding van jonge topsporters"
30 November 2001, Universiteit Gent.
"Motorische controle en ontwikkeling, motorisch leren"
6 December 2000, Universiteit Antwerpen.
"Fysieke activiteit in de preventieve gezondheidszorg"
8 December 1999, Katholieke Universiteit Leuven.
"Geslachtsverschillen en kinesiologie"
10 December 1998, Universiteit Gent.
"Lichamelijke opvoeding: quo vadis?"
11 December 1997, Vrije Universiteit Brussel.
"Van Bewegen tot Beweging"
12 December 1996, Universiteit Antwerpen.

Symposium Abstracts

Lezingen op uitnodiging

Oral carbohydrate sensation affects motivation and exercise performance

Edward Chambers, *Nutrition and Dietetic Research Group, Department of Investigative Medicine Imperial College London*

Metabolic mechanisms exist to account for the ergogenic action of ingested carbohydrate during prolonged (>90 min) moderate intensity (45-75% VO2max) exercise. Carbohydrate feeding during high intensity (>75% VO2max) exercise of a relatively short duration (~60 min) has also been demonstrated to improve performance. However, recent evidence suggests that the underlying mechanism for the positive effect of carbohydrate ingestion during this type of activity is not metabolic and may reside in the central nervous system.
A number of studies have reported that simply rinsing the mouth with a carbohydrate solution can improve high intensity exercise performance. Furthermore, neuroimaging investigations have established that an oral carbohydrate stimulus activates "reward" related regions of the human brain independently of sweetness.
This would suggest that the beneficial effects of carbohydrate feeding during exercise are not confined to its conventional metabolic advantage but may also serve as a positive afferent signal capable of modifying perception of exertion and motor output.

Parental role in motivating young children to develop fundamental movement skills

Wouter Cools, *Vrije Universiteit Brussel, Faculty of Physical Education and Physiotherapy, Department of Movement Education and Sports Training & Department of Teacher Education*

Introduction. It is important that young children are encouraged to engage in a variety of different physical activities. These activities underlie the development of fundamental movement skills and help children to become independent and self-confident movers (1). This process supports the child in its activities of daily living as well as it initiates a fit and healthy lifestyle. Socio-ecological theoretical models underline that parental support and encouragement are of crucial significance during early childhood (2). A substantial number of young children however does not meet the daily recommended physical activity guidelines (3). Additionally, a growing amount of children also shows under average fundamental movement skill performances(4).
Methods: Participants included 846 preschool children (471 boys, 375 girls) between 4 and 6 years of age. The children's movement skill performance was assessed with the Motoriktest für Vier- bis Sechsjährige Kinder [MOT4-6]. Family context variables (e.g. family characteristics, parental behaviour, parental beliefs, and environmental characteristics) were measured by self-administered parental surveys. Data were analysed using SPSS® software. Values of $p < .05$ were considered statistically significant. A moderated multiple regression analysis was executed to investigate whether children's gender moderated the association between family socialization factors and preschool children's fundamental movement skill performance. To test this moderating effect of gender, family socialization factors were entered in a hierarchical regression (step 3), after analyzing the main effects of gender (step 1) and family socialization factors (step 2). To avoid high correlations between the main effects and the interaction terms and to reduce the effects of multicollinearity, centred variables (raw data minus mean data) were used. Before running the regression analysis, bivariate correlations were computed between family socialization variables and fundamental movement skill scores. Predictors were selected to be entered in the regression analysis when significant differences (independent t-tests) were found for the dummy variables from the parental characteristics (e.g. parental education and workload) or when significant bivariate Pearson's correlations were found for the scaled variables (e.g. parental PA, parental value). Next, intercorrelations among all selected predictors were computed and verified to reduce multicollinearity in the model.

Results: Higher motor quotients (MQ) were significantly predicted by a higher educational status of children's fathers and mothers (family characteristics), by a higher frequency of providing new equipment to children, by higher parental value on relative importance of motor development, higher parental value on the child's PA (parental beliefs). Lower parental value on the child's sleep also significantly predicted higher MQ's. More dense areas (environmental characteristic) also predicted higher MQ's in preschool children.
Results from similar analyses with sub categorized movement skills (balance, locomotion and object control skills) showed that higher performances were additionally significantly predicted by father's PA, use of active transport (parental behaviours) and parental value of the child's physical activities. Parental rating on the importance of a child's sleep and parental inquiry on a child's motor development with the preschool teacher were inversely correlated with movement skill performance. These family socialization factors explained between 6% and 8% of the variance in the preschool children's movement skill performance (MQ, BS,LS and OC).
Conclusions: This study supports that family socializing processes are significantly related to children's fundamental movement skill performance. Therefore targeting parents and the child's home environment should be included when planning interventions to improve fundamental movement skills in young children.
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Moetivatie of Motivatie: Het ABC van een motiverende leeromgeving
Wanting or having to: The ABC of a motivating learning environment

Leen Haerens, *Department of Movement and Sports Sciences, Ghent University*

The largest and probably most significant contribution social psychology has made to research on physical education (PE) over the past 30 years has been in relation to motivation. This research as well as studies in related fields such as classroom-based subjects, the sport domain and the workplace, has revealed that motivation is a complex concept. Lirgg (2006) identifies up to eight theories of motivation that have been used in research on physical education, such as Need Achievement Theory, Expectancy Value Theory, Achievement Goal Theory, and Self-Determination Theory (SDT, Deci & Ryan, 2000). Each of these theories has generated insights into learners' needs, perceptions, expectations, and interests, and into the sources of pupils' experiences in physical education classes and related settings. During the past years interest has grown in SDT.
SDT proposes that students are more likely to be autonomously motivated if their basic needs for autonomy (e.g., experiencing a sense of volition and psychological freedom), competence (e.g., feeling effective), and relatedness (e.g., experiencing a sense of closeness and friendship with the teacher) are fulfilled. Hence, to understand how to structure PE classes to foster optimal motivation, it is important to understand which social-contextual factors, including teaching behaviors, contribute to the satisfaction of the three basic needs. According to SDT, a need-nurturing environment is characterized by the provision of autonomy support and by the creation of a well-structured and warm environment. In contrast, a controlling, chaotic and neglectful climate will frustrate the basic needs and will in turn lead to less self-determined forms of motivation. Teacher autonomy support involves offering choice, minimization of controlling language, and provision of a meaningful rationale for taking part and being active (e.g. Reeve & Jang, 2006). Several cross-sectional (e.g. Hagger, et al., 2003) and experimental (e.g.

Vansteenkiste, et al., 2004) studies focused on the relationship between perceived autonomy support and self-determined motivation for physical education and found that an autonomy supportive context indeed evoked self-determined forms of motivation.
SDT furthermore proposes that teachers can structure the learning environment through the provision of optimal challenging tasks, positive feedback, encouragement after failure, and adequate help as well as through the communication of clear guidelines and expectations with respect to the task that needs to be accomplished. Finally, teachers' involvement refers to the demonstration of sincere concern and the provision of warmth and unconditional regard. Whereas most of the previously conducted studies focused on the relationships between subjective perceptions of need support (measured by questionnaires) and need satisfaction to identify features of need-supportive class environments, studies included in the presentation went beyond the assessment of subjective perceptions and aimed to observe PE teachers' teaching behaviors. This allows to assess relationships between concrete observable teacher behaviors and students' motivation. The results of such studies can, in a second step, form the basis for the development of interventions aimed at creating need supportive class environments by training PE teachers on how to teach in a need supportive way.

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Exercise in the heat: Challenges and the search for solutions

Phillip Watson, *Loughborough University, UK.*

It is commonplace for major sporting events (World Championships, Olympic Games etc) to be staged during the summer months often in countries that experience high temperatures and humidity. This poses a major challenge for competitors, as the performance of both physical and mental tasks can be adversely affected by both heat stress and dehydration. The well-documented effects of hyperthermia and hypohydration on the cardiovascular, thermoregulatory and endocrine systems play a significant role in the decrements in performance experienced in the heat. There is also growing evidence from a variety of experimental models to suggest that the effects of heat stress on performance may also be mediated by mechanisms residing entirely within the central nervous system. The increased sensation of effort during exercise in the heat appears to be mediated through changes to central neurotransmission, brain activity, cerebral blood flow and voluntary muscle activation. Strategies to improve performance include prior acclimatisation to the environmental conditions, pre-exercise cooling and an adequate hydration plan. The provision of fluids that have an appropriate composition and are given in appropriate amounts can prevent hypohydration and can greatly reduce the adverse effects of heat stress. Alternative strategies designed to attenuate the degree of thermal stress experienced may also provide some benefit to the sports performer, although reliable scientific evidence to support the claims of manufacturers are not always available.

Symposium Abstracts

Deelnemers VK-prijs voor jonge onderzoekers 2010

Voordrachten

Are Motivated Pupils More Active And Engaged During Physical Education Class? A Multilevel Analysis From A Self-Determination Approach

Aelterman Nathalie[1,3], Vansteenkiste Maarten[1], Van den Berghe Lynn[2], De Meyer Jotie[2] & Haerens Leen[2,3]

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[2]*Department of Movement and Sport Sciences, Ghent University*

[3]*Flemish Research Foundation*

Introduction. Self-determination theory[1] (SDT) provides a valuable theoretical framework to conceptualize and investigate motivation in physical education (PE). Central to SDT is the qualitative distinction between autonomous (e.g. regulation of behavior with the experiences of volition and psychological freedom) and controlled (e.g. regulation of behavior with the experiences of pressure and coercion) forms of motivation and amotivation (e.g. lack of intentionality to participate in a certain behavior). Previous studies, examining interpersonal differences in motivation, already demonstrated that more autonomous forms of motivation are positively associated with outcomes such as concentration[2], effort[2], enjoyment[3], and self-reported PA levels[3]. However, few if any prior studies have used objective indicators of PA and have mapped out class-based, relative to interpersonal differences in motivation and its relation to behavioral outcomes.

The purpose of the present study was to investigate if and to what extent levels of objectively measured moderate to vigorous physical activity (MVPA) and rated engagement during PE class are associated with motivation towards PE on both the interclass and interpersonal level.

Methods: Participants were 739 pupils (46.3% boys, *M* age = 14.36 ± 1.94) from 46 co-educational secondary school classes in Flanders (Belgium). Accelerometers were used to objectively assess the PA level and collective (i.e. class) engagement was rated based on videotapes. An adapted version of the Behavioral Regulation for Exercise Questionnaire (BREQ-II) was used to measure motivation towards PE. We relied on multilevel analyses to examine interclass and interpersonal differences in the relationship between motivation, MVPA and rated engagement.

Results: Pupils perform MVPA during 25.51% (*SD*=18.18) of PE class time, which corresponds with 9.02 (*SD*=6.70) minutes. Prevalence rates for achieving the recommendation of performing MVPA during at least 50% of class time[4] are fairly low, with 87.2% (81.2% boys, 91.1% girls) scoring below and 12.6% (18.8% boys, 7.5% girls) scoring above this cutoff point. Results of the multilevel analyses show that 63% and 37% of the total variance in objectively measured MVPA can be accounted for by interclass and interpersonal differences, respectively. In the multiple predictor model, including Autonomous motivation, Controlled motivation and Amotivation, Autonomous motivation (β=1.84, *S.E.*=.62, p<.01) positively relates to MVPA, explaining 4% of the interclass and 4% of the interpersonal variance in MVPA. Similarly, Autonomous motivation (β=.49, *S.E.*=.12, p<.001) is positively associated with rated Engagement, accounting for 3% of the interclass variance in Engagement. Controlled motivation and Amotivation are not significantly associated with either MVPA nor Engagement.

