AN ABSTRACT OF THE THESIS OF

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Title: Physical Activity and Motor Skills in Children with Disabilities.

Abstract approved:

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Megan MacDonald

The purpose of this study was to explore the relationship between physical activity level and motor skill proficiency in school-aged children ages 9-18 with developmental disabilities. Physical activity level was assessed using Actigraph GT3X+ accelerometers, which participants wore for all hours of the day for seven days. Motor skill proficiency was assessed using the Test of Gross Motor Development Second Edition (TGMD-2). The TGMD-2 assesses gross motor skills through the locomotor subtest and fine motor skills through the object control subtest. The correlation between the amount of time that children with developmental disabilities (n=16) spent in physical activity and total, locomotor and object control motor skill proficiency was non-significant ($p>0.05$ in all analyses). The relationship between physical activity and motor skills needs to be further explored.

Keywords: Physical activity, motor skills, developmental disabilities

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Physical Activity and Motor Skills in Children with Disabilities

by

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I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

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Lisa Michelle Cowgill, Author

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AUTHOR NOTE

The ideas for this undergraduate honors thesis were independent from a concurrent Masters thesis that was completed in the same lab. Similar questions were independently created during the time of this thesis. The data for this project came from a larger project exploring the physical fitness of school-aged children with disabilities. All writing, analysis and interpretation were independent and performed by the author of this undergraduate thesis.

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Introduction

Physical activity has been shown to improve physiological and psychological health and to reduce the incidence of many diseases in the general population as well as in under-served populations such as children with developmental disabilities (United States Department of Health and Human Services [USDHHS], 2014). Three-quarters of American adolescents ages 12-15 years old do not meet the recommended 60 minutes of moderate to vigorous physical activity per day (Fakhouri, Hughes, Burt, Song, Fulton & Ogden, 2014). People with developmental disabilities (DD) have higher rates of physical inactivity, and obesity in comparison to typically developing peers (Johnson, 2009).

One out of six children in the United States are affected by a developmental disability (Boyle et al., 2011). Developmental disabilities are defined as a group of conditions characterized by physical, learning, language or behavior impairments that are manifested in an individual before twenty-two years of age (Developmental Disabilities Assistance and Bill of Rights Act 2000). They include intellectual and learning disabilities, autism spectrum disorders (ASD), Down syndrome, cerebral palsy and other related conditions (CDC, 2013).

Primary conditions such as developmental disabilities make individuals more likely to develop other physical, cognitive, emotional or psychosocial conditions; called secondary conditions (Baylor College of Medicine, 2012). Physical inactivity associated with disabilities is a major factor in the prevalence of secondary conditions such as obesity (Johnson, 2009), metabolic disorders, depression and low self-esteem (Memari,

Ghaheri, Ziaee, Kordi, Hafizi, Moshayedi, 2013) in children with developmental disabilities. Recent studies have found that adolescents with Down syndrome and ASD are two to three times more likely to be obese than their typically developing peers (Rimmer, Yamaki, Lowry, Wang & Vogel 2010) making physical activity a critical public health issue.

Motor impairments have also been observed in many children with developmental disabilities. In a study on children with ASD, 73% of participants were rated 'poor' or 'very poor' on the Test of Gross Motor Development, second edition (Berkeley, Zittel, Pitney, & Nichols, 2001), indicating the presence of a motor deficit (Ulrich, 2000). Likewise, 81% of children ages 7-12 years old with mild ID have a motor impairment (Vuijk, Hartman, Scherder, & Visscher, 2010). The severity of cognitive impairment may be a factor in the severity of motor skill deficits (Berkeley et al., 2001; Westendorp, Houwen, Hartman & Visscher, 2011) but intellectual ability is not the only determining factor in motor skill proficiency (Lloyd, MacDonald & Lord, 2013). Motor impairment is associated with weaker social skills in children with ASD (MacDonald, Lord & Ulrich, 2013) and may be an important factor in a child's success building peer relationships, as well as their physical activity level.

