

6-1-2019

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Citation

Norman, Courtney; Geer, Wesley; and Looper, Julia, "Motor competency and physical activity in elementary school aged children who participate in nontraditional sports" (2019).

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Original Article

Motor competency and physical activity in elementary school aged children who participate in nontraditional sports

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Published online: June 30, 2019

(Accepted for publication: June 13, 2019)

DOI:10.7752/jpes.2019.02172

Abstract:

One after school program, Youth Ambassadors of Physical Education (YA), is designed to promote physical activity in school age children to help combat the growing levels of childhood inactivity. However, this program utilizes skills that are vastly different from the locomotor and object control skills assessed with the Test of Gross Motor Development. **Purpose:** The purpose of this study is to determine whether the TGMD-2 can identify the children in YA as competent in their motor skills. This study also examines if there is a link between the overall physical activity level of the children in YA and their motor competency scores. **Approach:** 12 participants for this study were recruited from the 2017 Youth Ambassadors Program (YA) sponsored by the Tacoma public schools. Following completion of the TGMD-2, each participant was fitted with an activity monitor for a period of five days. **Results:** Descriptive scores on the TGMD-2 range from below average to above average, representing scores from the 25th percentile for children of the same age and gender to the 95th percentile. No correlation was found between physical activity levels and TGMD-2 scores. All participants of YA logged activity levels significantly exceeding CDC recommendations, both during the weekday and on the weekends.

Conclusions: This study demonstrates that the factors of high activity levels and proficiency in complex motor skills do not correlate with average or above average scores on the test. The TGMD-2 may not be the best tool for measuring motor proficiency in specific populations of children that practice non-traditional motor skills in their activities.

Key Words: physical activity, motor competency, fundamental motor skills, TGMD-2, children

Introduction

There is great concern in our society that children are not as physically active as they once were. This lack of activity has been linked to a rise in a variety of health problems including increased levels of childhood obesity, heart disease, and type 2 diabetes (Guillarme, 1997; Steinberg, 2003). Additionally, when children do not move and play, they may not develop competency in their motor skills (Stodden, 2008). The research strongly suggests that children should accumulate an average of at least 60 minutes of moderate to vigorous physical activity (MVPA) per day (US Department of Health, 2018). The Center for Disease Control and Prevention reports that only 27.1% of children ages six to 19 are meeting the recommended 60 minutes or more of moderate to vigorous physical activity on at least 5 days per week (Center for Disease Control, 2014). While research shows that the majority of children are failing to meet these recommendations, there are a variety of programs designed to increase physical activity and get children moving and playing (Gomes, 2017; Janssen, 2010).

When children fail to develop motor competency through their movement experiences, it has the ability to negatively impact their overall levels of physical activity. Previous research suggests that children with better motor abilities are more likely to be physically active than their more sedentary counterparts. One study found that motor proficiency was positively associated with physical activity and inversely associated with sedentary activity. Decreased competence and confidence experienced by children with movement difficulties may lead to avoidance of participation in physical activities (Wrotniak, 2006). Ensuring that children are not only reaching the recommended levels of daily activity, but also developing high levels of motor competency through their activities may be key in promoting healthy lifestyles and lifelong involvement in physical activity.

The Young Ambassadors of Physical Education (YA) is an after school program focused on increasing childhood activity and encouraging kids to meet the recommended daily MVPA. The goal of this group is to “promote self-esteem, teamwork, and fitness” (www.tacomaschools.org/student-life/pages/ya.aspx.) The YA group emphasizes the importance of making healthy choices each and every day. (www.tacomaschools.org/student-life/pages/ya.aspx). Participants of YA are physically active children who

exhibit a unique set of motor skills such as unicycling, tumbling, and jump-roping. However, these are not the skills commonly tested when determining motor competence in children.