Conclusions: Although increasing MVPA per se is not a primary objective for PE class, PA levels are worrisome, especially in girls. Our findings provide support for the role of motivation in explaining both class-based and interpersonal differences in objective indicators of physical activity and engagement during PE, with autonomously motivated pupils performing higher levels of MVPA and being more engaged.

References

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Non-invasive estimation of muscle fiber type composition in elite athletes

Audrey Baguet[1], Inge Everaert[1], Eric Achten[2], Wim Derave[1]
[1] *Department of Movement and Sport Sciences, Ghent University, Ghent, Belgium*
[2] *Department of Radiology, Ghent Institute for Functional and Metabolic Imaging (GifMI), Ghent University, Ghent, Belgium*

Introduction. It has been established that excellence in sports with short and long exercise duration requires a high proportion of fast and slow twitch muscle fibers, respectively[1,2]. Until today, the muscle biopsy method is still accepted as gold standard to measure muscle fiber type composition. Because of the invasive nature and high sampling variance of a muscle biopsy, it would be useful to develop a non-invasive alternative, which can be used as a tool for talent identification. The purpose of the study was to develop a new and non-invasive estimation method of the fiber type composition in human muscles, based on proton magnetic resonance spectroscopy (^{1}H-MRS) measurement of muscle carnosine content, a typical fast twitch metabolite.
Methods. A total of 163 healthy subjects volunteered to participate in this cross-sectional study. The 4 subgroups consisted of 83 untrained control subjects (47 males and 36 females), 15 talented young male track-and-field athletes, 51 active elite athletes (40 males and 11 females) and 14 male ex-athletes. The carnosine content was measured in the gastrocnemius medialis muscle by ^{1}H-MRS, as previously described[3].
Results. The muscle carnosine content was ~30 % higher in explosive athletes (6.58 ± 0.92 mM), such as sprint runners, compared to a reference population (4.94 ± 1.43 mM), whereas it was ~20 % lower than normal in typical endurance athletes (3.98 ± 0.64 mM), such as 3000-marathon runners. Decathletes showed intermediate carnosine levels (5.32 ± 0.72 mM). When active elite runners were ranked according to their best running distance, a negative sigmoidal curve (R^2=0.9874) was found between the logarithm of running distance and muscle carnosine content. Noteworthy is that the muscle carnosine concentration remained significantly different between ex-sprinters and ex-endurance athletes (5.11 ± 1.07 vs. 3.61 ± 0.81 mM; p=0.012), who had discontinued training for many years already. Moreover, a similar difference (p=0.019) was observed in young talents between explosive (6.88 ± 1.83 mM) and endurance (4.90 ± 0.93 mM) athletes. This suggests that the muscle carnosine content is probably genetically determined.
Conclusion. ^{1}H-MRS based muscle carnosine quantification is a new non-invasive method for the estimation of muscle fiber type composition.
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Effect of modulation of a plantar flexor assisting exoskeleton on biomechanical and physiological gait parameters

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Introduction: Since 2006, publications that use Plantar Flexor Assisting Exoskeletons (PFAE's) as a tool to gain understanding on the gait related ankle motor control, are emerging[1]. In several experimental studies, PFAE's are actuated during different parts of the stance phase as there is no consensus on the optimal control algorithm and sensor type. Our aim was to study the effect of actuation timing by varying the onset of actuation. A largest decrease in metabolic cost was expected in the condition when actuation timing started closest before contralateral heelstrike[2].

Methods: Repeated measures design. Ten healthy female subjects (age, 23±3 years; length, 167.7±8.5 cm; weight, 63.6±10.2 kg; avg. ± s.d.) walked on a treadmill at 1.38m.s^{-1} with a bilateral PFAE powered by McKibben muscles, in five active conditions with a different start time for actuation (actuation started at 13%, 23%, 33%, 43% and 53% and ended at 63% of the total stride time). In the control condition (CTRL) subjects walked with unpowered exoskeletons. During these 4 min conditions, metabolic power (measured by means of respiratory gas analysis), muscle activation, joint kinematics, spatiotemporal factors, mechanics of the exoskeleton and subjects perception of the exoskeleton assistance, were measured. Tuckey's honestly significant difference Post-hoc tests were used to determine differences between conditions.

Results & discussion: A descending-rising pattern was found for the difference in metabolic cost with the control condition with progressively later actuation onset (Figure 1). The condition in which actuation started at 43% of the stride time, had the highest decrease in metabolic cost by 18 ± 0.6% (average ± s.e.m.) compared to the control condition ($p \leq 0.005$). In comparison, Sawicki and Ferris, who conducted a similar research in which actuation was started by onset of the user's own soleus muscle activity, found a decrease in metabolic cost by ~ 10% [3]. Compared to the control condition, the musculus tibialis anterior significantly more activated in the two conditions in which the actuation started earliest (start13%>CTRL, $p \leq 0.025$; start23%%>CTRL, $p \leq 0.005$). For the other measured muscles, no condition differed significantly with the control condition. In the condition in which the actuation started earliest, a largest mean plantar flexion during stance was found. The increase in musculus tibialis anterior activity combined with a greater plantar flexion might explain the smaller reduction in metabolic power in the two earliest start conditions. The smaller reduction in metabolic power in the late actuation condition might be due to the short assisting time.

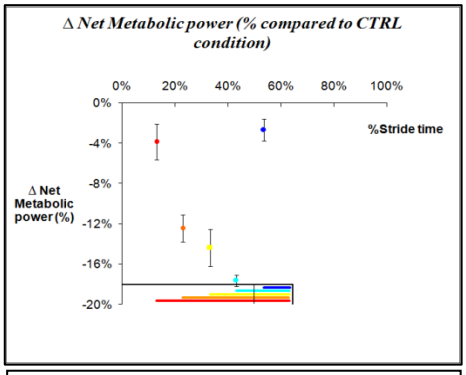

Figure 1: Metabolic power ±s.e.m. in the different actuation conditions compared to the control condition (colored dots & T-bars). (Dots are plotted on the horizontal axis according to the actuation onset.) Colored horizontal bars show the duration of the actuation in each condition. The thin vertical line represents the contralateral heelstrike, the thick vertical line, shows the end of the stance phase.

Conclusion: The hypothesis that the greatest reduction in metabolic power would be found in the condition closest before contralateral heelstrike, was confirmed. The smaller reduction in metabolic cost in early actuation conditions could be explained by a disrupted inverted pendulum movement and concentrically assisting the eccentric endogenous muscle activity in the early stance phase. The observed optimal timing could be useful for future more advanced exosketons serving to restore gait in impaired subjects and/or to increase walking capacity in able-bodied subjects.

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Effects of a novel prototype noncircular chainring on mechanical efficiency in well trained cyclists and triathletes.

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Introduction: Cycling performance can generally be improved in two different ways: physiological and biomechanical. The gross of research has been done about maximal oxygen uptake (VO_2max) and fractional utilization of VO_2max on the lactate or ventilatory thresholds. All of these physiological parameters have been shown to have positive relationships with cycling performance (1). On the other hand, more and more studies have recently been developed on biomechanical factors, such as aerodynamics (2) and mechanical efficiency. Therefore researchers have created many shapes and sizes of noncircular chainrings to ameliorate the efficiency of cycling (3). Results from investigations on this topic are rather inconclusive. This text handles about a completely new shape of chainring developed by the company *somovedi SAM (Monaco).* The hypothesis states that mechanical efficiency will be higher when cycling with the noncircular chainring compared with cycling with a conventional round chainring.

Methods: *Protocol*: 15 well trained cyclists and triathletes participated in this study. They all had at least 2 years of cycling experience, rode there bike for at least 6000km a year and had an average VO_2max of 65.5 $ml.kg^{-1}.min^{-1}$. An incremental maximal exercise test to exhaustion was done as a pre-test before the actual protocol, which consists of two experimental trials on the same day, separated by a 10min seated resting period. Subjects were randomly assigned to start either with the conventional or prototype chaining. They performed the exact same incremental test as mentioned before (pre-test), but had to stop the exercise at 90% of their maximal heart rate. Respiratory gas exchange values and heart rate were measured throughout the whole test. These values were required to calculate mechanical efficiency. Finally, rate of perceived exertion (RPE, Borg) was measured as well.

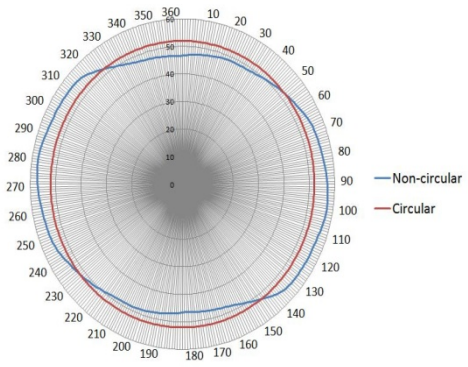

Fig 1*: Schematic overview of the path of the foot by the conventional and prototype chainring (greatest radii at 100° an 280° and the smallest at 0° and 180°).*

Material: A schematic overview of the chainring is presented in **fig 1**. The novel chainring has a greater radius at 100° and 260° of the cyclus and a much smaller radius at both top and bottom death center. This would theoretically help the cyclist to generate more power at ±100° of the cyclus and furthermore help him to overcome top and bottom death center.

Results: Throughout the test VO_2, VCO_2, heart rate and Borg were similar for every incremental step (100-220W), no significant differences were found, except for the Borg values at 140 W. We also used values of VO_2 and VCO_2 to calculate rate of energy expenditure and so mechanical efficiency. Mechanical efficiency tended to be the same for conventional or prototype chainrings at every power output.

Conclusions: So overall, no positive effects where found of the noncircular chainring compared with the conventional chainring. Application to competition seems not useful to us. Further research is necessary.

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Transitions between symmetrical and asymmetrical gaits. A biomechanical analysis.

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Introduction: Gallop is a skipping gait in which one leg (the leading leg) is continuously kept in front of the other (3). This type of locomotion occurs spontaneously in the development of locomotion in children (1) and occurs sometimes in adults when descending stairs or a slope at high speed (2). Although gallop is a naturally occurring human locomotion pattern, research on human gallop is limited.
Methods: Fifteen female subjects with homogeneous stature were selected. They were asked to walk, run and gallop at preferred speed and to perform multiple transitions from walking to running (WRT), galloping to running (GRT) and walking to galloping (WGT). Subjects were equipped with 59 reflective markers and performed the trials on an overground walkway with 6 built-in forceplates and 12 infrared cameras (Pro Reflex, Qualisys). Kinematics and kinetics were calculated using commercial software (Visual 3D, C-motion).
Results: Subjects consistently used the same leading leg during gallop. Joint kinematics and kinetics showed differences between the leading and trailing leg in gallop. Transition speed of GRT ($3.83\pm0.34 ms^{-1}$) was significantly higher than transition speed of WGT ($2.66\pm0.24 ms^{-1}$)($p<0.01$) and WRT ($2.82\pm0.26 ms^{-1}$)($p<0.01$) but no statistical difference was found between WGT and WRT ($p=0.410$)(fig.1). A clear transition step was seen in the WRT and the GRT based on joint kinematics, kinetics, and patterns of mechanical energy. In the WRT, GRT and WGT the swing phase prior to the transition step showed greater (dorsi)flexion in the ankle, knee and hip in comparison with previous walking/galloping steps. In the WGT ($2.66\pm0.24 ms^{-1}$) also the stance phase in the step before transition showed more (dorsi)flexion in the ankle, knee and hip. When subjects initiated the WGT when the leading leg was not in front, they showed some inconsistent intermediate running/skipping steps before they started galloping.

