The Influence of Sports Participation on Sustained Attention in Children with Cerebral Palsy

ABSTRACT

Cerebral palsy is a persistent disorder because of a nonprogressive pathological process that damaged the brain in the prenatal, perinatal or the early postnatal periods. The most characteristic signs of cerebral palsy are motor impairments. Cognitive impairments, like attention deficits, are also common in cerebral palsy. The aim of the present study was to investigate whether children with cerebral palsy have sustained attention deficits. The second aim was to investigate whether sports participation has a positive influence on sustained attention in children with cerebral palsy and in healthy children. 32 children with cerebral palsy were included, divided into two groups: a sporting group of 12 children and a non-sporting group of 20 children. Also a group of 42 healthy children was included. This group consisted of a sporting group of 22 children and a non-sporting group of 20 children. To measure sustained attention the Bourdon-Vos Test was used. The number of hits and the total time needed to complete the task were used to rate sustained attention. Results indicated that sustained attention is less well developed in children with cerebral palsy than in healthy children. There was no significant effect found of sports participation on sustained attention in children with cerebral palsy. There was also no significant effect found of sports participation on sustained attention in healthy children. In conclusion this study contributes to the research to attention in children with cerebral palsy. Despite that there was found no effect of sports participation on sustained attention in this study, future studies can possibly found this effect when working on the limitations of this study.

Keywords*: cerebral palsy, children, sports participation, sustained attention, cognition, healthy children*

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Introduction

Cerebral palsy is one of the most common disorders affecting children, with a prevalence of 1.5-3 per 1,000 children in Europe (Van Eck et al., 2008; Mukherjee & Gaebler-Spira, 2007; Odding, Roebroeck, & Stam, 2006). Cerebral palsy, also called infantile encephalopathy, is a persistent disorder because of a nonprogressive pathological process that damaged the brain in the prenatal, perinatal or the early postnatal periods of a child's life (Van Eck et al., 2008; Becher & Van Der Sluijs, 2003). It often affects the periventricular white matter in the brain, either unilaterally or bilaterally (Bottcher, Flachs, Uldall, 2010).

Cerebral palsy is classified according to the size of the impairment (hemiplegia, diplegia or tetraplegia) (Bottcher, 2010). It is also classified according to the type of motor symptoms (spastic, dyskinetic or ataxic) (Bottcher, 2010). The most characteristic signs of cerebral palsy are namely motor impairments, such as movement disorders, spasticity, muscle weakness, ataxia and rigidity (Van Eck et al., 2008). The severity of motor impairments ranges from subtle motor impairments to involvement of the whole body in cerebral palsy (Van Eck et al., 2008).

Although the primary consequences of cerebral palsy are motor impairments, this impairments are often accompanied by disturbances of cognition (for example attention deficits or learning disabilities), sensation and perception (vision or hearing), communication (speech) and behavior (dependency, being headstrong), by secondary musculoskeletal problems (hip luxations, contractures and scoliosis) and by epilepsy (Rosenbaum et al., 2007; Odding et al., 2006; Becher & Van Der Sluijs, 2003). Especially when epilepsy is present, the prevalence of some impairments, like cognitive impairments, increases (Odding et al., 2006). Estimations are that 23-44% of the individuals with cerebral palsy have some kind of cognitive impairments (Odding et al., 2006).

Common cognitive impairments in individuals with cerebral palsy are attention deficits. Attention deficits can be expected when the periventricular white matter is affected in anterior regions (White & Christ, 2005; Schatz, Craft, White, Park & Figiel, 2001) or parietal regions (Pavlova, Sokolov, Birbaumer & Krageloh-Mann, 2008). A comorbid diagnosis of attention-deficit hyperactivity (ADHD) is common as well in individuals with cerebral palsy (Gross-Tsur, Shalev, Badihi & Manor, 2002). To get a complete picture of attention deficits in individuals with cerebral palsy still more research is needed.

Above-mentioned impairments in individuals with cerebral palsy can also lead to limitations in their ability to participate in activities. Similarly in physical activities: they report more limitations for physical activity participation (Longrnuir & Bar-Or, 2000). The physical activity level of individuals with cerebral palsy actually is lower than the physical activity level of healthy people (Van Eck et al., 2008; Longrnuir & Bar-Or, 2000; Van Den Berg-Emons et al., 1995). In a recent study (Zwier et al., 2010) 93% of the children with cerebral palsy did not meet the Dutch standard of healthy physical activity (in Dutch 'de Nederlandse Norm Gezond

Bewegen'). In another recent study (Van Eck et al., 2008) the percentage of individuals with cerebral palsy who do not meet this standard was 89%.

Especially in people with cerebral palsy physical activity is important: studies have found that increased physical activity may lead to better physical and mental health in people with cerebral palsy (Zwier et al., 2010; Damiano, 2006). Physical activity for at least twice a week may lead to general effects, as found in healthy people (Windle, Hughes, Linck, Russell & Woods, 2010; Stiggelbout, Popkema, Hopman-Rock, De Greef & Van Mechelen, 2004).

Physical activity may also lead to improvements in the cognitive performance, as found in studies with healthy people (Barenberg, Berse & Dutke, 2011; Damiano, 2006; Leppo, Davis & Crim, 2000; Pica, 1997; Shephard, 1996; Raviv & Low, 1990). Physical activity leads to an increase of blood flow in different areas in the brain what in turn can lead to a bigger motivation to learn: the attention span and concentration was found to increase in healthy people (Shephard, 1996; Raviv & Low, 1990; Metzler, n.d.).