Empirical research on children with DD, particularly ASD, has focused on social communicative deficits, cognitive impairments and repetitive, stereotyped movements and behaviors associated with the disorder. The relationship between motor skill functioning and physical activity has been explored in typically developing children; a study by Barnett et al. (2009) found that motor skill proficiency was associated with more time spent in physical activity in children without a disability (Barnett, van Beurden,

Morgan, Brooks & Beard, 2009). Better motor skills were also found to be associated with participation in physical activity in a study on children with cerebral palsy (Palisano, Copeland & Galuppi, 2007). Recent studies on children with ASD have explored motor skill competence (MacDonald et al., 2013; Lloyd, Lord & MacDonald, 2013) and physical activity (MacDonald, Esposito, Ulrich, 2011) but the relationship between the two in ASD and in other disabilities has not been widely investigated.

The purpose of this study was to explore the level of moderate to vigorous physical activity and motor skills such as locomotor and object control in children with developmental disabilities. It is hypothesized that children with developmental disabilities who spend more time in moderate to vigorous physical activity will have better motor skills.

Review of the Literature

Physical Activity and Disability

Physical activity is defined as any bodily movement produced by the skeletal muscles that result in the expenditure of energy (World Health Organization [WHO], 2014). The WHO recommends that children spend at least 60 minutes in moderate-to-vigorous physical activity (MVPA) per day as the minimum to gain health benefits, such as maintaining a healthy body weight (2014). Intensity of exercise is defined by the degree of energy expenditure; moderate intensity PA includes activities such as walking briskly or dancing, while vigorous PA includes activities like running and cycling.

Children with ASD have been found to be similar to their typically developing peers in level of physical activity (Gleason et al., 2013) however, there are conflicting reports on whether or not children with ASD are meeting the minimum recommendation for MVPA. A study on children ages 9-18 years with ASD (n=72) found that participants generally did meet the minimum recommendation for MVPA (MacDonald, Esposito & Ulrich, 2011). However, Gleason et al. (2013) found that only 23% of 3-11 year old children with ASD met the minimum MVPA.

This may be similar to children with Down syndrome; a study on the physical activity of children age 8 to 16 with DS found that, though 80% of participants spent at least 30 minutes per day in MVPA on average, only about 20% of individuals met or exceeded the minimum recommendation for MVPA (Esposito, MacDonald, Hornyak & Ulrich, 2012). A conflicting study indicated that children with Down syndrome far exceed the recommended MVPA; it was reported that a sample of children age 3-10 years

spent an average of 2.5 hours in moderate PA per day and 59 minutes in vigorous PA (Whitt-Glover, O'Neill & Stettler, 2006).

An intellectual disability is a developmental disability characterized by a significant limitation in cognitive functioning (IQ < 70) (American Psychiatric Association, 2013). Children with intellectual disabilities seem to be at high risk for spending little time in physical activity. Bodde et al. reported that children with intellectual disabilities average just 7.73 minutes of MVPA per day (Bodde, Seo, Frey, Van Puymbroeck, & Lohrmann, 2013). In the same study, 47.6% of participants averaged zero minutes per day of MVPA (Bodde, et al., 2013). However, no clear physical activity behavior pattern exists in youth with ID and individuals vary widely; different studies have shown that youth with ID are more active (Lorenzi et al., 2000), less active (Foley, 2006) and equally active (Faison-Hodge & Porretta, 2004) than their TD peers (Frey, Stanish, & Temple, 2008).

Adolescents with cerebral palsy are also less physically active than their peers, including peers with disabilities (Maher, Williams, Olds, & Lane, 2007; Van Eck, et al, 2008). Van Eck et al. (2008) found that 89% of Dutch adolescents with cerebral palsy were not sufficiently physically active. A study on Australian adolescents that compared 11-17 year olds with CP with their typically developing peers found that children with CP spend less time in MVPA than their peers do (Maher et al., 2007).

Increasing age is associated with a decrease in time spent in physical activity in children with disabilities, like in typically developing children (Esposito et al., 2012; Maher et al., 2007; MacDonald, Esposito & Ulrich, 2011; Pan & Frey, 2006). A study on children with ASD found that 78% of elementary school children, 67% of middle school

students and just 8% of high school students met the minimum recommendation for MVPA (Pan & Frey, 2006). Similar patterns of decreasing activity and an increasingly sedentary lifestyle as people age have also been observed in other disabilities (Esposito et al., 2012; MacDonald et al., 2011; Maher et al., 2007).

Physical activity in individuals with CP tend to be more solitary, less intense and less structured than in the typically developing children (Maher et al, 2007) and this may be true in some children with other DD as well. More structured physical activity, such as physical education classes, tends to foster more involvement in physical activity in students with ASD compared to unstructured activity, such as recess (Pan, 2008). Involving children with DD in more structured physical activities could be an avenue to increasing their physical activity levels, as well as provide them with more opportunities to engage in activities that build peer relationships rather than solitary play.