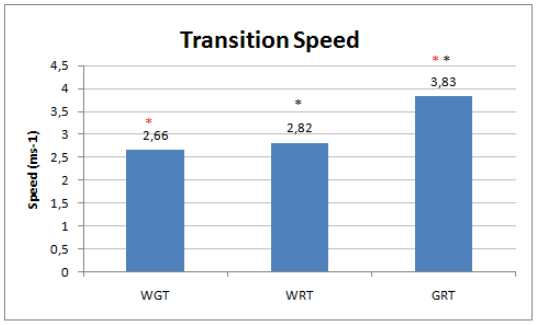

Fig.1: transition speed for WGT, WRT and GRT. *and* are significant differences between transitions ($p<0,01$)

Conclusions: Gallop is appropriately called an asymmetrical gait pattern as the leading and trailing leg execute a different movement. Adults seldom switch spontaneously from walking to galloping so the WGT is supposed to be planned. Still the initiation of transition seems to occur spontaneously because transition sometimes initiated when the leading leg was not in front. If the transition would occur intentionally, one would expect that transition only initiates when the leading leg is in front. Transition speed is very similar for WGT and WRT so it could be that a similar mechanism (arising in the acceleration from walking) determines when the transition occurs.
Transition is prepared in the same way in the WRT and the GRT. There is a limited preparation in the swing phase preceding the actual transition step. In the WGT two transition steps were seen. As both legs carry out a different movement in gallop, it seems like each leg needs a transition step to alter the new gait configuration.

The transition from an asymmetrical gait pattern to a symmetrical gait pattern (GRT) seems easier to perform than a transition from a symmetrical gait pattern to an asymmetrical gait pattern (WGT) as at least two steps were necessary to make the transition in the WGT in comparison with one step in the GRT. The gait pattern before the transitions, seems to determine the instant of transition initiation (similarity between **W**GT and **W**RT). The gait pattern after transition seems to be important in the way the transition is prepared (similarity between W**R**T and G**R**T).

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Blootstelling aan PM in het verkeer: Fietsers vs. Autopassagiers

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Introductie: Het doel van deze studie is om de blootstelling aan verkeersgerelateerde luchtdeeltjes (PNC, $PM_{2.5}$ en PM_{10}) en de ventilatie (VE) te meten bij de fietspendelaar en de autopassagier en de blootstelling tussen beide te vergelijken.

Methode: Concentraties PNC, $PM_{2.5}$ en PM_{10} en de ventilatoire parameters (minuutventilatie (VE), ademfrequentie en teugvolume) werden simultaan gemeten op drie Belgische locaties (Brussel, Louvain-la-Neuve en Mol) bij 55 proefpersonen (38 mannen en 17 vrouwen). De proefpersonen werden eerst met de auto rondgereden en vervolgens legden ze het identieke parcours af met de fiets.

De concentraties PNC werden bepaald a.d.h.v. P-Tral UFP tellers (TSI Model 8525, USA). De TSI DustTrak DRX model 8534 (TSI Inc, USA), een draagbare optische stofmonitor, werd gebruikt om simultaan $PM_{2.5}$ en PM_{10} op te meten. De ventilatoire parameters werden geregistreerd a.d.h.v. een draagbaar cardiopulmonair indirect adem-per-adem calorimetrie systeem (MetaMax 3B, Cortex Biophysik, Duitsland).

Resultaten: In Mol was de PNC significant ($P<0.01$) hoger in de auto dan op de fiets. De gemiddelde $PM_{2.5}$ en PM_{10} concentraties waren significant ($P<0.01$) hoger op de fiets dan in de auto. De minuutventilatie (tabel 1) is gemiddeld 4.3 keer hoger tijdens het pendelen met de fiets in vergelijking met het rijden in de auto. De fiets/auto ratio's die de longdepositie verhouding weergeven (tabel 2) zijn 4.50 (2.17), 6.83 (1.68) en 6.05 (3.46) voor respectievelijk BXL, LLN en Mol. De ingeademde µg PM_{10} km^{-1} en de ingeademde µg $PM_{2.5}$ km^{-1} zijn significant ($P<0.01$) hoger tijdens het fietsen in vergelijking met het autorijden.

Tabel 1: Gemiddelde respiratoire parameters. Waarden zijn gemiddeldes (SD).

	# testpersonen	Ademfrequentie (# min^{-1})	Teugvolume per ademhaling (L)	Minuut Ventilatie (VE) (L min^{-1})	Hartslag (slagen min^{-1})	Totaal ingeademd volume tijdens rit (L)
Fiets	**Mannen = 21**	**27.9 (4.2)**	**2.2 (0.4)**	**59.1 (13.7)**	**129.6 (12.8)**	**924.8 (182.3)**
	Vrouwen = 10	**32.7 (7.0)**	**1.4 (0.3)**	**46.2 (10.6)**	**140.0 (13.6)**	**801.4 (98.2)**
Auto	**Mannen = 8**	**18.3 (3.0)**	**0.8 (0.2)**	**13.4 (1.7)**	**71.9 (9.7)**	**176.8 (55.8)**
	Vrouwen = 1	**21.3 (4.8)**	**0.6 (0.1)**	**11.3 (1.8)**	**74.8 (9.0)**	**153.4 (62.7)**
Fiets/auto ratio	**Mannen = 9**	**1.6 (0.3)**	**2.8 (0.6)**	**4.5 (1.1)**	**1.8 (0.2)**	**5.8 (2.3)**
	Vrouwen = 6	**1.6 (0.2)**	**2.6 (0.4)**	**4.1 (0.6)**	**1.9 (0.3)**	**5.9 (2.0)**

Tabel 2: Gemiddelde ingeademde hoeveelheden aan PNC, PM_{10} en $PM_{2.5}$. PNC m^{-1} en µg km^{-1}; Gem. (SD)

		PNC (SD) #ingeademd per meter	PNC #dosis per meter	µg PM_{10} (SD) ingeademd km^{-1}	µg PM_{10} (SD) dosis km^{-1}	µg $PM_{2.5}$ (SD) ingeademd km^{-1}	µg $PM_{2.5}$ (SD) dosis km^{-1}
BXL	Fiets	5.580.195 (1.924.800)	4.631.562[a]	11.5 (4.5)	2.6	3.4 (1.3)	0.8
	Auto	1.335.467 (83.365)	841.344[b] 965.696[c]	1.6 (0.6)	0.4	0.6 (0.2)	0.1
	Fiets/auto ratio	4.50 (2.17)		7.3 (3.0)		5.9 (2.1)	
LLN	Fiets	2.023.702 (594.881)	1.679.673[a]	8.1 (1.6)	1.9	3.8 (0.8)	0.9
	Auto	305.095 (83.365)	192.210[b] 214.045[c]	0.9 (0.1)	0.2	0.5 (0.1)	0.1
	Fiets/auto ratio	6.83 (1.68)		9.0 (1.0)		8.0 (0.8)	
Mol	Fiets	1.135.046 (435.493)	942.088[a]	8.5 (0.2)	1.9	5.2 (0.2)	1.2
	Auto	216.768 (75.832)	136.564[b] 135.956[c]	1.2 (0.2)	0.3	0.7 (0.1)	0.1
	Fiets/auto ratio	6.05 (3.46)		6.6 (0.3)		7.4 (0.6)	

[a] Gem. DF = 0.83, Daigle et al. (2003). [b] Gem. DF = 0.63, Daigle et al. (2003). [c] Variabele DF, Chalupa et al. (2004).

Conclusie: Uit de resultaten kunnen we concluderen dat het aantal en de grootte van de verschillen in concentraties afhankelijk zijn van de locatie. Gelijkaardige tegenstrijdigheden worden in de literatuur bevestigd. Voor wat de resultaten van de ingeademde hoeveelheden en longdepositie dosis betreft toont ons onderzoek aan dat de verschillen, fietser vs. autopassagier, groot en consistent zijn over de verschillende locaties. De minuutventilatie is gemiddeld 4.3 keer hoger tijdens het pendelen met de fiets in vergelijking met die van de autopassagier. Dus de fietspendelaar ondergaat een grotere blootstelling aan PM dan de autopassagier.

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Evidence-based farriery: pressure plate evaluation of shoeing with a wide toe in sound warmblood horses at the walk and trot

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Introduction: By decreasing biomechanical stresses on injured anatomical structures, corrective shoeing may provide immediate pain relief and may even support the healing process in many equine orthopaedic disorders. Contrary to modern evidence based medicine, most farriery techniques have been developed empirically. Recently, researchers succeeded in performing detailed evaluation of the effect of shoeing with a rolled toe using a dynamically calibrated pressure plate.[1] Because a toe wedge has been shown to decrease the extension of the fetlock joint and the strain on the superficial digital flexor tendon (SDFT) and suspensory ligament (SL),[2] a shoe with a wide toe and narrow branches is increasingly being used in the treatment of SDFT and SL injuries. Presumably, this shoe results in more extension of the distal interphalangeal joint, hence a decreased strain in the SDFT and SL, at least in a soft bedding. It was hypothesized that a pressure plate could quantify the altered load distribution underneath this shoe even on a solid surface, providing a first step towards evidence based application of this shoeing procedure.

Methods: Six sound Dutch Warmblood mares (10.5 ± 3.7 years; height at the withers 1.62 ± 0.02 m; 585.5 ± 43.5 kg) were shod with 2 types of shoes (normal flat shoe and shoe with a wide toe and narrow branches) in a cross-over study. The horses were led at the walk and trot over a pressure plate (Footscan 3D 1 m-system, 250 Hz, RsScan International) with dedicated software (Footscan Scientific Gait 7,

RsScan International), mounted on top of a force platform (Z4852C, Kistler), embedded in the middle of a 20 m long track, covered with a 5 mm rubber mat. A trial was considered valid if the horse moved at a constant pace, looking straight forward, while gait velocity was within a preset range and the hoof of at least one forelimb fully contacted the plate surface. Five valid measurements were collected for both forelimbs. Hoof prints were divided in a toe and heel region by a line through the maximal hoof width. For the toe and heel region the following variables were recorded: 1) stance duration (ST), 2) peak vertical force (PVF), 3) vertical impulse (VI), 4) peak vertical pressure (PVP), 5) time at which the maximal pressure occurs (tPVP), 6) total vertical pressure over the complete stance phase (TVP) and 7) contact area (CA). For all variables, hoof balance (toe versus heel) was calculated as: $[(X_{TOE} – X_{HEEL}) / 0.5 (X_{TOE} + X_{HEEL})] \times 100\%$. Statistical analysis (linear mixed model; Wilcoxon signed ranks test) was performed with SPSS 17.0 with $\alpha = 0.05$ and 0.025 respectively.

Results: There were no significant differences in toe-heel balance between both shoes for ST, PVF and VI. The toe-heel balance of both PVP and tPVP appeared lower (i.e. slightly lower and earlier exerted maximal pressure in the toe region), although these did not reach statistical significance ($P = 0.097$ and 0.079 respectively). However, the shoe with a wide toe showed a significantly larger CA and a lower TVP in the toe region ($P < 0.001$ and $P = 0.05$ respectively).

Conclusions: The present study demonstrates that the shoe with a wide toe results in a significant increase in toe contact area and a decrease in pressure underneath the toe, although the net force exerted in the toe region is not significantly affected. This altered pressure distribution can promote sinking of the heels in a deformable surface such as arena footing, providing a rationale for its application in SDFT or SL injuries.

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Athletes' motivation to (dis-)engage in elite sport: An investigation into the push and pull factors in the holistic career development of elite Flemish athletes

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Introduction: By saying "Although I developed a major depression several times during my athletic career, I do not regret my life as an elite athlete" (Flemish former mountain biker, 2010), it becomes clear that elite sport has a major impact on athletes' lives, whether it be a (very) positive or a (very) negative one. In order to enter the perfection stage, i.e. perform at the highest level of international competition, talented young athletes are required to sacrifice increasing amounts of time and energy (2). To understand what motivates athletes to engage in elite sport, this study examines the four factor (anti-)push (anti-)pull model (1) within the athletic and non-athletic career development of elite athletes (4). Related to sport, push factors are defined as negative considerations within the sport context, pull factors as positive factors outside of sport, anti-push factors as attachment factors, and anti-pull factors as costs and risk factors perceived in the future.