Early and accurate assessment of motor skills to identify children requiring intervention is an important area of pediatric research because motor development is closely correlated with cognitive development in children. Research shows that high levels of aerobic and vigorous physical activity at a young age are associated with beneficial cognitive outcomes, such as cognition, academic achievement, behavior and psychosocial function (Tandon, 2016). The Test of Gross Motor Development (TGMD-2) is one of the most commonly used tools to assess the motor competency of fundamental skills of children. This test scores children on their ability to complete tasks such as hopping, shuffling and throwing and catching a ball (Ulrich, 2000). The skills utilized in the YA program are vastly different from the locomotor and object control skills assessed with the TGMD-2. Despite the children in YA having high motor competence, this test may fail to accurately assess their motor skills. Due to the widespread use of the TGMD-2 in identifying under-developing children and the relationship between motor competency and physical activity, understanding the limitations of the test is an important area of research.

The purpose of this study is to determine whether the TGMD-2 will identify the children in YA as competent in their motor skills. This study also examines if there is a link between the overall physical activity level of the children in YA and their motor competency scores. It is hypothesized that the TGMD-2 will misclassify YA participants as having average motor competence because of their extensive practice in non-standard physical skills. It is also hypothesized that children with higher levels of physical activity will score higher on the TGMD-2.

Materials and Methods

Participants

Participants for this study were recruited from the 2017 Young Ambassadors Program (YA). Flyers about the study were handed out to all YA members. Emails were sent to the legal guardians to inform them about the study and request participation from their YA member. Only children currently active in YA were included in the study. Any members with developmental disabilities, neurological disabilities, or orthopedic injuries that would affect their ability to participate in the testing were excluded. Children were not excluded if they were also participating in other physical activity groups or sports. Of the 30 current YA members, 12 participated in the study, 11 females and 1 male. Participant age ranged from eight to 11 years old (see table 1).

Measurements

Testing took place once a week over the course of three weeks directly following the YA practice session. Between three and five participants were tested each week in the same school gymnasium where practice was held. Prior to beginning the testing, consent was obtained from the legal guardian of each participant. Assent was obtained from all participants after they were read a description of the testing procedures, including the types of activities they would be asked to perform, and given the opportunity to ask any questions they had. Height and weight were recorded for each participant prior to testing and the participants were randomly assigned to begin with either the locomotor or object control portion of the TGMD-2. Two researchers trained in administration of the TGMD-2 completed all testing, with each researcher administering the same portion of the test every session.

After each participant completed both portions of the TGMD-2 they were fitted with an Actigraph fitness tracker to be worn around the waist, under the shirt or clothing, for the following five days. Actigraph activity monitors have been shown to be a valid and reliable tool for measuring activity measuring activity in children (Freedson, 2005). The acceleration data has previously been correlated with metabolic data so the device relays information about how much time each participant spends in low, moderate, or vigorous physical activity. The Actigraphs were preprogrammed to begin data collection at 6:30pm on the testing day and to cease recording when returned to the researchers after a five-day period. Participants were also provided a journal to record each time the Actigraph was removed or put back on. Guardian signatures were required for each journal entry to ensure that Actigraphs were being properly used. Written and verbal instructions were presented to all participants and legal guardians regarding use of the activity monitors. Instructions stated that Actigraph were not to be worn while the participant was sleeping and should be removed for showering or during water activities. Actigraphs were returned to the researchers at the next YA practice, five days later. No data was collected on weekends corresponding with a YA performance. Participants were also provided a printed summary of their recorded physical activity upon completion of the study.

Data Analysis

Researchers ran descriptive statistics for the TGMD-2 raw scores, as well as minutes of sedentary, light, moderate, vigorous and very vigorous physical activity collected from actigraph data. Four 24-hour periods of activity data were analyzed. A Pearson's correlation was run to determine if there was a relationship between these variables. Finally, paired t-tests were done to determine if physical activity levels varied between weekends and weekdays. The alpha level was set at 0.05.

Results

12 children, one male, 11 female, aged 8 year 11 months to 11 years 4 months old, participated in the study with a mean weight of 79.89 lbs ± 13.91SD and a mean height of 56.62in ± 2.93 SD. (See table 1).

The mean TGMD-2 locomotor raw score was 45 ± 2.18 and the mean object control raw score was 43 ± 4.02. There was no correlation between locomotor and object control subtest scores ($r=0.04, p=0.898$) (see figure 1).