Physical Inactivity and Secondary Conditions

Secondary conditions are physical, cognitive, emotion or psychosocial conditions that individuals with underlying primary conditions, such as developmental disabilities, are more susceptible to (Baylor College of Medicine, 2012). Obesity is a common secondary condition in children with developmental disabilities (Johnson, 2009). Physical inactivity has been shown to be a factor in the high obesity rate of people with developmental disabilities, like in the typically developing population (Johnson, 2009; Memari, et al., 2013). Phillips et al. (2014) found that 20.4% of adolescents with any developmental or learning disability are obese, compared to 13.1% of adolescents

without disability (Phillips et al., 2014). The same study found that adolescents with ASD are over twice as likely to be obese as their typically developing peers (31.8% compared to 13.1% respectively) (Phillips et al., 2014). Obesity in people with intellectual disabilities and Down syndrome specifically is an even greater cause for concern; conflicting studies have found the rate to be between 28 and 59% (Esposito et al., 2012).

Apart from obesity, many conditions that are associated with physical inactivity are more common in individuals with developmental disabilities than those without disability such as, cardiovascular disease, metabolic disorders, depression and low self-esteem (Memari et al., 2013). These and other similar secondary conditions could be partially alleviated by preventative health behaviors such as increasing physical activity (Bodde et al., 2013).

Barriers to Physical Activity

Barriers to physical activity exist for the general population, however, individuals with developmental disabilities may have more barriers to increasing their physical activity and this puts them at a greater risk of physical inactivity (Esposito et al., 2012; Bodde et al., 2013) such as lack of accessibility, physical activity education, adaptable physical activity programs, and the high cost physical activity participation sometimes requires (Bodde et al., 2013). Individuals with DD also may not understand the importance of physical activity; in a study of adults with Down syndrome, approximately half of participants did not recognize that physical activity is good for overall health and

89% could not identify healthy activities in a card sorting task (Jobling & Cuskelly, 2006).

Secondary health conditions can also be significant barriers to physical activity. Individuals with Down syndrome commonly have comorbidities; about half of people with Down syndrome also have a congenital heart defect and they are also more likely to have gastrointestinal, vision, and thyroid related health issues (Mayo Clinic, 2014). All of these may make physical activity much more difficult.

Motor skills and Disability

Motor skills consist of locomotor skills and object control skills (Ulrich, 2000). Locomotor skills include running, galloping, hopping, sliding, leaping and jumping (Ulrich, 2000). Object control skills include overhand throwing, striking, kicking, underhand rolling, dribbling and catching a ball (Ulrich, 2000). Fundamental skills such as these serve as the foundation for the development of more complex skills (Memari et al., 2013; Reid & Todd, 2006). Deficits in these skills may be an inhibitory factor to participation in physical activities

Motor skill deficits in children with ASD can be present from as early as six to nine months of age (Reid & Todd, 2006) and can persist in school-aged children, although they are not present in all individuals (Staples & Reid, 2010). It has also been indicated that children with ASD have the motor skills of a typically developing child about half their chronological age (Staples & Reid, 2010). On the Test of Gross Motor Development, 73% of children with ASD scored in the ‘poor’ or ‘very poor’ range,

indicating that a motor deficit is present (Berkeley, et al., 2001). In the same study on males with ASD (n=10) locomotor skills were more impaired than object control skills, while the opposite was true for females with ASD (n= 5) (Berkeley et al., 2001).

Cerebral palsy is a group of disorders that are characterized by pervasive motor deficits that can range from minor to severe (Capio, Sit, Abernethy & Masters, 2012). Motor deficits in individuals with CP is often linked to abnormal development or damage to the motor areas of the brain (Capio et al., 2012). The severity of motor deficits is classified on a scale of one to five according to the Gross Motor Function Classification System (GMFCS), where a category one GMFCS score indicates that the individual is minimally impaired while a five indicates that the individual is highly impaired (Cerebral Palsy Alliance, 2014). In CP, generally a child over five years old may not be able to significantly improve their motor skills and improve their GMFCS classification (Cerebral Palsy Alliance, 2014).