Methods: Theory-based Sampling (3) was used in current study, involving the selection of participants on the basis of their potential representation of important theoretical construct, i.e. entering and ending the elite athletic career. Using face to face interviews, nine former Flemish elite athletes participated in a semi-structured interview. A combination of inductive and deductive research methods was used.

Results: Results revealed 31 push compared to 6 pull factors when *entering the perfection stage*. Also, when making this within-transition, 56 anti-push (e.g., readiness, pride) and zero anti-pull factors were

reported. However, when *entering the discontinuation stage*, 45 push factors (e.g., injuries) and 25 pull factors (e.g., career awareness) were mentioned. Participants were confronted with 14 anti-push (e.g. financially attractive) and 8 anti-pull factors (e.g., vocational delay).

Conclusions: It can be concluded that while the number of negative factors associated with an athletic career increases overtime, the number of positive considerations decreases. This study moves beyond the pragmatic goal of predicting the timing of retirement to a stronger understanding of the decision process when entering and ending athletic careers, enabling practitioners to design more individualized and targeted strategies – examples of which will be given during the presentation.

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The role of motivation in explaining objectively assessed physical activity in preadolescents.

De rol van motivatie in het verklaren van objectief gemeten fysieke activiteit bij preadolescenten.

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Introduction:

The guideline of 60 minutes moderate to vigorous physical activity (PA) is only reached by a minority of the (Flemish) school-aged youth (3). Grounded in the self-determination theory (SDT) (2), a lot of attention is given to the importance of autonomous motivation to explain young people's PA. Recent research concluded that autonomous motivation, enjoyment and PA in physical education (PE) seem to, directly or indirectly, predict PA during leisure time (LT) (1). This study supports the premise that motivational orientations can be transferred from a PE-context into a LT-context. However, previous studies predominantly used behavioural intentions or self-reported PA data (1). The present study tried to counteract this limitation by using an objective measure of PA. Therefore, we tested the hypothesis that autonomous motivation during PE is a significant predictor for pedometer-determined habitual PA levels in preadolescents.

Methods:

The sample in this study consisted of 2433 grade 6 pupils from 103 randomly selected schools. The level of PA was objectively measured using pedometers (Yamax digiwalker SW-200) and a PA diary for 7 days. Pupils' weight status was assessed by means of the Body-Mass-Index (BMI) calculated from measured height and weight. Furthermore, participants completed a questionnaire including items concerning concepts central in SDT (e.g. basic need support).

Results:

Multilevel analyses revealed a between-school variance of 7.28%. Entering BMI, age, gender and amotivation, controlled motivation and autonomous motivation during PE showed that BMI (β=-507.25, p=.00) and gender (β=-2551.73, p=.00) where significantly associated with physical activity. Autonomous motivation showed a trend towards significance (β=272.99, p=.07). When motivational regulations to be active during LT were entered into the model, the trend towards significance of autonomous motivation in PE diminished (β=-184.16, p=.23) and autonomous motivation during LT became a significant

predictor (β=1097.19, p=.00). SEM-analyses (χ^2(14)=308.53, p=.00, CFI= .91, GFI=.96, AGFI=.90, RMSEA=.11) revealed that pupils perceiving a need-supporting environment during PE experienced higher levels of need satisfaction (β=.53, p=.00). Need satisfaction predicted autonomous motivation during PE (β=.89, p=.00), which, in turn, was positively related to physical activity (β=.10; p=.00). However, when autonomous motivation during LT was added to the model (χ^2(19)=262.47, p=.00, CFI=.94, GFI=.97, AGFI=.93, RMSEA=.09), this resulted in a direct effect of competence on autonomous motivation to be active during LT (β=.27, p=.00), and of competence on the number of steps per day (β=.17, p=.00). Moreover, the model showed that autonomous motivation during PE was a significant predictor of autonomous motivation during LT (β=.32, p=.00), which in turn, predicted the average number of steps per day (β=.17, p=.00).

Conclusions:

To conclude, our hypothesis was only partly confirmed. Based on the multilevel analysis, autonomous motivation during LT seems to be a stronger and more important predictor of the level of habitual physical activity rather than the quality of motivation for participating during PE classes. However, SEM showed an indirect effect of autonomous motivation during PE on habitual PA.

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Dimensions of objectively measured physical (in)activity and risk factors for the metabolic syndrome

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Introduction: Little is known about the association between objectively measured physical activity in different domains of daily life and the odds of having the metabolic syndrome (MS) or individual risk factors. The aim of this study is to determine the association between several domains of physical (in)activity and risk factors for the MS in Flemish employees.

Methods: Data was obtained from 442 Flemish men and women (22-64 yrs). Physical activity was assessed during 7 days using a SenseWear Armband and an electronic diary. The information of both instruments was combined to calculate total physical activity and active energy expenditure (AEE, metmin/day ≥ 3 met) in multiple domains of daily life. Participants were divided into tertiles of physical activity and classified as having the MS or individual risk factors using the NCEP-ATPIII definition. Spearman correlations and logistic regression were used to examine associations between physical activity and (risk factors for) the MS. Odds ratios (OR) were calculated against the reference group of the least active (OR: 1.0). Analyses were adjusted for gender, age, education, smoking and alcohol consumption.

Results: The MS was observed in 6% of subjects. Hypertension, hypertriglyceridemia, low HDL levels and abdominal obesity was found in 39%, 16%, 13% and 11% of subjects respectively. Hyperglycemia occurred in only 2% of subjects and was not used in further analyses. Low correlation coefficients (-0.61 to 0.38) between physical activity and the risk factors were obtained. Subjects with a moderate or high physical activity level (met), high amounts of moderate, vigorous or total physical activity (min/day) or

low sitting time had a significantly lower odds of having the MS (OR: 0.12 - 0.24) or individual risk factors (OR: 0.02 - 0.55). Light activity was not associated with the MS or individual risk factors. Subjects with a moderate and high number of steps were significantly less likely to have abdominal obesity, hypertriglyceridemia or hypertension (OR: 0.26-0.55). The OR for abdominal obesity, hypertriglyceridemia and low HDL in the high leisure time AEE group was 0.42 (CI: 0.20 - 0.90), 0.33 (CI: 0.15 - 0.73) and 0.34 (CI: 0.13 - 0.88) respectively. Subjects with moderate and high AEE during transport or household chores were significantly less likely to have abdominal obesity, hypertriglyceridemia or hypertension (OR: 0.16 - 0.66). In addition, the OR for low HDL in the high household AEE group was 0.15 (CI: 0.05 - 0.46). High occupational AEE was only significantly associated with hypertriglyceridemia (OR: 0.36, CI: 0.15 - 0.84).
Conclusion: High levels of total physical activity or AEE during leisure time, transport and household chores were associated with lower odds of the MS and individual risk factors.

Pain inhibition and postexertional malaise in myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS): an experimental study.

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Introduction:
ME/CFS patients show severe symptom and pain exacerbation following physical exercise[1-3]. It seems that the pain inhibitory systems in these patients do not respond to exercise as they do in healthy subjects. The aim of this study was to examine the efficacy of the pain inhibitory systems in ME/CFS patients during two different types of exercise and to examine whether there was an association with symptom increases following exercise.
Methods:
Twenty-two women with ME/CFS and 22 healthy sedentary controls performed a submaximal exercise test and a self-paced, physiologically limited exercise test on a cycle ergometer with continuous cardiorespiratory monitoring. Subjects their health status and pressure pain thresholds [PPTs] were assessed before and after each exercise bout. Activity levels were assessed using accelerometry. Possible changes in any of the outcome measures in response to exercise were compared using repeated measures ANOVA.

Results:

In ME/CFS patients, PPTs decreased following both types of exercise, whereas they increased in healthy subjects. This was accompanied by a worsening of the ME/CFS symptom complex post-exercise. Decreased pressure thresholds during submaximal exercise were associated with postexertional fatigue in the ME/CFS group (r=.454;P=.034).

Conclusions:

These observations indicate the presence of abnormal central pain processing during exercise in ME/CFS patients and demonstrate that both submaximal exercise and self-paced, physiologically limited exercise trigger postexertional malaise in these patients.

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Symposium Abstracts

Deelnemers VK-prijs voor jonge onderzoekers 2010

Postermededelingen

The Peroxisome proliferator-activated receptor alpha (*PPARα*) intron 7 G/C polymorphism is associated with muscle strength in a young-adult population

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Introduction: Peroxime proliferator-activated receptor alpha (*PPARα*), a ligand dependent transcription factor, regulates fatty acid metabolism in heart and skeletal muscle. A polymorphism in intron 7 has been associated with athletic performance in Russian athletes. The rare C allele was found to be more common in power athletes, whereas the G allele was more frequent in endurance athletes (1). A similar trend (although not significant) was observed in Israeli athletes (2) and in Polish rowers (3).
Methods: The *PPARα* intron 7 G/C polymorphism (rs4253778) was genotyped (Illumina Bead Array platform, Illumina Inc., San Diego, USA) in 500 non-athletic, healthy young men (age 24.2±4.4yr) from the Leuven Genes for Muscular Strength study (4, 5). The peak torque of knee extension and flexion was measured at velocities of 0°/s, 60°/s, 120°/s and 240°/s during 3, 25 and 5 repetitions respectively using a Cybex NORM isokinetic dynamometer (Lumex Inc., New York, USA) and used to calculate Average Work (torque×distance) and Power (torque×angular velocity). The endurance ratio was calculated as a measure of resistance to muscle fatigue during the 25 repetitions by dividing the Work in the last 20% of repetitions by the Work in the first 20% of repetitions of the set, multiplied by 100. Differences in knee strength phenotypes among the three genotype groups were analyzed using a one-way analysis of covariance before and after adjusting for age, weight, stature, muscle bone area and fat mass.
Results: The polymorphism did not influence the ability to produce knee flexor and extensor peak torque during static or dynamic conditions in this population. Average Work and Power were also similar between genotype groups. In contrast, the endurance ratio of the knee flexors was found to be higher in CC homozygotes (82.5%) compared to GC (76.0%) and GG (75.2%) carriers (P = 0.03; ES = 0.84%).
Conclusion: These data suggest that CC homozygotes have an improved resistance to muscle fatigue, which may be beneficial in endurance type activities. Since association with the C allele is opposite to earlier findings (1, 2, 3), further studies are needed to unravel the true effect of the *PPARα* intron 7 G/C polymorphism.

