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Cortney N. Armitano
University of Rhode Island

Emily D. Clapham
University of Rhode Island, eclapham@uri.edu

See next page for additional authors

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SURFING FOR CHILDREN WITH DISABILITIES PILOT STUDY

Benefits of Surfing for Children with Disabilities: A Pilot Study

Cortney N. Armitano, Emily D. Clapham, Linda S. Lamont, Jennifer G. Audette

University of Rhode Island

Abstract

The purpose of this study was to assess the effectiveness of an eight-week surfing intervention for 16 children with disabilities. The assessment procedure consisted of pre and post physical fitness measures to determine the benefits of this intervention. Our results showed an overall improvement in upper body strength (right: P = 0.024, left: P = 0.022), core strength (P = 0.002) and cardiorespiratory endurance (P = 0.013). This research is the first of its kind, illustrating the feasibility and effectiveness of a surfing intervention on improving the physical fitness of children with disabilities.

Keywords: Aquatic, Ocean, Fitness

Benefits of Surfing in Children with Disabilities: A Pilot Study

Of the 53.9 million school-aged children (aged 5 to 17) in the United States, about 2.8 million (5.2 percent) were reported to have a disability (Brault, 2011). Children with disabilities have the same activity requirements as all children, who are recommended to accumulate 60 minutes or more of moderate to vigorous physical activity throughout the day (World Health Organization, 2012; ACSM, 2010). Participation in sports and recreational activities provide opportunities for these children that promote inclusion, minimize deconditioning, optimize physical functioning, and enhance overall well-being (Murphy, Carbone, & the Council on Children with disabilities, 2008). Despite the benefits, disabled children are more restricted in their participation, have lower fitness levels, and higher obesity levels than their able-bodied peers (Murphy, 2008). This limited participation also puts them at risk for secondary health problems later in life such as dyslipidemia, coronary artery disease, osteoporosis and diabetes (Fragala-Pinkham, Haley, and O'Neil, 2008; Hayden, 1998). Unfortunately, opportunities to participate in fitness and activity programs, whether for leisure, recreation, or competition, are limited (Murphy, 2008; Okagaki, Diamond, Kontos, & Hestenes, 1998; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004).

Adapted aquatics programs offer necessary physical activity and educational programming to these children (Kelly & Darrah, 2005; Koury, 1996) and the physical and psychosocial benefits are more pronounced than those reported for children without disabilities (Koury, 1996; Fragala-Pinkham, 2008; Haley, 2010). Research involving children with cerebral palsy determined that aquatic exercise improves muscle strength, cardiorespiratory function, and gross motor skills (Peganoff, 1984; Hutzler, Chacham, & Bergman, 1998; Thorpe and Reilly, 2000). There are reports that carefully planned and implemented water activities can contribute to the

psychosocial and cognitive development of a child with a disability (Yilmaz, Yanardag, Birkan & Bumin, 2004; Kelly, 2005). Similar benefits could potentially be derived from surfing in the ocean. Surfing is known to be highly aerobic and exercise intensities are high (75% - 85% of maximal heart rate) (Mendez-Villanueva & Bishop, 2005). There are several surf programs offered to people with disabilities around the world (e.g., Surfers Healing, Ride-a-Wave, and the Disabled Surfers Association in Australia), and they are quickly gaining popularity.

The present study was designed to determine whether a surfing program is beneficial by assessing physiological characteristics of the children before and after completion of the program. Surfing programs for children with disabilities are gaining popularity, however the benefits of these intervention programs have not been formally studied. This pilot project provides a preliminary exploration of the benefits of ocean surfing in children with disabilities by assessing for physiological improvements.

Methods

Participants

This study was approved by the Institutional Review Board at the University of Rhode Island on March 22, 2012. Sixteen participants were recruited from the University of Rhode Island Adapted Physical Education class, Special Olympics Rhode Island and through word-of-mouth throughout the local community. There was a wide range of children with disabilities in this study which included intellectual and learning disabilities, Down syndrome, several Autism Spectrum disorders, Microcephaly, Global Developmental Delays, Dandy-Walker syndrome, heart defects, and hypothyroidism (Table 1). Individuals interested in participating in the study needed to meet the inclusion criteria of being between 5 and 18 years, diagnosed with a

developmental, sensory, and/or physical disability, categorized by disability levels of mild to severe by a parent and/or guardian report, cleared by a medical doctor, and have an informed consent signed by their parent/guardian and an assent form signed by the participant.