Motor deficits are also associated with cognitive disabilities; 81% of children with mild intellectual disabilities were found to have a motor deficit (Vuijk et al., 2010). Children with ID have significantly impaired motor skills compared to their typically developing peers in both locomotor and object control skills, though object control is more significantly impaired (Vuijk et al., 2010; Westendorp et al., 2011). This is consistent with the assumption that object control skills are more complex and require higher level cognitive functioning than locomotor skills do.

Cognitive functioning may be a contributing factor in motor skill deficits in children with developmental disabilities (Berkeley et al., 2001) however, recent work has shown that it cannot be entirely attributed to the presence of an intellectual disability

(Lloyd, MacDonald, & Lord, 2013). In a comparison of children with ID that divided individuals into two groups, individuals with mild ID (IQ 50-70) were more impaired in locomotor skills than peers with borderline ID (IQ 71-79), but both groups scored similarly in object control skills (Westendorp et al., 2011). Another study, which looked at children with ASD, found that 70% percent of children with ASD had a delay in locomotor skills, while only 30% have a delay in object control skills (Berkeley et al., 2001). Both of these studies suggest that locomotor skills may be more strongly linked to cognitive functioning than object control skills are, but many factors contribute to an individuals' skill in both areas (Berkeley et al., 2001; Westendorp et al., 2011).

Motor Skills and Level of Physical Activity

Motor skill deficits may be related to the level of physical activity specifically; to the amount of time children with disabilities spend in sedentary behavior. In children with cerebral palsy, gross motor functioning was found to be related to physical activity level (Capio et al, 2012). Locomotor and object control skills were also found to be influential in the amount of time an individual spent in both sedentary behaviors and physical activity (Capio et al., 2012). This relationship has not been widely explored in people with disabilities but has been explored in the typically developing population.

In a study of 8 to 10 year old typically developing children, motor skill proficiency was positively correlated with time spent in MVPA and inversely correlated to time in sedentary activity (Wrotniak, Epstein, Down, Jones & Kondilis, 2006). A contradicting study found that leisure-time physical activity level is not related to motor

skill proficiency (Jaakkola et al., 2009). However, participation in organized physical activity such as a sports team may be positively related to motor skill level (Jaakkola et al., 2009; Okely, Booth & Patterson, 2001).

A longitudinal study that specifically investigated object control skills in typically developing children (N=276) found that perceived and actual proficiency in object control skills is significantly associated with increased physical activity (Barnett et al., 2009). Interventions focusing on the improvement as well as on locomotor skills, may be an avenue to improving MVPA levels and fitness in typically developing adolescents (Barnett et al., 2009) as well as children with developmental disabilities.

Literature Review Summary

Based on the review of these studies, it can be summarized that, overall, children with developmental disabilities are less physically active than their typically developing peers. They are also not meeting the minimum recommended MVPA needed for health benefits, though there is considerable variation among individuals. Children with DD are also likely to have a deficit in gross and fine motor skills, which have been shown to be related to physical activity level in the typically developing population.

Methods

Participants

Participants in this study include children with developmental disability (n=13, n=8 ASD, n=3 Down syndrome, n=4 Cerebral Palsy, n=1 Ehlers-Danlos syndrome) 9 to 18 years of age (mean age = 12.75 years, SD = 3.07 years). Seven participants are male and nine are female. The data used was part of a larger study. Descriptive statistics of the participants are described in Table 1. Participants were recruited from schools and from the IMPACT program in Corvallis, Oregon and the surrounding area. IMPACT is a physical activity program at Oregon State University for children with disabilities. The Institutional Review Board of Oregon State University approved all policy's and procedures of this study. Written parental and participant consent were obtained from all participants prior to data collection.

Physical Activity Measurement

Actigraph GT3X accelerometers provide an objective and reliable method of measuring frequency, intensity and duration of physical activity (Hänggi, Phillips & Rowlands, 2013). They are a reliable measure of physical activity if worn by the participant for at least nine hours each day for at least two days (Rich et al., 2013). The GT3X is triaxial; it measures vertical, antero-posterior and medio-lateral axes and can accurately distinguish sedentary activity; light, moderate and vigorous and very-vigorous intensity physical activity (Hanggi et al., 2013). Hanggi et al. (2013) found that the

GT3X accurately measures MVPA 86% of the time. Participants wore the accelerometers on their right hip using an elastic belt; accelerometers are more reliable when worn on the hip than on the wrist (Rosenberger, Haskell, Albinali, Mota, Nawyn & Intille, 2013).

