EFFECTS OF 8-WEEK AEROBICS EXERCISES ON SELECTED PERFORMANCE RELATED PHYSICAL FITNESS COMPONENTS OF CHILDREN WITH AUTISM SPECTRUM DISORDERS

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Abstract

Despite the vocational training, Applied Behavioural Analysis and other programmes designed for children with Autism Spectrum Disorders at National Orthopaedic Special School Igbobi, Lagos, exercise or physical fitness activities were not included as part of daily activities for this group of individual which form the fulcrum for the study. Two group pre-test posttest experimental design was adopted for the study. The population for the study consists of Sixty–four children diagnosed with Autism Spectrum Disorders attending National Orthopedic Hospital Special School, Igbodi, Lagos between the ages of 2-20 years. The participants for this study were forty children selected from the population which the severities are mild. The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, DSM-5 was used to categorised the participants and those within severity levels 1 were part of the sample. . The simple random sampling technique was used to select the sample. The data collected was analysed with the use of statistical tools of mean, standard deviation for demographic data while inferential statistics of t-test was used to test the stated hypotheses. All hypotheses were tested at 0.05 level of significance. Findings from the study revealed that 8-week aerobics exercises have effects on static balance, bilateral coordination and reaction time of children with autism. It was recommended that Balance activities, aerobic dance, manipulative exercise/activities, throwing and catching of small balls and bean bag should be added to Special School children physical education programme/activities.

Keywords: physical fitness, static balance, bilateral coordination, reaction time, Autism Spectrum Disorder

Introduction

Physical fitness is a state of being that reflects a person's ability to perform specific exercises or functions, and is related to present and future health outcomes (Institute of Medicine, 2012). Beyond physical development, physical fitness implies efficient performance in exercise or work and a reasonable measure of motor skill in the performance of selected physical activities, Physical fitness varies with individual and with the demands and requirements of a specific task (Fahey, Insel & Roth, 2001). Physical fitness means that the various systems of the body are healthy and function efficiently so as to enable the person to engage in activities of daily living, as well as in recreation pursuits and leisure activities without unreasonable fatigue (Corbin, Welk, Corbin & Welk, 2004; Adeogun, Setonji and Dansu ,2003; Fahey, Insel & Roth, 2001).

Good physical fitness not only enables a person to carry out daily works, but also gives him / her extra

energy to enjoy leisure, ensuring the body can adapt to unexpected environmental changes and daily pressures. There are two kinds of physical fitness, namely Health-related Physical Fitness and Performance-related Physical Fitness (Leisure and Cultural Services Department, Hong Kong, 2014). Exercise is essential for a child's emotional and physical health, but regular exercise provides more benefits for children with autism. Exercise is among the most effective therapy for those who have autism. Even though, most kids receive some amount of exercise through playing with some other kids, which is not always the case for autistic children (Dangerouslyfit, 2014).

Autism Spectrum Disorders is a neuro-development disorder and / or condition that impair individual ability to communicate, form relationship, socially interact and respond appropriately within a given environment. Autism is a spectrum of closely-related disorders with a shared core of symptoms (American Psychiatric Association, 2000). In addition to these core diagnostic impairments, children with Autism spectrum disorders may have a range of impairments in cognitive-behavioural and perception and motor domains. Cognitive and behavioural impairments may include attention problems, intellectual delays, anxiety, depression, aggression, temper tantrums, and self-injurious behaviours (Williams, Goldstein & Minshew, 2006).

Autism predominately affects males, with a male-to-female ratio of approximately 3:1 (Esposito Venuti, Maestro & Muratori 2009). Bhat, Landa and Cole-Galloway (2011), study found that many children with ASD demonstrate atypical motor development and delay in motor milestones achievements such as asymmetry, oral-motor problems repetitive motor movements, poor motor coordination (Fournier, Hass, Naik, Lodha & Cauraugh, 2010), movement preparation reaction (Rinehart, Bradshaw, Brereton & Tonge, 2001), and motor milestone delays (Provost, Lopez & Heimer, 2007; Esposito, Venuti, Maestro & Muratori, 2009; Rinehart, Bradshaw, Brereton & Tonge, 2001).

Estimates of the prevalence of Autism Spectrum Disorders are scarce possibly due to the complexity of the symptoms and comorbidities associated with the disorder (Kim, Leventhal, Koh, Fombonne, Laska, Lim & Grinker, 2011). World Facts (2017) indicates that Japan and other developed countries have the highest rates of autism; the statistics show that there are 161 cases per 10,000 children studied in Japan. The United Kingdom study on autism among its children involved school children between the ages of five and nine, found 94 cases of autism spectrum conditions per 10,000 children. In Sweden, 72 cases per 10,000 children studied, in Denmark, 68 cases per 10,000 children studied, United States data on autism recently showed that one in 66 American children have the disorders.