Figure I: TGMD-2 Object Control vs. TGMD-2 Locomotor Subtest Raw Score

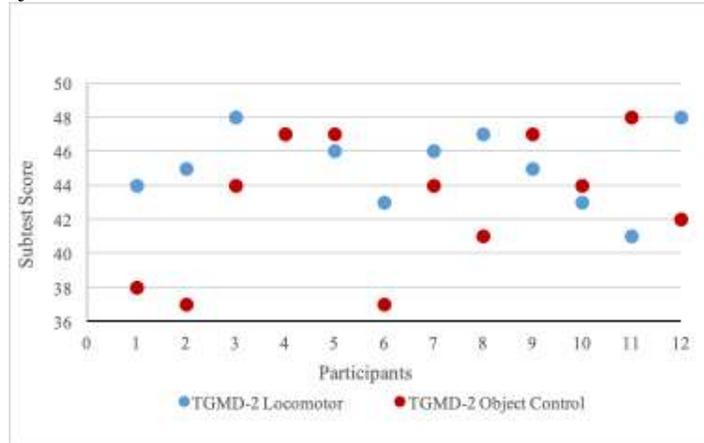


Table I: Participants

Male	1
Female	11
Average height	56.62 in ± 2.93
Average weight	78.89 lbs ± 13.91
Age range	8yr 11 mo - 11yr 4mo

Eight of the participant’s raw scores were converted to standard scores and percentiles using the TGMD-2 test manual. The remaining four participants were outside of the normative age range for the test and so we could only use their raw scores. Of the participants scored, 62.5% of participants were classified as average and 37.5% were classified as above average in locomotor skills. In object control skills, 12.5% of participants were classified as below average, 50% were classified as average, 12.5% were classified as above average, and 25% were classified as superior. Participant’s scores put them in a wide range of percentiles for their age. For locomotor skills the lowest scoring participant was in the 25th percentile and the highest scoring participant was in the 84th percentile. For object control skills the lowest scoring participant was in the 25th percentile and the highest scoring participant was in the 95th percentile (See table 2).

Table II: TGMD-2 Descriptive and normative scores

Category	Percent of participants	
	Locomotor	Object control
Very poor	0	0
Poor	0	0
Below average	0	12.5%
Average	62.5%	50%
Above average	37.5%	12.5%
Superior	0	25%
Very superior	0	0
Percentile	25-84	25-95

Table 3 reports the average amount of MVPA over four days being 181.92 ± 52.02 min, with a minimum amount of 82.25 minutes of MVPA per day for any participant. Participants spent an average of 177.9 ± 35.3 min in MVPA during the weekday and 185.9 ± 79.2 min in MVPA on the weekend days. Sedentary activity was significantly lower on the weekend as compared to the weekday ($t(11)=-3.848, p=0.003$). Participants spent an average of 605.8 ± 174.3 min in sedentary time during the weekday and 493.5 ± 239.9 min in sedentary time on the weekend. MVPA levels did not correlate to TGMD-2 raw scores for the locomotor subtest ($r = 0.09, p=0.767$) or for the object control subtest ($r = 0.09, p=0.781$). Sedentary levels did not correlate to TGMD-2 raw scores for the locomotor subtest ($r = 0.42, p=0.177$) or for the object control subtest ($r = 0.13, p=0.69$).

Table III: Time spent in MVPA per day

	Average MVPA in minutes	Minimum MVPA	Max MVPA	Average sedentary time in minutes
Total (Friday-Monday)	181.92 ± 52.02	113.5	287.88	549.6 ± 203.5
Weekend (Saturday and Sunday)	185.92 ± 79.81	82.25	344.25	493.5 ± 239.9
Weekday (Friday and Monday)	177.92 ± 35.25	139.5	207.5	605.8 ± 174.3

Discussion

The purpose of this study was to determine whether the TGMD-2 would identify the children in YA as competent in their motor skills, and examine if a correlation exists between the physical activity levels of the children in YA and their motor competency. The outcomes included TGMD-2 total and subtest scores and time spent in moderate and vigorous physical activity during weekdays and weekends. It was hypothesized that the TGMD-2 would misclassify YA participants as having average motor competence because of their extensive practice in non-standard physical skills. It was also hypothesized that children with higher levels of physical activity would score higher on the TGMD-2.