This effect of physical activity on attention is frequently found in healthy people (Pontifex, Scudder, Drollette & Hillman, 2012; Barenberg et al., 2011; Pica, 1997; Shephard, 1996; Raviv & Low, 1990). However, research to this effect in people with cerebral palsy is lacking. Therefore, the current study investigates the effect of sports participation on attention in children with cerebral palsy. Especially children deserve research attention, considering the life-long effects of cerebral palsy. When the physical activity is started early in life the nervous system and the musculoskeletal system are the most adaptable, so the biggest improvements may be possible (Damiano, 2006).

Beside that this study focuses on children, it focuses also on one component of attention instead of attention in its entirety. Attention is a broad concept, seen as consisting of separate components. Kessels et al. (2012) attempt to divide attention in four elements: arousal, sustained attention, divided attention and focused attention. The current study focuses especially on sustained attention. Sustained attention is a component of attention characterized by somebody's readiness to detect signals (vigilance) over prolonged periods of time (Sarter, Givens & Bruno, 2001). Some studies have found that individuals with cerebral palsy mainly have difficulties with sustained attention and divided attention (Bottcher et al., 2010; Pirila, Van Der Meere, Korhonen, 2004; Kolk & Talvik, 2000).

The first purpose of this study was to investigate whether children with cerebral palsy have sustained attention deficits compared to healthy children. The second aim was to investigate whether sports participation has a positive influence on sustained attention in children with cerebral palsy. To compare the effect of sports participation on sustained attention between children with cerebral palsy and healthy children, the effect of sports participation on sustained attention is in this study also investigated in healthy children.

Methods

Participants

A total of 32 children with cerebral palsy were included in this study. The children were recruited from schools, sports clubs and rehabilitation centers. They were recruited for the Health in Adapted Youth Sports Study (Hays-Study) and the Sport 2 Stay Fit study (S2SF-Study). Inclusion criteria for this study were an official diagnosis of cerebral palsy and an age between six and nineteen years.

The group of children with cerebral palsy were divided into two groups, based on the frequency of sports participation: the sporting group which participated in sports at least twice a week (12 children) versus the non-sporting group which participated in sports less than twice a week (20 children). Physical education lessons at school did not count as sports participation in this study.

Also a group of 42 healthy children was included. The group of healthy children consisted of two groups too: a sporting group (22 children) and a non-sporting group (20 children) based on the same frequency of sports participation as the children with cerebral palsy. They were recruited from schools and 'het Universiteitsmuseum' in Utrecht (the Netherlands). The inclusion criterion to be part of this group was an age between six and nineteen years. The exclusion criterion was an official diagnosis of Attention Deficit Hyperactivity Disorder (ADHD), Attention Deficit Disorder (ADD) or autism, because this diagnosis may have a negative impact on attention.

Procedure, Task and Stimuli

Participants were tested by a team of professionals and trained students. Participants and their parents received an information brochure about the study (see appendix A). Written informed consent was obtained before participation in the study (see appendix B).

To measure sustained attention the Bourdon-Vos Test (Vos, 1998) was used. Children with cerebral palsy can have a reduced hand function, so a special tablet version of this task was developed to minimalize the effect of the reduced hand function. With this tablet version the participant only needed to tap on the tablet.

The Bourdon-Vos Test started with a practice trial. The practice trial had four lines with four stimuli on each line. The stimuli were groups of dots, varying between the three and five dots per stimulus. Per line the participants had to tap only those stimuli that had four dots. In this part of the test instructions and feedback were given. After the practice trial, the Bourdon-Vos Test was started. The test had thirty-five lines with stimuli, spread over three pages (respectively 12, 12, 11 lines per page). To go to the next page, the participant needed to tap the little red square in the lower right corner of the screen of the tablet. Just as with the practice

trial, the participant had to tap only those stimuli that had four dots. Participants had to work from top to bottom, line by line, from left to right, without going back to correct any errors. The maximum time to finish all the thirty-five lines was ten minutes. If the participant could not finish in ten minutes, the participant had to stop. The number of finished lines was recorded. Observations like omissions and distraction were also recorded by the experimenter.

The Bourdon-Vos Test consisted of 840 stimuli, namely 280 targets and 560 distractors. Every line has eight targets interspersed with sixteen distractors. Hits (number of crossed out targets) and the total time needed to complete the task were used to rate sustained attention in the participants. So the rating was based on both speed and accuracy.

A questionnaire was also included (see appendix C). A parent (or guardian) of the participant filled out a questionnaire that consisted of questions about the sports participation of the participant. Also some questions about general information, such as the age and the date of birth of the participant were included in the questionnaire.

The total procedure of the Bourdon-Vos Test and the questionnaire took about half an hour.

Analyses

The statistical analyses were performed with IBM SPSS Statistics, version 23.0. To check whether the age of the participants differed significantly per group, a Mann-Whitney Test was used. To check whether gender of the participants differed significantly per group, Chi Square Tests were used. In this way age and gender was analyzed between children with cerebral palsy and healthy children, between sporting and non-sporting children with cerebral palsy and finally between sporting and non-sporting healthy children.

To analyze whether there were differences between the performances of children with cerebral palsy and healthy children on the Bourdon-Vos Test, multivariate analysis of variance (MANOVA) was used. The independent variable was the presence or absence of cerebral palsy in the participants. As dependent variables number of hits and the total time needed to complete the task were chosen.

To analyze whether sports participation had an effect on the performance on the Bourdon-Vos Test in children with cerebral palsy and in healthy children, multivariate analysis of variance (MANOVA) was used. To investigate the source of the possible differences and to investigate whether sports participation had an influence on sustained attention in children with cerebral palsy and in healthy children separately, a Games-Howell *post hoc* test was also conducted. There were two independent variables, namely a variable called cerebral palsy (children with cerebral palsy versus healthy children) and a variable called sports participation (sports participation for less than two times a week versus sports participation for at least twice

a week). In this way there were four groups within the independent variables: a group of sporting children with cerebral palsy, a group of non-sporting children with cerebral palsy, a group of sporting healthy children and a group of non-sporting healthy children. As dependent variables the hits and the total time needed to complete the Bourdon-Vos test were chosen.