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Belevingsonderzoek bij de bewoners van de gaststad van een grootschalig sportevenement: *Case study stad Gent.*

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Inleiding:
Al geruime tijd voert men onderzoek naar de effecten van grootschalige sportevenementen. Ze raken bijna elk aspect van ons leven en onze samenleving, of het nu om sociale, culturele, economische, milieu of politieke aspecten gaat. Impact blijkt echter een moeilijk te omschrijven en operationaliseren begrip. Lange tijd heeft men zich sterk gefocust op het meten van economische effecten, het 'succes' van een evenement werd en wordt vaak gemeten in termen van haar economische bijdrage (1). De socio-culturele impact is echter ook van grote waarde. Zo kan ontevredenheid binnen de host community het lange termijn succes van een evenement bedreigen (2). Ondanks de erkenning onder evenementorganisatoren en –onderzoekers voor de groeiende nood, is er nog steeds geen theoretisch kader om het sociale nut en de impact van evenementen te bestuderen (3). Belevingsonderzoek is 'hot' (4), beleving speelt een steeds grotere rol in onze maatschappij, en is een zinvol instrument omdat het zowel inzicht biedt in de emotionele aspecten van het consumentengedrag (5) als dat het kan aantonen of de organisatie/medewerking van/aan sportevenementen terecht is. Het onderzoeken van beleving blijkt vrij complex en er bestaat bijgevolg nog geen algemeen gehanteerde methodologie (6).
Methode:
Enerzijds willen we a.d.h.v. een review van de bestaande literatuur inzicht verwerven in hoe de theorie rond de beleving van de host community van een grootschalig sportevenement gekaderd is. Op grond hiervan trachten we stof aan te reiken om een model te ontwikkelen op basis waarvan de (sociale) impact van (sport)evenementen kan worden onderzocht. Anderzijds wordt a.d.h.v. een case study over de Z6sdaagse van Gent onderzocht hoe dit sportevenement leeft onder de Gentse bevolking en hoe het beleefd wordt. Er wordt o.b.v. een vragenlijst, afgenomen bij 184 omwonenden en a.d.h.v. halfgestructureerde interviews, afgenomen bij een evenementorganisator en de schepen van sport van Gent, een beschrijvend onderzoek gevoerd.
Resultaten:
We constateerden dat het Social Impact Evaluation model (2) met bijhorende Social Impact Perception Scale (7) een zinvol instrument kan zijn voor de evaluatie van (sport)evenementen. Anderzijds stelden we vast dat de Z6sdaagse van Gent over het algemeen positief beleefd wordt, ondanks dat de effecten ervan niet zo duidelijk worden waargenomen. De beleving van de Z6Sdaagse door de host community blijkt vooral 'basaal' te zijn en is nauwelijks te beïnvloeden. Toch blijken traditie, imago, sfeer en bezoekersdrukte de beleving enigszins te kunnen beïnvloeden.
Conclusies:
In de literatuur vinden we verschillende modellen en theorieën van beleving, maar de relatie ervan tot (sport)evenementen en de host community is nog maar weinig onderzocht. Ook is er beperkt onderzoek naar het kader waarbinnen (sport)evenementen plaatsvinden, de verschillende soorten van (sport)evenementen én hun relatie met de beleving van de host community. Vervolgonderzoek is aan te raden, ook naar de link tussen beleving, evenementen, host community en SIP-schaal. Er is nog steeds geen theoretisch kader om het sociale nut van evenementen te bestuderen (3). Het SIE-Model mét SIP-schaal kan hiervoor een zinvolle tool zijn en vormt een bruikbaar uitgangspunt voor verder onderzoek. Organisatoren en beleidsvoerders moeten naast de socio-culturele impact ook andere mogelijke impact in kaart brengen.
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Effect of an active physical education lesson on the physical activity levels of preschool children

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Introduction:
Physical activity (PA) in childhood is important to prevent chronic diseases and obesity in adulthood. However, preschool children are not physically active enough and spend their days most of the time sedentary. Some interventions to promote physical activity in preschool children have been evaluated, but with mixed results. The aim of this study was to investigate if an active physical education (PE) lesson can contribute to the promotion of total physical activity in preschool children.
Methods:
Sample 316 preschool children, with an average age of 5,37 years, participated in the study. PA levels of 188 preschool children were measured for three consecutive days using accelerometers (43% boys, 57% girls).
Methods: On day 1, preschool children had a regular PE lesson from the preschool teacher and on day 2, a PE lesson focusing on activating the children was given by one of the researchers. 188 preschool children had three consecutive days with measured PA levels and the remaining 128 preschool children were only measured during the active PE lesson. The cut-off points, developed by Sirard et al. (2005), were used to define the PA levels for preschool children.
Statistical analysis: Paired sample T-Testing was used to examine the difference between the regular and the active PE lesson and the difference between the PA measured on the two intervention days. One sample T-Testing was used to examine if the preschoolers reached the 60 minutes moderate to vigorous physical activity norm.
Results:
The intensity of the active PE lesson given by the researchers was, as predicted, significantly higher than the intensity of the regular PE lesson. Preschool children were during the regular PE lesson more sedentary compared with the active PE lesson. Preschool children spent 48% of the time sedentary during the active PE lesson and 68% of the time sedentary during the normal PE lesson.
The PA levels on the day of the active PE lesson were also significantly higher compared with the PA levels on the day of the normal PE lesson.
94% of the preschool children did not reach the recommended 60 minutes moderate to vigorous physical activity (MVPA) on the day of the active PE lesson (29,84 minutes MVPA). On the day of the regular PE lesson, 96% (33,46 minutes MVPA) of the preschool children did not reach the 60 minutes moderate to high physical activity norm.

Conclusions:
The active PE lesson was more intensive compared to the normal PE lesson at preschool. Preschool children were significantly more active on the day of the active PE lesson. We can conclude that an active PE lesson for preschool children can be used for the promotion of physical activity in preschool children. This positive effect was small and further research in this domain is needed.

The difference in basic performance characteristics between sampling and specializing boys aged 6-12.

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Introduction. The Developmental Model of Sports Participation (DMSP: Coté, 1999; Coté, Baker & Abernethy, 2003,2007; Coté & Fraser-Thomas, 2007) proposes two distinct pathways towards reaching an expert level of performance: early specialization and early diversification. Early specialization is based on 'the theory of deliberate practice', stating that 10.000 hours of intense sport-specific training are needed in order to reach expertise in sports (Ericsson et al., 1993). Early diversification has been associated with young athletes (aged 6-12) participating in various sports activities with an emphasis on playfulness and overall enjoyment (Coté et al, 1999). This study focused on the effect of both sampling various sports activities and the total amount of hours spent in sport participation per week on scores for basic performance characteristics (anthropometry, physical fitness and motor coordination).
Methods: The basic performance characteristics of 735 boys aged 6-12, divided into three age groups (6-8: n=161, 8-10: n=310, 10-12: 264) were assessed by a test battery containing anthropometrical, physical fitness and coordinative tests. Data on sports participation were obtained through the use of the Flemish Physical Activity Computerized Questionnaire (Philippaerts et al., 2006).
Results: At the age of 8-10, only the amount of hours spent in sports seems to affect performances, resulting in better scores for those boys who had spent more time in sports on a knee push-ups test, the standing broad jump test, a 10x5m shuttle run test, an endurance shuttle run test and the overall gross motor coordination. For the 10-12 year olds, along with the overall time spent in sports per week, the participation in one or more than one sport seems to also be a factor affecting basic performance characteristics. Children participating in a wider variety of sports jumped further and had a better overall motor coordination than children participating in fewer sports.
Conclusions: Sampling various sports as well as a lot of time spent in sports are both of influence on scores for the basic performance characteristics of 6-12 year old boys. The effect of sampling multiple sports seems to be less acute however than the effect of a high amount of sports participation per week, since differences between boys participating in one sport and boys participating in multiple sports could only be found at the age of 10-12.

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Predicting performance in team sports with dynamic measures of collective efficacy.

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Introduction
Collective efficacy has been defined as the group's judgment of their combined capabilities to accomplish a given task (1). It has been suggested that in team contexts collective efficacy is crucial for optimal performance (e.g., 6, 7). However, the theoretical processes underlying this relation have not yet been elaborated. Moreover, the studies that have investigated this relation have relied on cross-sectional self-report measures.
In this project, we will use the Social Identity Approach (SIA: 4; 8; 9) as theoretical basis to test these assumptions and elaborate the fundamental group processes that differentiate between successful and unsuccessful team outcomes. In essence, SIA proposes that the more we identify ourselves with a group, the more we will internalize the values and norms of this group, and will behave accordingly.
Because leaders in sports teams have the power to persuade and set the example (2), we propose that leadership behaviors initiate and/or change the collective efficacy beliefs of the whole team, and consequently of team performance.
As a result, we hypothesize that the stronger athletes' identification with their team, the faster they will adapt to the collective efficacy standards displayed by the team leader(s), following the behaviours demonstrated by the leader(s). This implies that a leader with high collective efficacy beliefs will only produce high collective efficacy throughout the whole team if the players see and accept this person as a leader ànd when they identify with the team.
Although collective efficacy and team identification are dynamic processes (4), until now they have both been studied in a rather static way based on cross-sectional measurements. Kuao-Hsiung and Jing-Horng (5) have already emphasized the need for longitudinal measurements in order to detect more dynamic patterns and links between the abovementioned concepts. Therefore, the second main objective of project is to abandon the static measurements of previous research and to construct dynamic measures of collective efficacy, in collaboration with BioRICS NV, a spin-off company of the K.U.Leuven that specializes in continuous physiological measurements and real time modelling of individuals.
The aims of this project are thus twofold: first, to test the moderating influence of leadership's behaviours and of players' identification with the team on collective efficacy from the perspective of the Social Identity Approach (4). Second, to develop a more dynamic and multidimensional measure of collective efficacy by integrating on-line measurements of body-responses or on-line biomedical data (e.g., 3; 10).
Method Several volleyball teams will be continually monitored during competition games on a number of biomedical parameters (e.g., heart rate). A reference measure will be constructed by integrating self-reports and video recorded behaviours. The variations in collective efficacy will be linked to critical game situations, leadership behaviours and team identification to predict individual and team performance.
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Gross motor coordination in obese children improves after weight loss induced by a multidisciplinary residential treatment program

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Introduction: Motor skill competence is considered a key determinant of physical activity participation (1). Since adequate motor competence facilitates a physical active lifestyle, a lack thereof puts less skilled children at risk for developing overweight or obesity (2). At the same time, excess body weight imposes significant constraints on children's motor competence, especially gross motor skills and associated body coordination seem to be affected (3). Accordingly, weight loss may have a beneficial effect on motor skill.
Methods: Thirty-six overweight and obese children (10.5 ± 1.4 years, 12 girls and 24 boys) who participated in a multidisciplinary residential treatment program at a local medical centre were recruited, and 36 age- and gender-matched normal-weight children were included to serve as controls. Anthropometric characteristics were recorded and gross motor coordination was assessed by means of the Körperkoordinationstest für Kinder (KTK) on two occasions with a time interval of 4 months.
Results: Residential treatment resulted in a significant decrease in body weight for participants in the obese group. Regardless of the test moment, significantly poorer KTK performances were observed in the obese children compared to their normal-weight peers. However, the obese children displayed a significantly greater increase in KTK scores after a treatment period of 4 months. Within the obese group, the amount of relative weight loss explained 26.9% of the variance in Δ overall KTK performance.

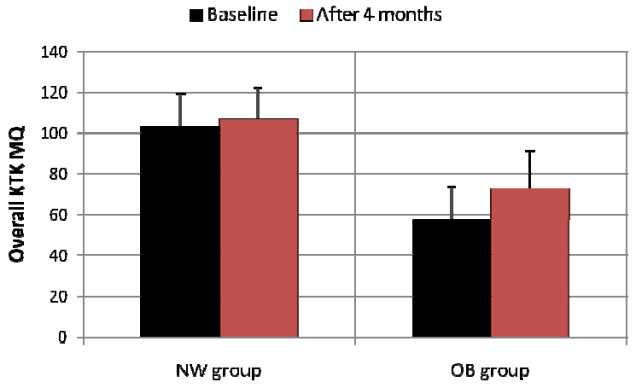

Figure 1. Overall motor quotient (MQ) on the KTK at baseline (black blocks) and after a (treatment) period of 4 months (red blocks) for the normal-weight (NW) group and the obese (OB) group.

Conclusions: This study demonstrated that the level of OB children's gross motor coordination can be successfully improved after weight loss induced by a multidisciplinary residential treatment program. The extent of improvement in gross motor coordination was linearly related to the amount of relative weight loss achieved. Weight loss can be considered an important first step in improving obese children's gross motor coordination, which in turn can promote physical activity participation.

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DIFFERENCES BETWEEN U16 INTERNATIONALS AND U16 FUTURES IN SOCCER

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Introduction:

Boys advanced in maturity are associated with better performance in sports, especially in size, speed, strength and power[1]. Coaches are inclined to select players with superior capacities, mostly without focussing on early or late physical maturation.