Materials

This was a pilot study with an experimental study design utilizing pre and post fitness testing measurements (variables) to assess the surfing intervention. The fitness tests used were from the Brockport Physical Fitness Test Manual (Winnick & Short, 1999; Cureton, 1994) which is based on The Cooper Institute's Fitnessgram. The tests were selected to measure cardiorespiratory endurance, flexibility, muscular strength and muscle endurance. A practice day was completed to familiarize all the children with the testing procedures.

Procedures

Each child was paired with an adult instructor for one-on-one surfing instruction. The surf instructors were given training on the program goals, skills and optimal learning style of each child to encourage maximum progression and participation in the program (Clapham, Armitano, Lamont & Audette, 2014). The surf instruction consisted of a one-hour session, twice a week, for eight weeks; the child practiced surfing skills during these sessions. Specifically, children progressed from: 1) paddling, 2) balancing on a surfboard while sitting (Figure 1), laying, kneeling or standing (Figure 2), 3) catching a wave and riding it into shore in the prone, sitting, kneeling (Figure 3), or standing position, and 4) how to paddle back out through the wave unassisted (Clapham et al., 2014). The skills were first practiced in a large group format, then the child and their surf instructor would break off to practice their skills one-on-one beginning on

land and then in the ocean (Clapham et al., 2014). The progression through the skills were based on each child's individual pace of learning and the goals set by the surf instructors.

SPSS version 19 statistical software was used for the data analyses. Given the broad variability in disabilities of our sample group we used a Shapiro-Wilk Test to examine the normality of distribution for our measures. For the normally distributed data a repeated measures multivariate analysis of variance (ANOVA) using two time points (pre and post) was employed (sit and reach, modified Apley's scratch test and hand grip). Significance was based on an alpha of 0.05 using a Bonferroni correction and a 95% confidence interval. For the non-normally distributed data (trunk lift, modified curl-up, isometric push-up, 20 meter pacer scores $P < 0.05$) we used the nonparametric Wilcoxon Signed Ranks Test for paired variables. All data are presented as mean ± standard error of the mean.

Results

Table 2 lists the experimental results of this study. In the normally distributed items, we found significant increases in the grip strength in both hands and flexibility of the right arm as measured by the Apley's scratch test. The Back Saver Sit-and-Reach for both left and right arms remained unchanged. For the non-normally distributed data, we found significant improvements in core body muscle strength and aerobic capacity of our sample group as measured by the modified curl-up and cardiorespiratory endurance test employed. There were no significant improvements in the trunk lift or the isometric push up over the eight weeks of surfing instruction for this sample of children with disabilities.

Discussion

The purpose of this study was to explore the effectiveness of a surfing intervention for children with disabilities through an assessment of physiological measurements including; balance, strength, endurance, flexibility, and cardiorespiratory endurance. Results indicated that this surf program improved numerous areas of physical fitness and is another activity that can be added to the repertoire of effective adapted aquatic exercise programs. There were significant improvements in the participants' upper-body strength, core strength, as well as cardiorespiratory endurance. In the upper extremities there were increases in grip strength and in the participants' range of motion. The Modified Apley's scratch test was used to indicate improvements in the participants' range of motion. These results are consistent with research by Peganoff (1984) who found lap swimming increased shoulder flexion 15° and shoulder abduction 10° in the their participants right upper extremity. These improvements could be attributed to carrying the surfboard, arm use during swimming, and the repetitive arm motion needed to paddle through the water.

We found a substantial increase in core body muscle strength in our participants. Research by Fragala-Pinkham et al. (2010) also reported similar improvements after aerobic aquatic exercise. The improvements that we reported for core strength and endurance should be underscored, and are particularly beneficial as children with disabilities typically show a limitation in postural control (Liao, Jeng, Lai, Cheng & Hu, 1997). We found no improvements in the trunk lift or balance. The lack of improvement in the trunk lift could be attributed to a ceiling effect, because the majority of our participants obtained the maximum score prior to the surfing instruction.

Most research indicates that children with disabilities have low levels of cardiorespiratory endurance when compared with their abled bodied peers (Murphy, 2008; Hayden, 1998; Fernhall & Pitetti, 2001). Therefore, one of the most important benefits of this surfing project was the increase in cardiorespiratory endurance. A review by Mendez-Villanueva and Bishop (2005) (2005) indicated that surfing was a highly aerobic activity and Fragala-Pinkham et al. (2008) found improvements in cardiorespiratory endurance after a 14-week aquatic aerobic exercise intervention.