Results

Participants

Descriptions of the 74 participants are presented in Table 1.

Table 1

Demographic data of the participants

	N	Minimum age	Maximum age	Average age (SD)	Males	Females
Total group of participants	74	9	18	12.6 (2.8)	37	37
Sporting children with cerebral palsy	12	11	18	15.6 (2.1)	11	1
Non-sporting children with cerebral palsy	20	10	18	13.5 (2.6)	10	10
Sporting healthy children	22	9	16	12.1 (1.9)	9	13
Non-sporting healthy children	20	9	17	10.5 (2.2)	7	13

The distribution of age differed significantly between the children with cerebral palsy and the healthy children ($U = 262$, $p < .001$). The distribution of gender differed also significantly between the children with cerebral palsy and the healthy children χ^2 (1, $n = 74$) = 5.51, $p = .019$).

The distribution of age differed also significantly between the sporting children with cerebral palsy and the non-sporting children with cerebral palsy ($U = 63$, $p = .026$). The distribution of gender differed also significantly between the sporting children with cerebral palsy and the non-sporting children with cerebral palsy χ^2 (1, $n = 32$) = 3.13, $p = .077$).

Finally the distribution of age differed also significantly between the sporting healthy children and the non-sporting healthy children (U = 105, p = .003). The distribution of gender differed not significantly between the sporting healthy children and the non-sporting healthy children χ^2 (1, n = 42) = 2.38, p = .123).

Cerebral palsy

There was a significant difference between children with cerebral palsy and healthy children when considered jointly on the dependent variables hits and total time, Hotelling's Trace = .525, F(2,71) = 18.63, p < .001, partial η^2 = .34, with healthy children finding more targets (M = 242.45) than children with cerebral palsy (M = 177.84) and healthy children needing less time to finish the task (M = 498.57 seconds) than children with cerebral palsy (M= 546.31 seconds).

To investigate whether children with cerebral palsy and healthy children differ also significantly on the dependent variables hits and total time separately, a separate analysis of variance (ANOVA) was conducted for each dependent variable, with each ANOVA evaluated at an alpha level of .025. First there was a significant difference between children with cerebral palsy and healthy children on hits, F(1,72) = 35.66, p < .001, partial η^2 = .33, with healthy children (M = 242.45) finding more targets than children with cerebral palsy (M = 177.84). These results are presented in Figure 1. There was also a significant difference between the children with cerebral palsy and the healthy children on total time, F(1,72) = 7.18, p = .009, partial η^2 = .09, with children with cerebral palsy (M= 546.31 seconds) needing more time to finish the task than healthy children (M = 498.57 seconds). These results are presented in Figure 2.