The purpose of this study was to examine differences in anthropometry, physical performance and motor proficiency between Belgian international youth soccer players. Influences from maturity to size, speed, strength and power are well understood, but regarding motor proficiency is limited.

Methods:

National team coaches divided a group of 42 high-level U16 soccer players who participated in this study into two teams based on their maturation. Whereas the international group (IT) consisted of current international players, the future group (F) represented late maturing players with high potential to reach international level. Multivariate analysis of variance (MANOVA) was used to compare group differences.

Table 1: Anthropometric characteristics and physical performance measures

	U16 IT n = 20	U16 F n = 22	*p*
Age at peak height velocity (yrs)	13.6 ± 0.5	14.4 ± 0.5	***
Height (cm)	175.3 ± 7.7	169.0 ± 7.7	*
Weight (kg)	65.6 ± 7.7	54.3 ± 6.3	***
Fat (%)	11.2 ± 3.0	8.7 ± 1.6	**
30 m sprint (s)	4.4 ± 0.2	4.6 ± 0.2	***
T-test (s)	8.3 ± 0.2	8.5 ± 0.2	**
CMJ (cm)	34.5 ± 3.9	31.0 ± 4.5	**
HGR (kg)	43.3 ± 7.0	30.1 ± 7.8	***
SBJ (cm)	223.7 ± 11.1	204.8 ± 12.9	***
Dynamic balance (n)	61.7 ± 8.1	58.2 ± 10.6	N.S.
Jumping sideways (n)	104.5 ± 8.1	99.6 ± 8.4	N.S.
Moving on boxes (n)	68.0 ± 7.3	65.4 ± 8.4	N.S.

*(N.S. = Not Significant; * = p < 0.05; ** = p < 0.01; *** = p < 0.001)*

Results:
Table 1 shows the anthropometric characteristics, the physical performance measures and the motor proficiency of the two groups. MANOVA revealed that future players were smaller and weighted less than their international peers. Regarding speed, strength and power items, the international group significantly outperformed the future group. Although the latter group had consistently lower values for motor proficiency, these differences were not significant.

Conclusions:
In agreement with previous literature, the present findings demonstrated that boys advanced in maturity have an advantage in size, speed, strength and power-items, which causes difficulties for selection purposes. However, no maturity group differences were found for motor proficiency. Small nations should be careful with gifted athletes, focussing only on clear characteristics. Creating test batteries for selection purposes, motor proficiency tests should be included.

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How pendulum-like are siamangs?: Energy exchange during brachiation

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Introduction: Hylobatidae (gibbons and siamangs) are known for their brachiation skills. The comparison of brachiation with a pendulum is made several times in the literature and the costs and benefits of being pendulum-like are well described. However, the amount of energy exchange during brachiation of gibbons has rarely been determined. In this study, the amount of energy recovery during brachiation is assessed for three siamangs in a semi-natural environment. It is hypothesized that the amount of energy recovery decreases with an increasing setup complexity while the cost of transport increases. Additionally, we expect that support arm kinematics will be adjusted according to spatial complexity in order to maintain high recovery percentages.

Methods: The animals were recorded by four cameras while voluntarily brachiating on three different setups. The effects of locomotion speed, brachiation type and setup on energy recovery as well as on the mechanical cost of transport during brachiation are determined.
Results: Our results show that both energy recovery and mechanical cost of transport are mainly determined by brachiation speed. Regardless of type of brachiation or setup, brachiation is done with a lower energy recovery and a lower mechanical cost of transport when brachiating faster. Within our limited range of setup variation, the expected effect of increasing complexity is not found. Although there is significant variation in support arm joint angles, no clear relation with speed, brachiation type or setup is observed.
Conclusion: It seems that speed has a more determining effect on brachiation than environmental complexity.

A comparison of body composition in female anorexia nervosa patients, elite athletes and a control group

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Introduction. Body composition is an important indicator of nutritional status in Anorexia Nervosa patients (AN) and is also related to performance in athletes. Furthermore it is more informative than the body mass index (BMI) and is a relevant diagnostic tool to describe deficiencies in either fat mass (FM) and/or fat-free mass (FFM). To our knowledge, the body composition of female AN patients, athletes, and healthy, low-weight, non-athletic women has been compared in only one, small-scaled, study (1).
Methods. Body composition was assessed by air displacement plethysmography in three groups of women with a relatively low BMI (< 21.5 kg/m²): AN patients (n = 22), elite college athletes (n = 22) and a group of healthy, low-weight, non-athletic women (n = 25). ANOVA was used to compare the three groups and a Tukey post hoc test was performed.
Results. In table I the results of the ANOVA are displayed. Post hoc test revealed that all groups differed significantly in terms of body density (BD), percent body fat (PBF), FM and FFM ($p < 0.05$). Including age and height as covariates did not appreciably alter the results.

TABLE 1. Comparison of variables between female Anorexia Nervosa patients (n = 22), athletes (n = 22), and non-athletic women (n = 25)

Variable	AN patients (AN)		Athletes (B)		Non-athletic women (C)		F-value	p
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range		
Age (years)	24.5 ± 8.8	16.7 – 44.1	20.9 ± 2.2	17.9 – 25.2	27.0 ± 6.4	18.1 – 41.6	5.3	** b
Height (cm)	165.7 ± 5.4	154.0 – 174.8	171.0 ± 7.5	157.4 – 188.4	169.0 ± 5.5	157.2 – 177.9	4.1	* a
Weight (kg)	41.2 ± 4.6	34.6 – 50.0	58.4 ± 6.7	48.3 – 76.2	56.4 ± 3.4	50.0 – 62.4	78.7	*** c
BMI (kg/m²)	15.0 ± 1.5	12.1 – 17.5	19.9 ± 1.2	17.7 – 21.5	19.7 ± 0.8	18.6 – 21.2	124.7	*** c
BD (g/cm³)°	1.0747 ± 0.0157	1.0454 – 1.0988	1.0569 ± 0.0088	1.0413 – 1.0715	1.0424 ± 0.0099	1.0189 – 1.0587	44.05	*** d
PBF (%)°	10.7 ± 6.7	0.5 - 23.5	18.4 ± 3.9	12.0 - 25.4	24.9 ± 4.5	17.6 - 35.8	44.0	*** d
FM (kg)°	4.5 ± 3.0	0.2 - 9.6	10.8 ± 3.0	7.0 - 17.6	14.1 ± 3.1	9.4 - 21.7	59.8	*** d
FFM (kg)°	36.7 ± 4.2	31.2 - 44.7	47.5 ± 5.2	39.6 - 58.7	42.3 ± 2.8	37.4 - 47.6	38.3	*** d

N = number of participants; AN = Anorexia Nervosa; BMI = body mass index; PBF = percent body fat; FM = fat mass; FFM = fat-free mass; ANOVA; * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.0001$; Post Hoc Tukey set at $p < 0.05$; a = A vs B; b = B vs C; c = A vs B and C; d = A vs B vs C; ° measured by air displacement plethysmography

Conclusions. Although all groups had a relatively low BMI, they differed significantly in BD. Assuming that the assumptions underlying a two compartment (2C) model of body composition are correct for these three groups (i.e. density FM = 0.9 g/cm³; density FFM = 1.1 g/cm³), these BD resulted in significant differences in PBF, FM and FFM. AN patients had the lowest PBF, FM and FFM, and the highest BD, suggesting that AN patients lose excessive weight, consisting of both FM and FFM. These

results are in line with trends from a previous study using DXA-scans to compare body composition of AN patients with athletes and controls (1) and with findings comparing AN to controls (e.g. 2), although some did not report a lower FFM in AN patients compared to controls (e.g. 3). Future studies may want to implement a 4 or 5 compartment model of body composition to overcome the inherent limitations of a 2C model of body composition used in clinical practice in order to obtain more definitive results on body composition differences between these groups. Recovered AN patients could also be included to study whether their body composition and relative composition of FFM indeed returns to normal when an acceptable BMI is reached.

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COMPARISON OF PROFILES BETWEEN SELECTED AND NON-SELECTED SOCCER PLAYERS IN FLEMISH TOP SPORT SCHOOLS (BELGIUM)

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Many studies revealed that early mature soccer players outperform their late mature peers with regard to anthropometric and performance characteristics (Vaeyens et al, 2006). Consequently, coaches of pre-pubertal and pubertal players generally select the early mature players. The aim of this study was to investigate whether the Flemish top sport schools are using the same selection strategy.

In total, 234 players (range 11-15 years) underwent a set of anthropometric (weight, height and sitting height), performance (30m sprint, CMJ test, SBJ) and two motor proficiency tests after which they played soccer games. During those games experienced coaches evaluated the players. Based on their evaluations, players received the permission to enter a top sport school. Three separate MANCOVA's (anthropometry, physical and motor proficiency tests), with chronological age as covariate, were used to compare the profiles of selected and non-selected players.

The results of the MANCOVA's revealed no significant differences between selected and non-selected players with regard to all anthropometric measurements. However, a trend was found for APHV: selected players (14.00 ± 0.62 yrs) versus non-selected players (13.87 ± 0.55 yrs). Concerning performance and motor proficiency tests, the selected players significantly outperformed their non-selected counterparts (cfr. Table 1).

Table 1. Anthropometric, performance and motor proficiency characteristics

Variables	Selected players (N= 145)	Non-selected players (N=89)	F-value	P-value
Mean chronological age (yrs)	13.47 ± 1.21	13.82 ± 0.96	5.388	p <.05
APHV (yr)	14.00 ± 0.62	13.87 ± 0.55	2.981	p=.086
Height (cm)	160.36 ± 11.51	164.81 ± 9.90	3.111	p=.079
Weight (kg)	48.91 ± 11.87	51.58 ± 10.28	0.014	p=.907
30m sprint (s)	4.90 ± 0.31	4.92 ± 0.32	6.503	p<.05
SBJ	194.72 ± 21.40	192.36 ± 19.50	7.092	p<.01
CMJ test	33.58 ± 5.28	33.09 ± 4.89	4.446	p<.05
Jumping sideways (n/30s)	92.17 ± 8.24	89.78 ± 8.81	11.128	p<.01
Moving sideways on boxes (n/40s)	58.34 ± 7.26	57.34 ± 7.13	4.943	p<.05

Although selected players on average appeared to be younger and later mature compared to non-selected players, they mostly had the best results. Thus, Flemish top sport schools are selecting players with the highest potential (~LTAD).
The results of this study might be an interesting finding for youth coaches, soccer clubs and even federations as for selecting those players with the highest potential of becoming a gifted player once they sustained their developmental process during (pre)puberty. This might be possible by taking into account the maturity status and motor skills during the talent identification and selection process.

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Future Footwear: Walking in a cross-cultural perspective. Kolhapur footwear in the South of India.

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Introduction

'Future Footwear' is a six-year PhD project in the arts financially supported by the Research Fund of University College Ghent. The set-up of the research is interdisciplinary with input from physical medicine and biomechanics, ecological anthropology and design sciences. Two cases on ethnic footwear, one in South India on Kolhapuri footwear, one in Northern Europe on Sami boots, and one case on contemporary shoe design deliver the necessary data to develop a toolbox for the efficient creation of footwear.

For most of human evolutionary history people walked either barefoot or wore minimal footwear such as sandals[1]. In this paper we focus on the functional analysis of traditional Kolhapur footwear using vegetable tanned buffalo hides as an outsole.
We address two main questions: (1) Are the biomechanics of walking barefoot comparable to the effect of wearing Kolhapur footwear? and (2) What is the effect of the natural substrate on walking with and without Kolhapur footwear?