Studies are not available in recent times addressing epidemiology of ASD among sub-Saharan African children. In the African continent, limited data is available regarding the non-clinic based samples. Lack of information available to caregivers and inadequate skilled manpower often limit early detection and access to the few available under resourced services in the community (Oshodi, Olagunju, Oyelohunnu, Campbell, Umeh, Aina, Oyibo, Lesi & Adeyemi, 2017). GTBank (2018) reports also reveal that Nigeria ranks low in management systems, of individual with autism which prompted the Bank to forge relationships with several organisations in 2009 and commence advocacy programmes over the years, aimed at improving awareness and management of Autism Spectrum Disorders.

Milanovic, Sporis, Pantelic, Trajkovic and Aleksandrovic, (2012); Milanovic, Pantelic, Trajkovic and Sporis, (2011); Jorgic, Pantelic, Milanovic and Kostic, (2011) reported that aerobic training are used to decrease body weight and body fat, and change body composition. Milanovic, Sporis, Pantelic, Trajkovic and Aleksandrovic (2012) affirms that apart from walking and running as a means of aerobic exercise used to decrease body weight and change body composition, various other exercise to music models are used which include steps, hops, turns, jumps, and other body movements. Kimura and Hozumi, (2012) posits that aerobic dance exercises has high efficacy to reduce fat and performance. Kostic, Duraskovic, Miletic and Mikalacki, (2006) asserted that dance aerobic training provide sufficient cardiorespiratory demand to promote weight loss in female. Rahimi, 2006; Osei-Tutu and Campagna (2005) who found positive effect of various aerobic physical activities on the changes in body composition and anthropometric characteristics of a person has been confirmed. Srinivasan, Pescatello and Bhat (2014) recommended an exercise programme that combine the components of aerobic, resistance, flexibility, and neuromuscular training for maximum gains in fitness and body composition.

Sowa and Meulenbroek (2012) found that exercise interventions in children with ASD decreases stereotypical or aggressive behaviour, while improving physical, cognitive, and social development. Pan (2011); Rogers, Hemmeter and Wolery (2010); Fragala-Pinkham, Haley and O'Neil (2008); Pitetti, Rendoff, Grover and Beets (2007); , Yilmaz, Yanarda, Birkan and Bumin (2004); Lochbaum and Crews (2003) reported the physical benefits of exercise for children with ASD to include improvements in cardiorespiratory functioning, motor skill performance, and muscular strength, as well as a reduction in body mass index. Pan (2010), Wuang, Wang, Huang and Su (2010) found that recreational pool exercises and horseback riding have been used to facilitate gross motor coordination and balance in children with autism.

Taylor (2009) study found that exercise can also enhance attention, in addition to fitness and skills, and might serve as a safe, inexpensive, widely accessible new tool for managing behavioural symptoms. Sowa and Meulenbroek (2012) found that interventions in children with ASD seek to decrease stereotypical or aggressive behaviour, while improving physical, cognitive, and social development. Srinivasan, Pescatello and Bhat (2014) recommend an exercise programme combining components of aerobic, resistance, flexibility, and neuromuscular training for maximum gains in fitness and body composition. Physical benefits of exercise for children with ASD include improvements in cardiorespiratory functioning, motor skill performance, and muscular strength, as well as a reduction in body mass index (Pan, 2011; Rogers, Hemmeter & Wolery, 2010; Fragala-Pinkham, Haley & O'Neil, 2008; Pitetti, Rendoff, Grover & Beets, 2007; Yilmaz, Yanarda, Birkan & Bumin, 2004; Lochbaum & Crews, 2003).

Yilmaz, Yanardag, Birkan, and Bumin (2004) found that swimming training is effective for developing physical fitness and water orientation in autistic children. Verret, Guay, Berthiaume, Gardiner and Béliveau, (2012) study on the effects of a moderate- to high-intensity physical activity programme showed that fitness level and motor skills, assessed by standardised tests, as well as behaviour reports by

parents and teachers, and level of information processing were all improved in children with ADHD after a 10-week training compared to a control group Peters and Wright (1999) reported improved motor competence using the M-ABC in a group of fourteen children with DCD after participating in a 10-week (1 hour a week) specific group exercise programme designed by a physiotherapist.