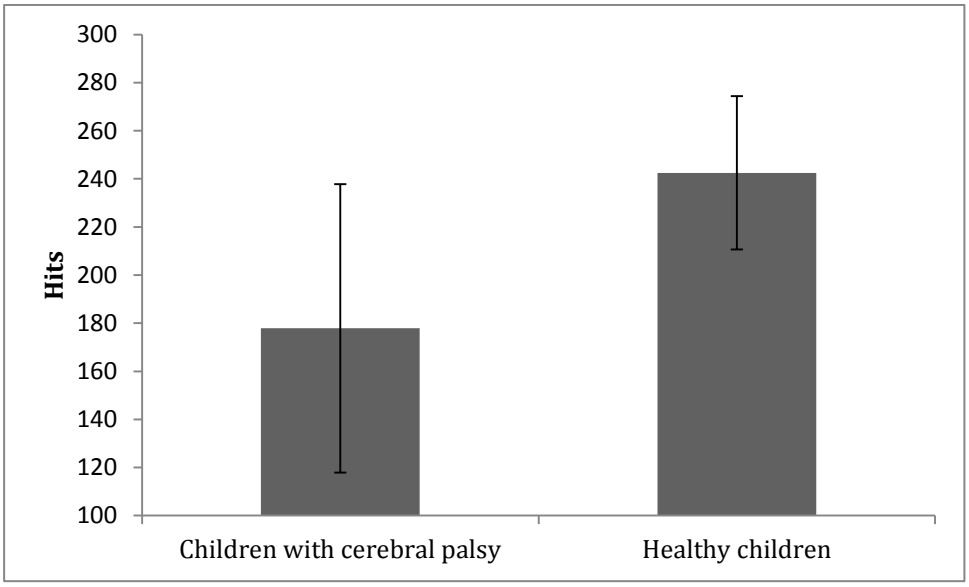

Figure 1. Hits on the Bourdon-Vos Test

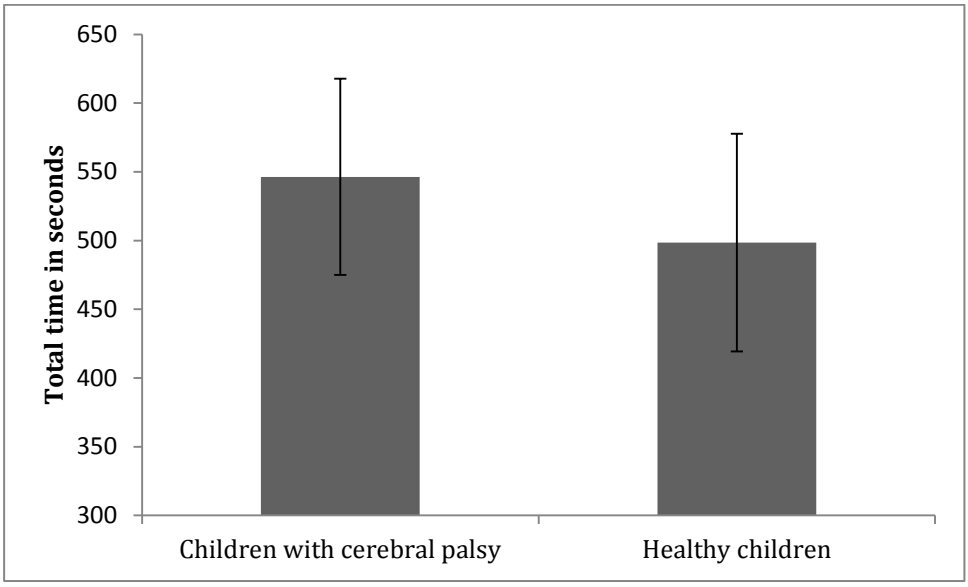

Figure 2. Total time in seconds needed to finish the Bourdon-Vos Test

Sports participation

There was a significant multivariate effect of sports participation and cerebral palsy when considered jointly on the dependent variables hits and total time, Wilks' $\lambda = .594$, $F(6,138) = 6.85$, $p < .001$, partial $\eta^2 = .23$. A separate analysis of variance (ANOVA) was conducted for each dependent variable, with each ANOVA evaluated at an alpha level of .025.

There was a significant difference between the four groups of participants on the dependent variable hits, $F(3,70) = 11.97$, $p < .001$, partial $\eta^2 = .34$, with respectively sporting healthy children finding the most targets (M = 245.05), non-sporting healthy finding the second most targets (M = 239.60), sporting children with cerebral palsy finding the third most targets (M = 186.67) and non-sporting children with cerebral palsy finding the least targets (M = 172.55).

There was also a significant difference between the four groups of participants on the dependent variable total time, $F(3,70) = 4.79$, $p = .004$, partial $\eta^2 = .17$, with respectively non-sporting children with cerebral palsy needing the most time to finish the task (M = 551.75 seconds), sporting children with cerebral palsy needing the second most time (M = 537.25 seconds), non-sporting healthy children needing the third most time (M = 528.75 seconds) and sporting healthy children needing the least time to finish the task (M = 471.14 seconds).

To investigate the source of this significant differences and to investigate whether sports participation had an influence on sustained attention in children with cerebral palsy and in healthy children separately, a Games-Howell *post hoc* test was conducted. To correct for multiple comparisons, a Bonferroni correction was used.

First sporting and non-sporting children with cerebral palsy were compared. Despite the significant differences that were found with the ANOVA between the four groups of participants

on the dependent variable hits, F(3,70) = 11.97, $p < .001$, partial $\eta^2 = .34$, there was no significant difference between sporting children with cerebral palsy (M = 186.67) and non-sporting children with cerebral palsy (M = 172.55) on hits ($p = .929$). This results are presented in Figure 3. Despite the significant differences that were found with ANOVA between the four groups of participants on the dependent variable total time, F(3,70) = 4.79, $p = .004$, partial $\eta^2 = .17$ as well, there was also no significant difference between sporting children with cerebral palsy (M = 537.25 seconds) and non-sporting children with cerebral palsy (M = 551.75 seconds) on total time ($p = .947$). This results are presented in Figure 4.

Secondly sporting and non-sporting healthy children were compared. Despite the significant differences that were found with the ANOVA between the four groups of participants on the dependent variable hits, F(3,70) = 11.97, $p < .001$, partial $\eta^2 = .34$, there was no significant difference between sporting healthy children (M = 245.05) and non-sporting healthy children (M = 239.60) on hits ($p = .944$). These results are presented in Figure 5. Despite the significant differences that were found with ANOVA between the four groups of participants on the dependent variable total time, F(3,70) = 4.79, $p = .004$, partial $\eta^2 = .17$ as well, there was also no significant difference between sporting healthy children (471.14 seconds) and non-sporting healthy children (528.75 seconds) on total time ($p = .076$). These results are presented in Figure 6.