Methods

We analysed walking at preferred speed for ten subjects in four conditions: (1) barefoot on a hard substrate, (2) barefoot in a natural environment, (3) wearing Kolhapur footwear on a hard substrate, (4) wearing Kolhapur footwear in a natural environment.
All subjects are healthy South Indians form the rural area of Karnataka. The following data were recorded: (a) plantar pressure recordings (RSscan Footscan), (b) videography of the gait (3 cameras, 50 fps), (c) registration of anthropometric variables, (d) surface EMG of the M. tibialis anterior and the M. gastrocnemius medialis, (e) 3D accelerometry (Biometrics, heel mounted) and (f) ankle kinematics (inversion-eversion and plantarflexion-dorsiflexion; Biometrics). On footwear level we measured the thickness of the buffalo hides at different locations and performed a three point bending of the outsole at two locations as a measure for functional stiffness. Natural substrate analysis (e.g. compliance and damping) is done by the soil management at the Ghent University by indenting the soil samples.

Results

We compared walking on an artificial (hard) and natural (softer) substrate – both barefoot and when wearing Kolhapur footwear. Preliminary analyses suggest that the effect of substrate (hard vs. soft) and footwear (barefoot vs. ethnic footwear) on biomechanical measurements was more subtle than expected.

Conclusion

Traditional Kolhapur footwear may respect the natural foot shape and function and may have little influence on the biomechanical behavior of the natural foot – a "minimal shoe" *avant la lettre*?

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Symposium Abstracts

Vrije postermededelingen

The role of vision in obese and normal-weight children's gait control

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Introduction. Research has found lower motor competence and alternative movement patterns in obese children when compared to normal-weight peers, thereby linking childhood obesity to non-optimal motor development [1-3]. Some authors suggested that perceptual-motor difficulties may account for obese children's poorer motor behavior [3,4]; however, specific evidence is currently lacking. Therefore, the purpose of this study was to examine the effect of altered visual information on the control of spatiotemporal and kinematic gait parameters in obese versus normal-weight children.
Methods: Sixteen obese and sixteen normal-weight children, matched according to gender (4 ♂, 12 ♀) and age (11.2 ± 1.5 years), participated in this study. Internationally accepted cut-off points for BMI in children were used for classification [5]. Participants were asked to walk barefoot on a level instrumented walkway at a constant self-selected speed during LIGHT and DARK conditions. Using Qualisys Track Manager and Visual 3D software, three-dimensional motion analysis was performed to calculate spatiotemporal parameters as well as sagittal trunk segment and lower extremity joint angles at heel-strike and toe-off.
Results: Self-selected speed, cadence and stride length were not significantly different between obese and normal-weight participants. Even when normalized for height, between group differences did not reach statistical significance. In the DARK condition, all participants walked at a significantly slower speed, decreased stride length and increased stride width. Without normal vision, obese children had a more pronounced increase in relative double support time than those within the normal-weight group, resulting in a significantly greater percentage of the gait cycle spent in stance. Walking in the DARK, both groups showed greater forward tilt of the trunk and restricted hip movement. In addition, all participants displayed increased knee flexion at heel-strike as well as decreased knee extension and ankle plantarflexion at toe-off compared to the LIGHT condition.
Conclusions: The present study confirms the important contribution of vision to children's gait control. The observed changes in spatiotemporal and kinematic parameters reflect their greater emphasis on maintaining dynamic balance rather than forward propulsion when walking in the DARK. However, the removal of normal vision affected the gait pattern of obese children to a larger extent than that of normal-weight peers. The different response in temporal phasing of obese participants during the DARK condition suggests an increased dependency on vision to control their gait. Next to the mechanical problem of moving excess mass, a different coupling between perception and action appears to be governing obese children's motor coordination and control. Further research examining the potentially decreased perceptual-motor function of obese children is warranted, since it might impede performance of everyday life activities as well as the willingness to participate in physical activities.

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The lowered plasma carnosinase activity in elite explosive athletes favors carnosinemia.

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Introduction. Carnosine is present in high concentrations in mammalian skeletal muscle (20-30 mmol/kg dw), where it is synthesized from the amino acids L-histidine and beta-alanine. Carnosine is not detectable in blood in fasted subjects as a result of the highly active enzyme carnosinase, which degrades carnosine into L-histidine and beta-alanine. The presence of carnosine in the circulation after carnosine or meat ingestion is controversial. Recent studies investigating the role of carnosine during high-intensity exercise focused mainly on carnosine in skeletal muscles. The chronic oral ingestion of beta-alanine (4-6 $g \cdot day^{-1}$, 4-10 weeks) can substantially elevate (up to 80%) the carnosine content of skeletal muscle which results in enhanced performance during high-intensity exercise (for review, see [1]). Furthermore, sprint-trained athletes are characterized with higher muscle carnosine levels compared to non-trained subjects [2]. Based on these data it is reasonable to assume that explosive athletes would have a less active carnosine-degrading enzyme. The first aim of this study was to investigate whether the plasma carnosinase activity (= CN1 activity) is lowered in explosive athletes compared to control subjects. A second aim was to explore the advantage of a low carnosinase activity. Would this result in an higher increase of the blood carnosine (= carnosinemia) after acute oral carnosine supplementation compared to subjects with a high carnosinase activity?
Methods: The CN1 activity (n= 42) and protein content (n = 48) of elite explosive athletes was compared with 148 control subjects. The explosive group comprised track athletes competing in events ≤ 400m, jump and throw athletes, swimmers competing in events ≤ 200m, judo athletes, gymnasts, short track athlete and were required to represent Belgium in international competitions, European and/or World championships. Furthermore, 24 healthy non-specifically trained subjects (14 men, 10 women) were supplemented with 60 mg/kg body weight carnosine (mean ± SD: 4209 ± 577 mg). Blood samples were collected prior to the supplementation and 20, 30, 40, 60, 120 minutes after carnosine ingestion. Blood was withdrawn in pre-cooled EDTA tubes and centrifuged at 4°C to separate plasma from the blood cells. Plasma was immediately deproteinized (35% SSA) and stored at -80°C. Plasma carnosine and beta-alanine concentrations were determined using High Performance Liquid Chromatography (PITC derivatization).
Results: The mean CN1 activity (5,03 µmol/ml/h) and protein content (53,87 µg/ml) of the explosive athletes was respectively 20% and 23% lower in comparison with the control group (6,32 µmol/ml/h and 80,22 µg/ml resp., $p < 0.001$). Furthermore, the data from the supplementation study suggest that a low plasma CN1 activity is necessary to obtain carnosinemia after carnosine supplementation. In 16 of the 24 subjects there was no increase in plasma carnosine detectable after carnosine supplementation, despite the precautions that were taken to block the carnosinase activity. In one third of the subjects, a mean increase of 73,3 ± 59,7µM carnosine in plasma was detected after 30-40 minutes, which had disappeared after 1 hour. Both the CN1 activity and the CN1 protein content of the non-responders (CN1 activity: 7,23 ± 1,79 µmol/ml/h, CN1 protein content: 107,08 ± 38,37 µg/ml) was significantly higher ($p = 0,001$) compared to the responders (CN1 activity: 4,65 ± 1,24 µmol/ml/h, CN1 protein content: 46,33µg/ml).
Conclusions: Elite athletes from explosive disciplines show lower plasma carnosinase activity, which is at least partly caused by a decreased protein content of carnosinase. Low carnosinase activity in sprint athletes may be advantageous because it favors carnosinemia following carnosine ingestion in the diet. It remains to be established whether and how carnosinemia may contribute to high-intensity exercise performance.

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Motivation in Reciprocal peer tutoring

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Introduction:
Reciprocal peer tutoring is the system of instruction in which students work in pairs to support each other's learning. In this format, learners are paired and exchange roles of doer and helper[1]. While one learner (doer) performs the task, the other learner (helper) observes and gives feedback based on information provided by the teacher orally or in the form of task cards.
The Self-Determination Theory[2] (SDT) is a theory of motivation and states that people's actions are driven by three core needs: the need for autonomy, the need for competence and the need for relatedness. It can be stated that peer tutoring supports autonomy during the learning process and that students develop competence either by doing or helping. Finally, relatedness between learners in reciprocal peer tutoring is created by defining roles of doer and helper, facilitating cooperation. Based on this reasoning, one could assume the motivating nature of peer tutoring. To investigate this, students' beliefs were mapped by means of a questionnaire. Additionally, these beliefs were linked to student performance in peer tutoring.
Methods:
88 university students in Kinesiology were paired to learn Basic Life Support (BLS) without instructor involvement. BLS is a psychomotor task consisting of nine lifesaving actions, to be performed in a specific order. Task cards were the only source of information to learn BLS and combine a picture of the skill with written instruction about how to perform it. In total, nine task cards were used. BLS assessments were conducted before (baseline), immediately after (intervention) and two weeks later (retention). Before intervention and following retention, students completed a questionnaire. The questionnaire consisted of four questions: (1): *I prefer working with a partner rather than individually*; (2): *I find working with a partner motivating*; (3): *Working with a partner adds value to my own learning*; (4): *I consider myself motor skilled*. Students scored each question on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Results from the questionnaire were mapped, analyzed, and linked to BLS performance at intervention. Gender effects were analyzed as well.
Results:
Strong learning effects were found between baseline and intervention, and between intervention and retention. From intervention to retention a significant drop in performance was detected. Reciprocal peer tutoring with task cards has proven to be an effective teaching strategy to acquire BLS.
For BLS scores, no gender differences in learning outcomes were revealed. Finally, neither correlation, nor analysis of variance could indicate a relationship between student cognitions and learning gains. Yet, the questionnaire pointed out that most students find working with a partner motivating and adding value to their own learning. They also prefer to work with a partner rather than working individually.
Conclusion:
Most students prefer working with a partner rather than working alone on a task. Results show positive learning effects to acquire BLS with task cards as the only source of information. No relation between students cognitions and learning gains were revealed.
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Subsarcolemmal and Intramyofibrillar Mitochondria And Lipids In skeletal Muscle of Morbidly Obese Patients: Extreme Weight Loss And Exercise.

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Introduction:
Gastric bypass surgery results in improved body composition, cardiovascular and metabolic profile. However, extreme weight loss in morbidly obese patients results in a large decrease in muscle mass. Mitochondria in skeletal muscle are known for their plasticity, subsarcolemmal mitochondria ($mito_{SS}$) seem to be important for cell signaling, on the other hand intramyofibrillar mitochondria ($mito_{IMF}$) are more involved in muscle contractions. The purpose of this study is to investigate the effect of extreme weight loss and exercise on subsarcolemmal and intramyofibrillar mitochondria and lipid droplets in skeletal muscle of morbidly obese patients.
Methods: Four morbidly obese patients were recruited for the study and followed an intensive strength and endurance exercise program during 12 weeks, starting 1 month after the operation. A needle biopsy from the vastus lateralis muscle was taken and resting metabolic rate (oxygen uptake) was measured before, one month and four months after the operation. Electron microscopy and stereology was used to determine the density of $mito_{SS}$, $mito_{IMF}$ and lipid droplets ($lipid_{SS}$ and $lipid_{IMF}$).
Results: Extreme weight loss during 5 weeks (9% of body mass) had a pronounced effect on $lipid_{SS}$ (-32,7%), but no effect on $mito_{SS}$, $mito_{IMF}$ and $lipid_{IMF}$ ($mito_{SS}$: pre: 15,7%±6,0 - post1m: 13,5%±6,5 ; $mito_{IMF}$: pre: 3,6%±1,5 - post1m: 2,9%±0,4 ; $lipid_{IMF}$: pre: 1,2%±0,5 - post1m: 1,6%±1,1).
A following exercise program of 12 weeks could significantly increase $mito_{SS}$ and $mito_{IMF}$, with respectively 96,8% and 49,7% and further decreased $lipid_{SS}$ with 43,6%. Remarkably, $lipid_{IMF}$ was not influenced by extreme weight loss and exercise.
Low resting metabolic rate of morbidly obese patients (2,59 ±0,48 ml/min/kg) did not improve after 5 weeks of extreme weight loss (2,09±0,76 ml/min/kg) or exercise during 12 weeks (2,23±0,90 ml/min/kg).
Conclusions: Mitochondria in skeletal muscle of morbidly obese patients can only be improved by exercise. Furthermore, it is difficult to influence $lipid_{IMF}$ through weight loss and exercise.