Anecdotally, many positive outcomes were reported to be observed from the surfing intervention. Researchers, surf instructors, and parents observed increased self-confidence, gains in social development by interacting with the volunteer surf instructors and other participants, and decreased anxiety. Some of these improvements, as seen in research by Clapham et al. (2014), included increased verbalization, excitement and motivation about physical activity, and improvements in surfing skills. Several outcomes of the program were also reported to carry over into other areas of the participants' lives including increased participation and improved performance in other physical activities such as adapted physical education classes, the Special Olympics and Unified Sports. These observations are concurrent with previous research that also found participation in the surf intervention aided the participants in acquiring the self-confidence, social skills, and physical fitness necessary to increase their participation in organized sport and physical activity (Clapham et al., 2014). It is recommended that future research examines these reported improvements formally.

It will be of interest to determine if improvements in cardiovascular fitness in children with disabilities can impact on the secondary health problems they are at risk of experiencing. The results of this study indicate that a surfing intervention program is feasible as well as

beneficial to improve the cardiorespiratory endurance, muscle strength, flexibility and range of motion of children with disabilities. Based on the researchers' results and feedback from participants and parents, it appeared as though the surf intervention was effective in improving lives of children with disabilities.

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Table 1

Subject Characteristics

ID #	Gender	Age	Disability type and other health information	Disability level
1	Male	15	Autism	Mild
2	Male	7	Down Syndrome	Mild
3	Male	6	Autism- non-verbal	Moderate/Severe
4	Male	10	Autism-non-verbal	Moderate
5	Female	9	Global developmental delays: specifically speech and motor skills	Mild
6	Male	13	Autism	Moderate
7	Female	13	Down syndrome, hypothyroidism	Moderate
8	Male	12	Hypoplastic left heart syndrome, Suffered from several strokes at a young age	Moderate
9	Male	10	Autism	Moderate
10	Male	10	ADHD, learning disabilities (reading), asthma	Mild
11	Male	13	Autism (Asperger Syndrome), ADHD, Tourette Syndrome	Moderate
12	Female	16	Down Syndrome, Hypothyroid	Moderate
13	Female	13	Autism (Asperger Syndrome), Obsessive Compulsive Disorder, Anxiety Disorder	Moderate
14	Male	15	Microcephaly, very low muscle tone	Severe
15	Male	5	Sensory integration disorder, hyperkinetic	Moderate
16	Female	6	Learning disabilities, dandy walker syndrome	Moderate

Table 2

Pre and Post Testing Results

Test	Pre ± SEM	Post ± SEM	Improvements	Significance
Grip strength (L)	120.5N± 25.5N	219.7N± 23.1N	99.2N	P = 0.024[a]*
Grip strength (R)	120.0N± 24.5N	225.6N ± 23.4N	105.5N	P = 0.022[a]*
Isometric Push-Up	1:28.8 min± 14.9sec.	2:00.4 min± 10.5sec.	31.6sec.	P = N.S.[b]
Modified Curl-Up	16± 5 reps.	27± 6 reps.	11 reps.	P = 0.002[b]*
Trunk lift	9.2in.± 0.8in.	9.8in. ± 0.6in.	0.6in.	P = N.S.[b]
Back Saver Sit-and-Reach (L)	28.63in.± 2.50in.	29.06in.± 2.39in.	0.4in.	P = N.S.[a]
Back Saver Sit-and-Reach (R)	29.0in.± 2.6in.	29.0in.± 2.4in.	0.0in.	P = N.S.[a]
Modified Apley's Scratch (L)	12.5°± 8.6°	14°± 7.1°	1.5°	P = 0 .095[a]
Modified Apley's Scratch (R)	10.8°± 7.7°	14°± 7.4°	3.18°	P = 0 .034[a]
20-m PACER	4 laps± 1 lap	6 laps± 2 laps	2 laps	P = 0.013[b]*

* = Statistically significant
N.S. = Not significant
[a] = Adjustment for multiple comparisons: Bonferroni
[b]= Wilcoxon Signed Ranks Test

Figure 1 Balancing on the surfboard while sitting

Figure 2 Balancing on the surfboard while standing

Figure 3 Riding a wave into shore while kneeling