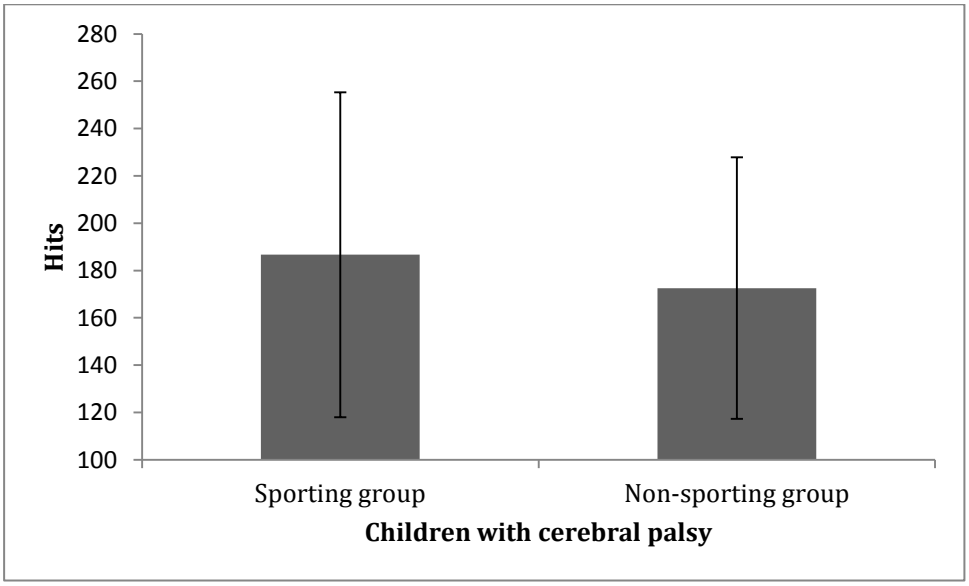

Figure 3. Hits on the Bourdon-Vos Test

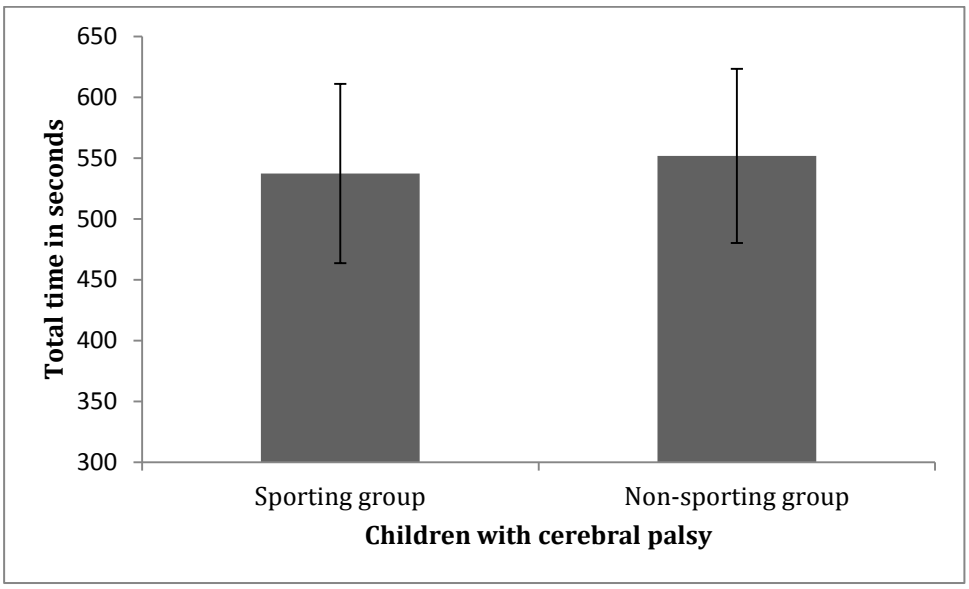

Figure 4. Total time in seconds needed to finish the Bourdon-Vos Test

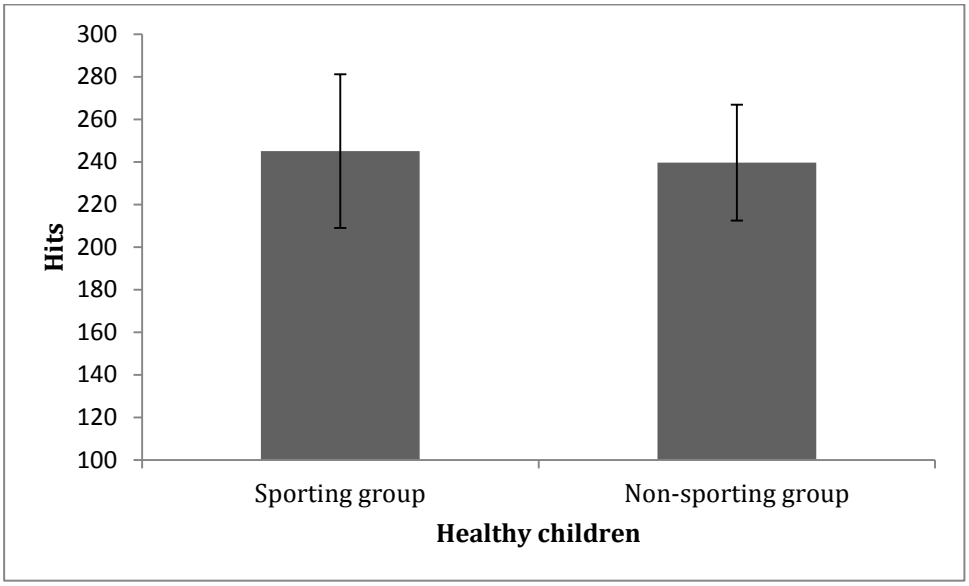

Figure 5. Hits on the Bourdon-Vos Test

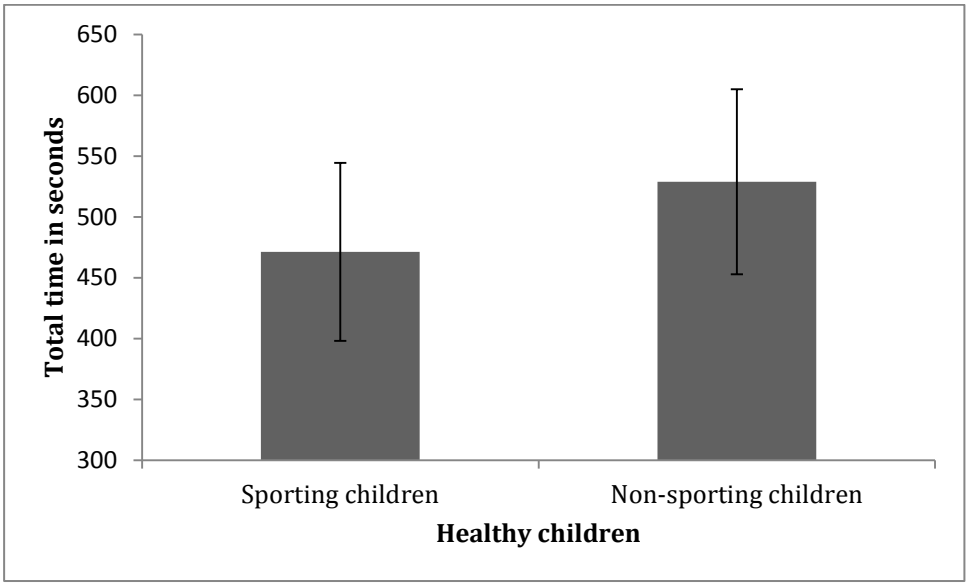

Figure 6. Total time in seconds needed to finish the Bourdon-Vos Test

Discussion

The first aim of this study was to investigate whether children with cerebral palsy have sustained attention deficits compared to healthy children. The second aim was to investigate whether sports participation has a positive influence on sustained attention in children with cerebral palsy and in healthy children.