Adaptations to expected and unexpected visual occlusions in interceptive actions

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Introduction: While it is clear that the availability of sensory information influences motor behaviour (1), Zelaznik et al. (2) showed that *expectancy* regarding the upcoming sensory information is an important source of advance information. Although the influence of expectancy of upcoming visual occlusions has been well established for self-paced motor tasks such as aiming and grasping, it has rarely been investigated in interceptive actions that differ from the former by their specific externally-paced spatio-temporal requirements. Therefore, it was investigated whether explicit advance knowledge of an impending visual occlusion resulted in adaptation to movement kinematics in an attempt to maintain outcome performance.
Methods: Catching performance and kinematics (3D motion capturing) of 20 good ball catchers were compared between no, early and late visual occlusion trials. In an unexpected condition, discrete visual

occlusions of 400 ms appeared randomly interspersed between no occlusion trials, whereas in an expected condition the presence and type of occlusion was announced a priori.
Results: Although there was a small decrease in catching performance when vision was occluded, participants responded adequately to early occlusions by exhibiting a 10-20 ms earlier movement onset, a retreated position of ball-hand contact (7-8 cm) to allow on-line corrections and a 1 cm larger and 7 ms earlier grasp. Expectation of occlusion resulted in an adapted limb transport and grasp phase, whereas in the unexpected condition an earlier movement onset (worst-case scenario) was followed by situation-specific on-line corrections.
Conclusions: Evidence was found for the use of explicit advance knowledge in the motor response of interceptive actions. Current results add to the increasing disposition to consider expectancy as an *important constraint on movement systems* (3) and should not be disregarded in future experimental methodologies.

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Determinanten van noodondersteunend leerkrachtgedrag in de les LO.

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Inleiding:
Er is al heel wat onderzoek gevoerd naar de motivatie van leerlingen voor de les LO. De zelf-determinatie theorie (1) stelt dat de basispsychologische behoeften voor autonomie, competentie en verbondenheid ondersteund moeten worden om optimale motivatie te bewerkstelligen. Een leerkracht kan aan de basisbehoeften van leerlingen tegemoet komen door autonomieondersteuning te bieden, door structuur te voorzien en door een goede relatie op te bouwen met de leerlingen (2). Omdat leerkrachtgedrag in de les LO gezien wordt als een beïnvloedende factor voor de motivatie van leerlingen, is het belangrijk om te weten welke factoren bepalen of leerkrachten het al dan niet haalbaar vinden om deze motiverende strategieën toe te passen. Huidige studie heeft als doel te onderzoeken hoe persoonsgebonden factoren (bv.: graad van perfectionisme, leeftijd) en contextuele factoren (bv.: leerjaar van de leerlingen) in verband staan met de overtuigingen van leerkrachten over de haalbaarheid van noodondersteunend lesgeven.
Methode:
Zevenenveertig leerkrachten LO (gem. lft. = 36,57 jaar ± 11,27; 26 ♂ en 21 ♀) uit het secundair onderwijs namen deel aan de studie. De populatie had een gemiddelde lesgeefervaring van 13,43 jaar (± 11,67). Persoonsgebonden factoren werden gemeten met een vragenlijst die peilde naar a) motivatie om les te geven, b) graad van perfectionisme, c) algemene doelenoriëntatie (autonoom vs. gecontroleerd) en d) leeftijd en ervaring in het lesgeven. Contextuele factoren waren: a) het aantal leerlingen per klas en b) het leerjaar waar de leerlingen inzaten. In een tweede vragenlijst werd gepeild naar de haalbaarheid van noodondersteunende strategieën (Bv.: 'Ik vind het haalbaar om geestdriftig en enthousiast les te geven' en 'Ik vind het haalbaar om toezicht te houden op het consequent naleven van instructies.')
Resultaten:
Autonome vormen van motivatie bij leerkrachten zijn positief gerelateerd aan de scores op haalbaarheid. Intrinsieke motivatie om les te geven was bijvoorbeeld positief gerelateerd aan het haalbaar vinden van het geven van een specifieke uitleg voor bepaalde afspraken (r=.547, p=<.01)). Naast motivatie is ook perfectionisme (d.i. bezorgdheid om fouten te maken en twijfelen) vaak

gerelateerd aan de haalbaarheid om noodondersteunend les te geven. Hoge scores op perfectionisme hebben bijvoorbeeld een negatief verband met het haalbaar vinden om geestdriftig en enthousiasmerend les te geven (r=.391, p=<.01). De algemene doelenoriëntatie van leerkrachten had geen verband met de scores op haalbaarheid. Bij de contextuele factoren was het aantal leerlingen per klas ook niet gerelateerd aan de scores op haalbaarheid, maar het leerjaar waar de leerlingen inzitten was negatief gecorreleerd met de haalbaarheid van duidelijke en beknopte instructies geven (r=-.490, p<.01) en met het zich inleven in het perspectief van de leerlingen (r=-.342, p<.05). Tot slot was er ook een verband tussen de leeftijd en ervaring van leerkrachten en de scores op haalbaarheid. De leeftijd en ervaring zijn bijvoorbeeld positief gecorreleerd met de haalbaarheid om toezicht te houden op het consequent naleven van instructies (lft: r=.475, p<.01, ervaring: r=.488, p<.01).

Conclusie:

Autonome vormen van motivatie om les te geven, de leeftijd en de ervaring van leerkrachten zijn positief gecorreleerd met de rapportering van de haalbaarheid van specifieke noodondersteunende leerkrachtgedragingen. De graad van perfectionisme en het leerjaar van de leerlingen zijn negatief gecorreleerd met deze haalbaarheidscores. Algemene doelenoriëntatie en het aantal leerlingen in de klas bleken geen verband te hebben met het haalbaar vinden van noodondersteunende strategieën.

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Can pain physiology education change pain cognitions and descending nociceptive processin in fibromyalgia? A randomized controlled trial.

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Introduction:

Fibromyalgia [FM] is characterized by central sensitisation.[1,2] The supraspinal descending facilitatory influences (like inappropriate cognitions) appear to contribute to the development and maintenance of central sensitization[3] and chronic pain complaints[4]. The objective of this study was to examine whether pain physiology education is capable of changing pain cognitions and influence descending nociceptive processing in FM.

Methods:

Thirty FM-patients were randomly allocated to either the experimental group or the control group, resp. receiving education about pain physiology or pacing self-management. Health status, pain behaviour/cognitions, pressure pain thresholds [PPTs], and the efficacy of the diffuse noxious inhibitory control mechanism [DNIC] were assessed at baseline, 2 weeks and 3 months follow-up.

Results:

After the intervention the experimental group presented a significant better knowledge on pain physiology (p<.001), an improvement in physical functioning (p=.046), vitality (p=.047), and mental (p<.001) and general health (p<.001) status. No significant effect were found for pain cognitions, behaviour or for the pressure pain thresholds. Although no significant effects were established for the efficacy of DNIC when the three different measurements in time were compared, a significant difference was found when the intervention group was compared with the control group at three months follow-

up. The intervention group reported lower pain scores during the spatial summation procedure (p=.019).

Conclusions:

These results suggest that FM-patients are able to understand and remember the complex material about pain physiology. They reported increased levels of vitality and physical functioning, and an improvement of their mental and general health. We could not establish any effects on pain cognitions or pain behaviour. Although pain pressure thresholds remained the same, a positive effect was found on the descending nociceptive processing at three months follow-up. Pain education seems a useful component in the treatment of FM as it can be used to improve health status, and could improve pain inhibition in the long term.

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Increased intramyocellular fat utilization following endurance training in the fasted state during a period of high-fat diet.

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Introduction:

An episode of increased dietary fat intake while ingesting reduced amounts of carbohydrates markedly stimulates energy provision via fat oxidation during exercise and may impair glycogen metabolism (1,2). The purpose of this study was to investigate the impact of an endurance training program in the fasted versus the fed state on exercise-induced net intramyocellular lipid (IMCL) and glycogen breakdown during a period of fat-rich diet.

Methods: Healthy male volunteers (18-25yrs) received a hypercaloric (~+30% kcal/day) fat-rich (50% of kcal) diet for 6 weeks (HFD). Part of the subjects performed endurance exercise training (4d/week) in the fasted state (F; n=10), whilst the others ingested carbohydrates before and during identical training sessions (CHO; n=10). The control group did not train (CON; n=7). Before and after the interventions, the subjects performed a 2-hr constant-load bicycle exercise (~65% of VO_2max) in the fasted state.

Results: Independent of the experimental group, HFD stimulated exercise-induced IMCL breakdown in type I as well as in type IIa fibers ($P<0.01$). Exercise-induced net muscle glycogen breakdown was not affected by HFD as such, but tended to be inhibited by both F and CHO ($P=0.09$). Furthermore, exercise-induced AMP-activated protein kinase α activation was blunted in F ($P<0.05$), but not in CHO or CON.

Conclusions: It is concluded that HFD as such stimulates net IMCL degradation during exercise in the fasted state, while maintaining the capacity for energy provision via muscle glycogen breakdown.

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General motor coordination in elite and sub-elite gymnasts

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Introduction:
Traditional Talent Identification (TID) models predict success by measuring the current performance of athletes on (a combination of) physical, anthropometric or technical variables within age-specific groups. However, those variables lack predictive value as they are influenced by growth and maturity, resulting in instability of those factors [1]. Stability of factors was suggested as an important criterion for effective TID [2]. Moderate to high long-term stability was found in motor coordination using the KTK (Körperkoördinationstest für Kinder) [3]. The KTK discriminates between normal and advanced children, speculating on the possibility of using the KTK for TID purposes [4]. This study critically evaluated the discriminating power of the KTK between elite and sub-elite seven-year-old female gymnasts in Flanders.

Methods:
In 2009, 62 seven–year-old female competitive level gymnasts took part in the TID day of the Flemish Gymnastics Federation for selection into the national talent development program. At the end of the test session, the gymnasts were assigned into 35 elite (selection) and 27 sub-elite (no selection) level based upon the observations of the Federation coaches during the technical tests on the four apparatus.
Prior to selection, all gymnasts completed the four subtests of the KTK: walking backwards along balance beams, moving sideways on boxes, jumping from one leg over an increasing pile of pillows and jumping sideways, comprising a Motor Quotient (MQKTK).
The Motor Quotients of the two groups (elite vs. sub-elite) were compared using ANOVA. Descriptive statistics were requested in order to compare the MQ's with those from 194 seven-year-old girls from the normal population. A discriminant analysis was used to identify the discriminating power of the KTK between the two levels. Significance level was set at $P<.05$.

Results:
Significant differences were found between elite (MQ: 135.37 ± 6.93) and sub-elite (MQ: 127.22 ± 8.55) gymnasts on the MQKTK ($F_{1,61} = 17.201$, $P<.001$). Flemish seven-year-old girls from the control population scored a lower mean MQ of 96.46 ± 14.21.
Discriminant analysis classified 72.6% of the Flemish elite and sub-elite gymnasts in the correct group based upon their MQKTK score.

Conclusions:
The present results showed that the KTK is a valuable general motor coordination test in gymnastics TID models as elite gymnasts outperformed their less skilled counterparts. In addition, the KTK was able to distinguish between gymnasts and non-gymnasts. Although the KTK showed long-term stability in the reference population, future longitudinal research is needed to check for stability in sport-specific contexts.

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