Motor Skills Measurement

The Test of Gross Motor Development 2nd Edition (TGMD-2) was used to assess motor skills. The TGMD-2 is a widely used, valid and reliable measure of two subtests of motor skills, locomotor and object control, including twelve fundamental motor skills (Ulrich, 2000). Locomotor skills include gross motor skills; running, galloping, hopping, sliding, leaping and jumping (Ulrich, 2000). Object control skills include fine motor skills; overhand throwing, striking, kicking, underhand rolling, dribbling and catching a ball (Ulrich, 2000). The TGMD-2 was written for children ages 3-10 but has also been used in older children, including those with disabilities. The maximum score possible for each skill is 9 and for each subtest is 48 (Ulrich, 2000).

Procedure

Motor skills were assessed by graduate students who have experience administering the TGMD-2. Participants wore accelerometers on the right hip using an elastic belt for seven days. Accelerometers were worn for all hours of the day, except for when swimming, bathing/showering or sleeping.

Data Analysis

Total time spent in MVPA was compared separately to total TGMD-2 scores, object control skills and locomotor skills using Pearson-product correlations. Individual skills were also analyzed in relation to time spent in MVPA. Moderate and vigorous physical activity was combined for analysis because physical activity recommendations consider MVPA to be the target PA intensity range needed for health benefits. TGMD-2 raw scores were used in the analysis because the TGMD-2 is not written for the participant age range used in this study.

Participants who did not wear an accelerometer for at least nine hours per day for two days were not included in the analysis. Due to missing data, twelve participants were included in the analysis of MVPA and locomotor skills, and thirteen participants were included in the MVPA and object control skills analysis. Data was analyzed using IBM SPSS data analysis software.

Results

Physical Activity Level and Motor Skills

This study found no significant linear correlation between the total time spent in MVPA and either total TGMD-2 score, locomotor skills or object control skills (p= 0.324, p=0.370 and p=0.226, respectively). There appears to be a curve linear relationship between locomotor skills and time spent in MVPA; the two are related in children who are less physically active, but not in children who are highly active. Correlational analysis data is located in Table 2. No individual skill tests were significantly correlated with physical activity level; the leap and slide skill tests came the closest (p= 0.106 and p=0.114, respectively). Figures 1 and 2 show the distributions between MVPA and each motor skills subtest.

Figure 1.