The normative data showed that the TGMD-2 classified over half of the study participants as having average or below average gross motor competence when compared to children of the same age and gender. However, children participating in YA must demonstrate above average motor competence based on the skills and tasks they are required to perform throughout the program. YA performances do not include skills such as throwing or kicking a ball, but they do include complex jump roping routines, choreographed dance and tumbling numbers and interactive unicycling routes. YA participants are skilled in riding and controlling unicycles ranging in size from three feet to five feet tall. Unicycle routines include mastery of skills such as linking arms with other riders, weaving through chains of riders, maneuvering around unicycles of differing heights and jumping rope while on the unicycle. Once the participants are back on the floor, they transition to tumbling routines consisting of cartwheels, backflips, rolling, headstands, and human pyramid construction, all synchronized to music. In addition to the complex floor routines, YA participants display advanced skills in jump roping, both with single ropes and larger double-dutch ropes. In one portion of the jump rope routine, a single jump roper performs inside larger double-dutch ropes. Based on these observations, the argument could be made that scores of average and below average are inherently a misclassification in this population.

Previous research hypothesized that if children perceived their motor ability as low, they would be less likely to attempt motor activity, which would lead to lower activity levels and inability to learn their motor skills (Wrotniak, 2006). Our results show that this cascade of events may not reflect the reality of motor skill development. The children in YA are highly active and still not classified as competent in all the fundamental motor skills. Vigorous and moderate activity levels were higher than the average population of children and exceeded the recommended daily amount (60 min/day). Despite their higher than average activity levels, many of these children were classified as average or below average in their gross motor development when compared to children of the same age and gender. Therefore, our results show that competency in fundamental skills tested with the TGMD-2 is not related to physical activity in these highly active children.

The TGMD-2 tests skills that are considered fundamental to daily childhood activities. However, these fundamental skills reflect the sports and activities most prevalent in our society, such as baseball, soccer, football and track and field. While these skills may be fundamental for many populations of children, they are not as fundamental for children that seek unique movement opportunities, such as unicycling and tumbling. As the

activities children participate in change, it is important for the tests and measures used to assess motor competency to represent a broader range of motor skills. Although skills of the TGMD-2 are important for the play component of being a child, the overall complexity and diversity of movements must also be taken into consideration. For children involved in YA and other non-traditional programs, assessment of motor competency based on the results of the TGMD-2 fails to consider the bigger picture of their motor skills and development.

In addition to the time spent participating in the YA program during the week, the children in this study are also highly active on the weekends. No data was collected on weekends corresponding with a YA performance, suggesting that these children are participating in other physical activity. Even with the constraints placed on children during the school day which increased their amount of sedentary time, they are still achieving above average activity levels and exceeding the CDC recommended amounts of physical activity.

Limitations

The small sample size and lack of male participants was a limitation of the study. Additionally, due to the age range of YA participants, four subjects fell outside the age range for normative data analysis. Furthermore, this study did not control for or qualify the types of physical activities the participants were involved in outside of YA. Therefore, no conclusions can be reached about the contribution of other sports and activities to the participant's overall TGMD-2 scores. Future studies should compare TGMD-2 scores between children meeting the current physical activity recommendations and those falling short of the recommended 60 minutes per day at least 5 days a week. Additionally studies comparing TGMD-2 scores in children involved in activities that utilize traditional motor skills with activities that do not utilize traditional motor skills to investigate the effects on gross motor skill development.

Conclusion

Based on the execution of complex and diverse skills demonstrated by the YA participants, it is reasonable to conclude that they demonstrate high motor competency in their specific skills set. However, the TGMD-2 classified the majority of YA participants as having average to below average motor competency based on the skills on the test. In addition, the high MVPA level of the YA participants was not related to their TGMD-2 scores. The TGMD-2 may not be the best tool for measuring motor proficiency in specific populations of children that practice non-traditional motor skills in their daily routines.

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