There were significant differences between sustained attention in children with cerebral palsy and sustained attention in healthy children, measured with the Bourdon-Vos Test. Children with cerebral palsy needed more time to finish the task than healthy children. Children with cerebral palsy found also less targets than healthy children. This suggests that sustained attention is less well developed in children with cerebral palsy than in healthy children. This is in line with previous studies which found that children with cerebral palsy have sustained attention deficits (Bottcher et al., 2010; Pirila et al., 2004; Kolk & Talvik, 2000). Perhaps this means that the periventricular white matter in anterior or parietal regions is affected in children with cerebral palsy, what is according to some studies related to attention deficits (Pavlova, Sokolov, Birbaumer & Krageloh-Mann, 2008; White & Christ, 2005; Schatz, Craft, White, Park & Figiel, 2001). More generally, the periventricular white matter is often affected in persons with cerebral palsy (Bottcher, Flachs, Uldall, 2010). However, it is important to keep in mind that a special tablet version of the Bourdon-Vos Test was developed to minimize the effect of a reduced hand function which children with cerebral palsy can have. With this tablet version they only needed to tap on the tablet. Despite this improvement, these motoric impairments can still had an influence on the performances of the children with cerebral palsy on the task.

The second aim of this study was to investigate whether sports participation has a positive influence on sustained attention in children with cerebral palsy and in healthy children.

When considering the four groups of participants (sporting children with cerebral palsy, non-sporting children with cerebral palsy, sporting healthy children and non-sporting healthy children) together, there was a significant difference found between sustained attention in the groups. However, when comparing sporting and non-sporting children with cerebral palsy there was no significant difference found in sustained attention. This means that there was no significant effect of sports participation on sustained attention in this group of children with cerebral palsy. Also when comparing sporting and non-sporting healthy children there was no significant difference found in sustained attention between the groups. Participation in sports for at least twice a week did in this study not lead to better sustained attention than participation in sports for less than twice a week. Previous studies have found that increased physical activity leads to better physical and mental health in people with cerebral palsy (Zwier et al., 2010; Damiano, 2006), but specific research to the effect of sports participation on sustained attention in people with cerebral palsy was lacking. There were studies that found a positive effect of sports participation on sustained attention in healthy children (Pontifex et al., 2012; Pica, 1997; Raviv & Low, 1990).

There are possible explanations for finding no effect of sports participation on sustained attention in both children with cerebral palsy and healthy children. Firstly, the distribution of age and gender differed significantly between almost all sporting versus non-sporting groups. Only gender was not significant different between sporting healthy children and non-sporting healthy children. The groups were too small to correct for age or to investigate the effect of age on sports participation and sustained attention. Another possible explanation for not finding an effect of sports participation on sustained attention in children with cerebral palsy is that there has been no control for the different types of cerebral palsy. Cerebral palsy is a broad term with different types and impairments that ranges from subtle impairments to involvement of the whole body (Van Eck et al., 2008). We took all types of cerebral palsy and all kind of impairments together in this study. It is also important to keep in mind that this study is a cross-sectional study. The data is obtained in a sporting group and a non-sporting group, instead of one group where the sports participation is manipulated. So sustained attention between the sporting and the non-sporting group can be influenced by another factor than sports participation, such as other physical activity (for example playing outside).

So further research can take a closer look to attention in the different types of cerebral palsy. Maybe not all types of cerebral palsy go hand in hand with equally sustained attention deficits and maybe sports participation has an positive effect in especially one or more types of cerebral palsy. Further research can also investigate whether different types of sports participation, such as team sports versus individual sports, may give different results in terms of their effect on sustained attention. Another recommendation for further research is to investigate whether sports participation has an influence on attention in its entirety or another

component of attention than sustained attention, like arousal, divided attention or focused attention.

In conclusion this study contributes to the research to attention deficits in children with cerebral palsy. Furthermore, previously research to the effect of sports participation on sustained attention in children with cerebral palsy was lacking. Despite that there was found no effect of sports participation on sustained attention in this study, this effect can possibly be found in future studies when they pay attention to the limitations of this study.

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Appendix A: information brochure