MVPA vs Object Control Skills

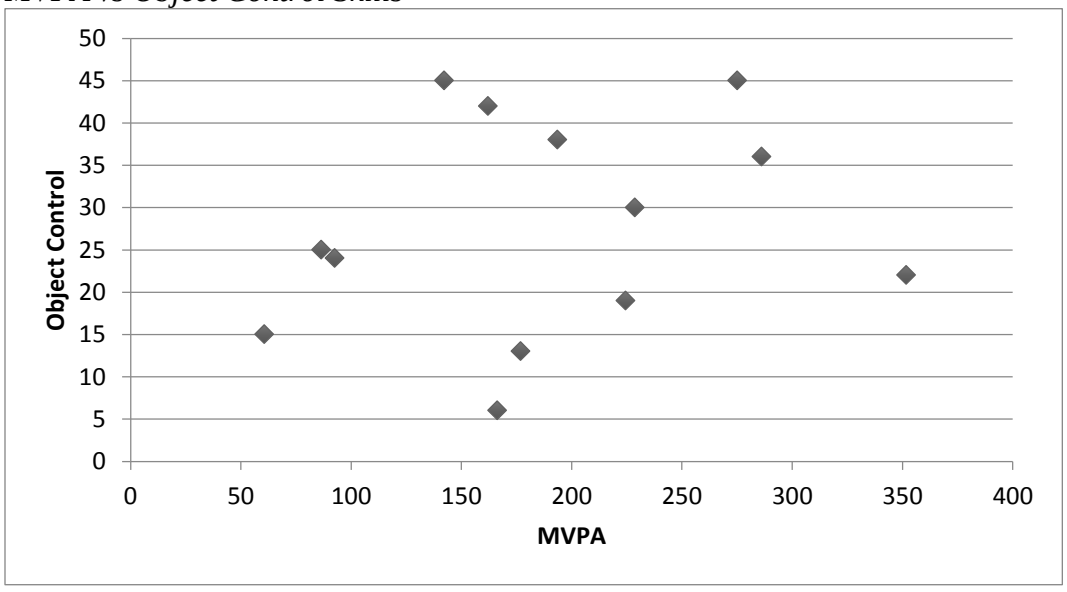
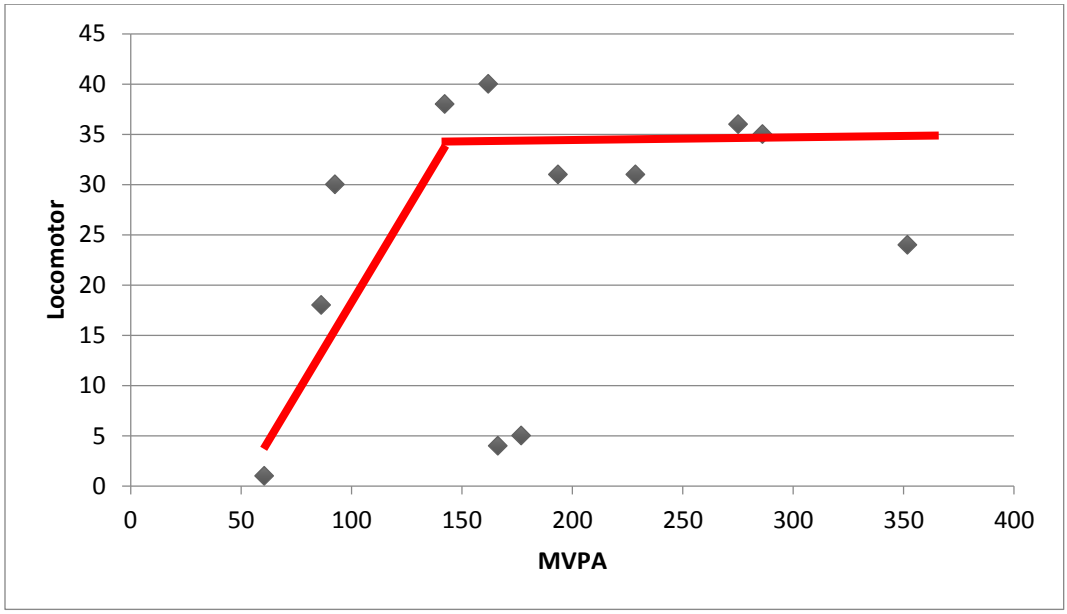


Figure 2.

MVPA vs Locomotor Skills



Motor Skills Data

Motor skills data can be found in Table 3. The mean total TGMD-2 score was 56.64 (± 26.6); out of a highest possible score of 96. The average score on the locomotor subtest was 27.93 (± 14.43) and the average for the object control subtest was 30.19 (±13.38); the highest possible score for each subtest is 48. The lowest total motor skills score was 10, and the highest was 90; indicating that motor skill deficits are present in this sample but not in every individual.

Physical Activity Data

The average time spent in MVPA in this sample was 188.21 minutes per day ± 14.43 minutes. All of the participants in this sample met the minimum recommended PA. However, the range of physical activity level was wide; it ranged from 60.58 minutes per day to 351.80 minutes per day. Significantly more time was spent in moderate intensity activity than in vigorous or very vigorous activity (174.29 minutes per day in moderate PA versus 13.91 minutes per day in vigorous or very vigorous PA). Physical activity data is located in Table 3.

Discussion

Total MVPA and Motor Skills

The purpose of this study was to explore the relationship between physical activity level and motor skills in children with developmental disabilities. The results do not support the hypothesis that children who spend more time in MVPA have stronger motor skills than less active children. This is contradictory to previous studies on typically developing children and children with cerebral palsy, which did find an association between physical activity level and motor skill proficiency. This finding is likely due to the small sample size and to the range of disabilities represented in the sample. It may also indicate that motor skill competency is more related to other factors, such as the cognitive ability of the participants and environmental factors, than to how much exposure the individual has had to the skill through engagement in physical activity.

As seen in previous studies on children with developmental disabilities, all participants in this study met the minimum recommended MVPA and some far exceeded it. Some participants in this sample were recruited from the IMPACT program, a physical activity program for children with disabilities at Oregon State University. This could be a reason that the participants have such high levels of physical activity compared to other studies on children with disabilities. IMPACT provides the participants with more structured and scheduled opportunities to be physically active than children in other communities might have.