It has been suggested that inactivity is the primary reason for low level of physical fitness and increased rate of overweight in children with Autism Spectrum Disorders, while unusual dietary patterns and the use of antipsychotic prescription drugs that can lead to weight gain may also contribute (Dawson & Rosanoff, 2009). Physical fitness is an important health marker both in the early years and later in life (Ruiz,Castro-Pinero, Artero, Ortega, Sjostr & Suni, 2009; Ortega, Ruiz, Castillo & Sjostr, 2008). There are numerous benefits of physical fitness for physical health (i.e, cardiovascular and metabolic diseases, obesity, and musculoskeletal problems) and mental health (i. e, depression and anxiety) (US Department of Health and Human Services, 2010). Adequate balance is critical to perform proficient fundamental motor skills and participate in various forms of physical activity (Jasmin, Couture, McKinley, Reid, Fombonne & Gisel, 2009).

Despite the vocational training, Applied Behavioural Analysis and other programmes designed for children with Autism Spectrum Disorders at National Orthopaedic Special School Igbobi, Lagos, exercise or physical fitness activities were not included as part of daily activities for this group of individual. Exercise is conspicuously lacking in traditional autism therapies such as vocational skills, applied behavioural analysis-ABA, in which therapists teach social skills and desirable behaviours using reward-based incentives. Finding ways to increase physical fitness levels in this population is necessary to reduce the likelihood of negative health consequences which form the fulcrum for this study. The focus of this study therefore was to determine the effects of 8-week aerobics exercises on selected physical fitness components of children with autism.

Research Hypotheses

The following hypotheses were formulated and tested in the course of the study:

1. 8-week aerobics will not have significant effect on static balance of children with Autism Spectrum Disorders
2. 8-week aerobics will not have significant effect on bilateral coordination of children with Autism Spectrum Disorders.
3. 8-week aerobics will not have significant effect on reaction time of children with Autism Spectrum Disorders

Methods and Procedure

Two group pre-test posttest experimental design was adopted for the Study. The population for the study consists of all sixty-four children diagnosed with Autism Spectrum Disorders attending National Orthopedic Hospital Special School, Igbodi, Lagos between the ages of 2-20 years. The participants for

this study were forty children selected from the population which the severities are mild. The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, DSM-5 was used to categorised the participants and those within severity levels 1 were part of the sample. Twenty participants were in experimental group and twenty in control group). The simple random sampling technique was used to select the sample. Experimental group was exposed to eight weeks aerobics which includes, aerobics dance and brisk walk, throwing and catching of bean bag, jumping on rope, walking on straight line, kangaroo jump on ropes and lifting of objects while no treatment was given to the control group. The selected physical fitness components are static balance, flexibility, muscular strength, bilateral coordination, reaction time and Body Mass Index. The two groups performed the selected physical fitness components as stated above before and after the treatment. The sit and reach was used to test for flexibility of each participant in each group in centimetre; hand grip dynamometer was used to test for muscular strength, modified stork standing test was used to test for static balance was measured in seconds, simple ruler catching method was used to measure reaction time in centimetre while wall toss test was used to measure bilateral coordination of each of the participants. The data collected was analysed with statistical tools of mean and standard deviation for demographic data while inferential statistics of paired t-test was used to test the stated hypotheses. All hypotheses were tested at 0.05 level of significance.

Results

Hypothesis 1: 8-week aerobics will not have significant effect on static balance of children with Autism Spectrum Disorders.

Table 1: Result of means, standard deviations and t-test analysis of 8-week aerobics on static balance

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Static Balance-Pretest	.75000	1.74341	.38984	-.06594	1.56594	1.924	19	.069
Pair 2	Static Balance Post –test	4.75000	3.47737	.77756	3.12254	6.37746	6.109	19	.000

Table 1 shows the Mean and Standard Deviation of the Pre–test and Post–test scores of participants for static balance components in relation to the effect of aerobics. The table showed the Mean pre–test score for balance was **.75 and standard deviation was 1.74** while the post–test mean score was **4.75 and standard deviation was 3.47.** The table further indicate a significant t-value was obtained in respect of balance of participants (t = **6.11**; p < 0.05). The stated hypothesis is hereby rejected indicating that eight weeks aerobics had significant effects on static balance of children with Autism Spectrum Disorders.

Hypothesis 2: 8-week aerobics will not have significant effects on bilateral coordination of children with Autism Spectrum Disorders.

Table 2: Result of means, standard deviations and t-test analysis of 8-week aerobics on bilateral coordination.

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Bilateral Coord.-Pretest	.25000	1.94327	.43453	-1.15948	.65948	.575	19	.572
Pair 2	Bilateral Coord. Posttest	4.05000	1.95946	.43815	3.13295	4.96705	9.243	19	.000

Table 2 shows the Mean and Standard Deviation of the Pre–test and Post–test scores of participants' bilateral coordination on the effect of aerobics. The table showed the Mean pre–test score for bilateral coordination before treatment was .**250 and** standard **deviation was 1.94** while the post–test mean score after the treatment was **4.05 and standard deviation was 1.96.** The table further revealed a significant t-value of (t = 9.24**;** p ≤0.05) was obtained on bilateral coordination of participants. The stated hypothesis is hereby rejected. This indicates that eight weeks aerobics had significant effects on bilateral of children with Autism Spectrum Disorders.