Geachte ouder/wettelijke vertegenwoordiger/voogd,

… (naam van de school/instelling) is benaderd door onderzoekers van de Universiteit Utrecht in samenwerking met het Wilhelmina Kinderziekenhuis met de vraag of uw kind mag deelnemen aan een onderzoek naar de relatie tussen sportdeelname en aandacht bij gezonde kinderen. Dit onderzoek maakt deel uit van een groter onderzoek waarbij gekeken wordt naar het effect van sport op de lichamelijke en mentale gezondheid van kinderen en jongeren met een lichamelijke beperking of chronische ziekte.
… (naam van de school/instelling) heeft toestemming gegeven om dit onderzoek uit te voeren. Wij vragen u vriendelijk of u ook toestemming voor deelname aan dit onderzoek wilt geven. U beslist zelf of uw kind mee mag doen. Voordat u de beslissing neemt is het belangrijk om meer te weten over het onderzoek. Lees deze informatiebrief rustig door. Bespreek het eventueel met uw partner, vrienden of familie. Met uw toestemming zal bij uw kind een testafname plaatsvinden met een drietal aandachtstaken, uitgevoerd op een tabletcomputer. Hebt u na het lezen van de informatie nog vragen? Dan kunt u terecht bij de onderzoekers. Onderaan deze brief vindt u hiervoor de contactgegevens.
Voor het meten van aandacht hebben we een drietal taken ontwikkeld, die verschillende soorten aandacht meten. Voor elke taak zal uw kind uitgebreid uitleg krijgen wat verwacht wordt. De taken zullen bestaan uit het zoeken van bepaalde objecten (appels tussen peren bijvoorbeeld) of het negeren van afleiders. Er wordt onder andere gekeken naar de reactietijd en het volhouden van de aandacht. De testafname zal in totaal ongeveer 20 tot 30 minuten duren. De test vindt plaats op school en onder schooltijd. Uw kind is op ieder moment in de gelegenheid om met deelname aan het onderzoek te stoppen.
De resultaten van dit onderzoek geven ons inzicht in de bruikbaarheid van de taken en het gebruik van de tablet. Via een vragenlijst vragen we van u de benodigde informatie over het sporten en bewegen van u en uw kind. Zo krijgen we ook kennis over de relatie tussen aandacht en sportdeelname van het kind en zijn/haar ouders.
Gegevens die de onderzoeker tijdens het onderzoek verzamelt over uw kind worden gecodeerd opgeslagen. Dit betekent dat de gegevens onder een code worden opgeslagen en dat in rapporten over het onderzoek alleen die code wordt gebruikt en dus niet de naam van uw kind. Alleen de onderzoekers weten welke code uw kind heeft. De resultaten van het onderzoek zullen alleen op groepsniveau naar de ouders en basisscholen worden teruggekoppeld.
De onderzoeksgegevens worden na afloop van het onderzoek nog enige tijd bewaard. De bedoeling is deze in toekomstig onderzoek te gebruiken als vergelijkingsmateriaal. Na 15 jaar worden alle gecodeerde gegevens vernietigd.

Via onderstaande link kunt u aangeven dat u toestemming geeft voor het afnemen van drietal aandachtstaken bij uw kind en dat u voorafgaand aan het onderzoek duidelijke uitleg hebt ontvangen. Kinderen dienen hiervan op de hoogte te zijn voor het onderzoek plaatsvindt. Indien uw kind 12 jaar of ouder is wordt via het formulier ook toestemming gevraagd van uw kind. Daarnaast worden na toestemming enkele vragen gesteld over onder andere sport deelname van u en uw kind die van belang zijn voor het onderzoek.

http://www.formdesk.com/FG/HAYS_controle

Voor eventuele vragen kunt u contact met ons opnemen via onderstaande email adressen en telefoonnummer. Als u klachten heeft kunt u dit melden aan de onderzoekers. Mocht u ontevreden zijn over de gang van zaken bij het onderzoek en een klacht willen indienen dan kunt u contact opnemen met Patiëntenservice van het UMC Utrecht. Dit is bereikbaar via tel. 088- 7558850.

Met vriendelijke groeten,

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Appendix B: informed consent

HOGESCHOOL UTRECHT UNIVERSITY OF APPLIED SCIENCES

Universitair Medisch Centrum Utrecht

Toestemmingsverklaring

De HAYS (Health in Adapted Youth Sports)-Studie: Gezondheidseffecten van sport voor kinderen en jongeren met een chronische ziekte of aandoening

Voor beide ouders en/of voogd

Ik ben gevraagd om toestemming te geven, zodat mijn kind meedoet aan dit wetenschappelijke onderzoek:

Naam proefpersoon:_____ Geboortedatum: __ / __ / _____

- Ik heb de informatiebrief voor de proefpersoon gelezen. Ik kon aanvullende vragen stellen. Deze vragen zijn naar tevredenheid beantwoord. Ik heb voldoende tijd gehad om te beslissen of mijn kind meedoet.
- Ik weet dat meedoen helemaal vrijwillig is. Ik weet dat ik op ieder moment kan beslissen dat mijn kind toch niet meedoet. Daarvoor hoef ik geen reden te geven.
- Ik geef toestemming om de onderzoeksgegevens te gebruiken voor de doelen die in de informatiebrief staan.
- Ik geef toestemming om in de toekomst opnieuw gevraagd te worden voor deelname aan nieuw onderzoek.
  - ☐ ja
  - ☐ nee
- Ik weet dat de onderzoeksgegevens na het onderzoek nog 15 jaar bewaard worden en daarna worden vernietigd.

Ik vind het goed dat mijn kind meedoet aan dit onderzoek.

Naam ouder/voogd*:_____ Datum: __ / __ / _____

Handtekening:_____

Naam ouder:_____ Datum: __ / __ / _____

Handtekening:_____

- Ik verklaar hierbij dat ik bovengenoemde persoon/personen volledig heb geïnformeerd over het genoemde onderzoek.
- Als er tijdens het onderzoek informatie bekend wordt die de toestemming van de ouder(s) of voogd zou kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam onderzoeker:_____ Datum: __ / __ / _____

Handtekening:_____

*Wanneer het kind jonger dan 18 jaar is, ondertekenen de **beide ouders** die het gezag uitoefenen of de voogd dit formulier. Kinderen van 12 t/m 17 jaar die zelfstandig beslissingen kunnen nemen (wilsbekwaam zijn), moeten zelf ook een toestemmingsformulier ondertekenen.