However, though participants all met the minimum recommended MVPA, participants engaged in over twelve times as much moderate intensity activity as vigorous or very-vigorous intensity activity. Even activity such as walking at a comfortable pace would count toward time spent in MVPA. Children who had high levels of MVPA still may not be spending a significant amount of time in activities that may be more beneficial to building motor skill proficiency, such as playing basketball, which is vigorous activity and employs fine motor skills.

Typically developing children scored a 40.7 on the locomotor skills subtest on average (Westendorp et al., 2011) when compared to 26.93 in children with disabilities in this study. On the object control subtest, TD children scored an average of 39.5 (Westendorp et al., 2011), while children in this study got an average score of 29.00. This indicates that motor deficits are present in some participants in this study, as expected. However, like in previous studies, not all individuals were affected. Two participants' locomotor skills and four participants' object control skills are in the same range as the average typically developing child.

The three participants who scored highest in total motor skill ability all had different disabilities; one has ASD, one has DS and the third has CP. This shows that many factors are likely involved in motor skill proficiency aside from disability status or physical activity level. Environment, genetic factors, gender and BMI are just a few of the other potential contributing factors to motor deficits in this population. More research on factors that play into motor skill level is needed.

Limitations

The small sample is a crucial limitation to this study. Studies that use a large sample size would likely get different results than this study found.

The method of the physical activity assessment is another possible limitation. Accelerometer data is reasonably accurate but cannot account for weight bearing activities or any activity that does not involve movement of the entire body, such as riding a stationary bike. The ability of the accelerometer to differentiate between light, moderate, vigorous and very vigorous activity is also not entirely accurate and this may be a reason that some participants had very high MVPA. The parameters that defined what activity counts as MVPA was also very generous in this study, which also may be a reason for the high levels of physical activity seen in the participants.

Future Research

Future studies should investigate the relationship between motor skills and physical activity investigating other factors such as potential factors that may be associated with motor skill proficiency. Larger sample sizes and studies that look at children who have similar disabilities and severity levels would give more conclusive evidence of how the two are related.

Conclusion

Physical activity level and motor skill proficiency were found to be non-significantly related in this study. However, due to a small sample size and diverse participants, this is not conclusive evidence that the two are not related in children with developmental disabilities. Motor skill proficiency may be considerably dependent on factors other than the amount of physical activity participation a child engages in and how much practice they have had using the gross and fine motor skills assessed through motor skill testing.

Disclaimer

The data used in this study was collected as part of a larger study conducted by Dr Megan MacDonald, Kiley Tyler, M.S. and Nicole Cooke, M.S.

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Table 1.

Descriptive Characteristics of Participants

	Total sample (N=16)
Age	Mean= 12.75 (SD= 3.07)
Gender	7 Male, 9 Female
Diagnosis	8 ASD, 3 DS, 4 CP, 1 E-D
Completed PA data and Object Control	N= 13
Completed PA data and Locomotor	N= 12

Note: E-D indicates Ehler-Danlos Syndrome

Table 2.

Correlational Analysis: Time Spent in MVPA and Motor Skills

	N	Pearson Correlation (r)	P- value
Total TGMD-2	12	0.324	0.305
Locomotor	12	0.370	0.237
Run	12	0.291	0.359
Gallop	12	0.283	0.374
Hop	12	0.332	0.292
Leap	12	0.490	0.106
Slide	12	0.480	0.114
Horizontal Jump	12	0.189	0.556
Object Control	13	0.226	0.458
Strike	12	0.357	0.255
Kick	12	0.386	0.216
Dribble	13	0.374	0.208
Catch	13	0.043	0.890
Throw	13	0.040	0.897
Roll	13	0.040	0.897

Table 3.

Descriptive Statistics: Motor Skills and MVPA

	N	Total mean	Standard Deviation	Minimum	Maximum
TGMD-2- Total	14	56.64	26.60	10.00	90.00
TGMD-2- Locomotor	14	26.93	14.42	1.00	42.00
TGMD-2- Object Control	15	29.00	12.95	6.00	48.00
MVPA (Minutes/day)	13	188.21	84.69	60.58	351.80
Moderate PA (Minutes/day)	13	174.29	69.76	60.42	292.10
Vigorous PA (Minutes/day)	13	13.13	18.09	0.17	57.40
Very Vigorous PA (Minutes/day)	13	0.78	1.14	0.00	3.67