Toestemmingsverklaring

De HAYS (Health in Adapted Youth Sports)-Studie: Gezondheidseffecten van sport voor kinderen en jongeren met een chronische ziekte of aandoening

*Voor proefpersonen vanaf 12 jaar**

- Ik heb de informatiebrief voor de proefpersoon gelezen. Ik kon aanvullende vragen stellen. Mijn vragen zijn genoeg beantwoord. Ik had genoeg tijd om te beslissen of ik meedoe.
- Ik weet dat meedoen helemaal vrijwillig is. Ik weet dat ik op ieder moment kan beslissen om toch niet mee te doen. Daarvoor hoef ik geen reden te geven.
- Ik geef toestemming om mijn onderzoeksgegevens te gebruiken voor de doelen die in de informatiebrief staan.
- Ik geef toestemming om in de toekomst opnieuw gevraagd te worden voor deelname aan nieuw onderzoek.
  - ☐ ja
  - ☐ nee
- Ik weet dat mijn onderzoeksgegevens na het onderzoek nog 15 jaar bewaard worden en daarna worden vernietigd.

Ik vind het goed om aan dit onderzoek mee te doen.

Naam proefpersoon:_____ Datum: __ / __ / _____
Handtekening:_____

- Ik verklaar hierbij dat ik bovengenoemde persoon/personen volledig heb geïnformeerd over het genoemde onderzoek.
- Als er tijdens het onderzoek informatie bekend wordt die de toestemming van de ouder(s) of voogd zou kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam onderzoeker (of diens vertegenwoordiger):_____
Handtekening:_____ Datum: __ / __ / _____

*Voor kinderen van 12 t/m 17 jaar, moeten de **beide ouders** die het gezag uitoefenen of de voogd ook een toestemmingsformulier ondertekenen.

Appendix C: questionnaire

Sport en aandacht

Geeft u toestemming voor het afnemen van de aandachts- en motoriektest bij uw kind(eren)? *	○ ja ○ nee

Hieronder volgen enkele vragen over uw kind.

Klik het hokje aan indien uw kind 12 jaar of ouder is.	☐
	○ Ja ○ Nee
Wat is de voornaam van uw kind? *	
Wat is de achternaam van uw kind? *	
Wat is het geslacht van uw kind? *	○ man ○ vrouw
Wat is de geboortedatum van uw kind? *	dd-mm-jjjj
Wat is de lengte van uw kind (in cm)? *	<maak uw keuze>
Wat is het gewicht van uw kind (in kg)? *	<maak uw keuze>
Speelt er een chronische ziekte bij uw kind? *	○ Ja ○ Nee
Gaat uw kind naar een Buitenschoolse Opvang (BSO)? *	○ Ja ○ Nee
	○ Ja ○ Nee
Zit uw kind op zwemles? *	○ Ja ○ Nee
Klik het hokje aan indien uw kind buiten schooltijd buitenspeelt.	☐
	○ 1 uur of minder per week ○ tussen de 1 en 2 uur per week ○ tussen de 2 en 3 uur per week ○ tussen de 3 en 4 uur per week ○ meer dan 4 uur per week
Klik het hokje aan indien uw kind buiten school aan sport doet.	☐
	○ 1 uur of minder per week ○ tussen de 1 en 2 uur per week ○ tussen de 2 en 3 uur per week ○ tussen de 3 en 4 uur per week

	meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
Heeft uw kind een autistische stoornis? *	Ja Nee
Heeft uw kind een stoornis die te maken heeft met aandacht (zoals ADHD) ? *	Ja Nee

Hieronder volgen een aantal vragen over de ouder(s) van het/de kind(eren).

De bovenstaande vragen zijn beantwoord door: ?	
Wat is uw geboortedatum? (ouder/verzorger) *	dd-mm-jjjj
Wat is uw geslacht? *	man vrouw
Wat is uw hoogst voltooide opleidingsniveau (van ouder/verzorger)? *	Basisonderwijs Middelbaar algemeen voorgezet onderwijs Middelbaar beroepsonderwijs Hoger algemeen voortgezet onderwijs/VWO

	Hoger beroepsonderwijs Wetenschappelijk onderwijs
Doet u aan sport? *	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
	Ja Nee
	1 uur of minder per week tussen de 1 en 2 uur per week tussen de 2 en 3 uur per week tussen de 3 en 4 uur per week meer dan 4 uur per week
Is er een tweede ouder/verzorger in beeld? *	Ja Nee
	dd-mm-jjjj
	man vrouw
	Basisonderwijs

	◯ Middelbaar algemeen voorgezet onderwijs ◯ Middelbaar beroepsonderwijs ◯ Hoger algemeen voortgezet onderwijs/VWO ◯ Hoger beroepsonderwijs ◯ Wetenschappelijk onderwijs
	◯ Ja ◯ Nee
	◯ 1 uur of minder per week ◯ tussen de 1 en 2 uur per week ◯ tussen de 2 en 3 uur per week ◯ tussen de 3 en 4 uur per week ◯ meer dan 4 uur per week
	◯ Ja ◯ Nee
	◯ 1 uur of minder per week ◯ tussen de 1 en 2 uur per week ◯ tussen de 2 en 3 uur per week ◯ tussen de 3 en 4 uur per week ◯ meer dan 4 uur per week
	◯ Ja ◯ Nee
	◯ 1 uur of minder per week ◯ tussen de 1 en 2 uur per week ◯ tussen de 2 en 3 uur per week ◯ tussen de 3 en 4 uur per week ◯ meer dan 4 uur per week
	◯ Ja ◯ Nee
	◯ 1 uur of minder per week ◯ tussen de 1 en 2 uur per week ◯ tussen de 2 en 3 uur per week ◯ tussen de 3 en 4 uur per week ◯ meer dan 4 uur per week
Laat hier uw email-adres achter voor bevestiging en eventuele correspondentie over dit onderzoek: *	