Hypothesis 3: 8-week aerobics will not have significant effects on reaction time of children with Autism Spectrum Disorders.

Table: 3: Result of means, standard deviations and t-test analysis of 8-week aerobics on reaction time.

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Reaction Time-Pretest	.10000	2.53190	.56615	-1.28497	1.08497	-.177	19	.862
Pair 2	**Reaction Time Posttest**	6.90000	3.09329	.69168	5.45230	8.34770	9.976	19	.000

Table 4.10 shows the Mean and Standard Deviation of the Pre–test and Post–test scores of participants' reaction time on the effect of aerobics. The table showed the Mean pre–test score of reaction time was .**100** and standard **deviation was 2.53** while the post–test mean score was 6.90 **and standard deviation was 3.09.** The table further revealed a significant t-value of (t = **9.98;** p $\leq$0.05) was obtained on reaction time of participants. The stated hypothesis is hereby rejected. This indicates that eight weeks aerobics had significant effects on reaction time of children with Autism Spectrum Disorders.

Discussion of findings

Hypothesis one postulated that 8-week aerobics exercises will not have significant effects on static balance of children with autism was rejected indicating that 8-week aerobics exercises has significant effect on static balance of children with Autism Spectrum Disorders. This study corroborates findings of work done on static balance by Waleed, Moronkola, and Oladipo, (2002); Randa, (2001), Paterno and Mmyer, (2004); Young, Jordan and Waren, (2010) studies found that that strength exercises cause a significant increase in static and dynamic balance Ahmadi, Sokhanguei and Memar, (2013) study showed significance improvement in static and dynamic balance's triple tests among experimental ad control groups. Pan, 2010; Wuang, Wang, Huang and Su, (2010) found that recreational pool exercises and horseback riding have been used to facilitate gross motor coordination and balance in children with Autism Spectrum Disorders.

Hypothesis two which postulated that 8-week aerobics exercises will not have significant effect on bilateral coordination of children with Autism Spectrum Disorders was rejected. This implies that 8-week aerobics had significant effects on bilateral coordination of children with Autism Spectrum Disorders. This study supports Srinivasan, Pescatello and Bhat, (2014) recommend an exercise programme combining components of aerobic, resistance, flexibility, and neuromuscular training for maximum gains in fitness and body composition. Sowa and Meulenbroek, (2012) found that interventions in children with ASD seek to decrease stereotypical or aggressive behaviour, while improving physical, cognitive, and social development. Pan, 2011; Rogers, Hemmeter and Wolery,

2010; Fragala-Pinkham, Haley and O'Neil, 2008; Pitetti, Rendoff, Grover and Beets, 2007; Yilmaz, Yanarda, Birkan and Bumin, 2004; Lochbaum and Crews, (2003) reported the physical benefits of exercise for children with ASD include improvements in cardiorespiratory functioning, motor skill performance, and muscular strength, as well as a reduction in body mass index. Sowa and Meulenbroek, (2012) found that interventions in children with Autism Spectrum Disorders decrease stereotypical or aggressive behaviour, while improving physical, cognitive, and social development. Pan, 2010; Wuang, Wang, Huang and Su, (2010) found that recreational pool exercises and horseback riding have been used to facilitate gross motor coordination and balance in children with Autism Spectrum Disorders. Taylor, (2009) study found that exercise can also enhance attention, in addition to fitness and skills, and might serve as a safe, inexpensive, widely accessible new tool for managing behavioural symptoms.

Hypothesis three which state that 8-week aerobics will not have significant effects on reaction time of children with Autism Spectrum Disorders was rejected indicating that 8-week aerobics will not have significant effect on reaction time of children with Autism Spectrum Disorders. This finding agree with Sowa and Meulenbroek, (2012) that interventions in children with Autism Spectrum Disorders decrease stereotypical or aggressive behaviour, while improving physical, cognitive, and social development. Srinivasan, Pescatello and Bhat, (2014) recommended exercise programme that combines components of aerobic, resistance, flexibility, and neuromuscular training for maximum gains in fitness and body composition. Pan, 2011; Rogers, Hemmeter and Wolery, 2010; Fragala-Pinkham, Haley and O'Neil, 2008; Pitetti, Rendoff, Grover and Beets, 2007; Yilmaz, Yanarda, Birkan and Bumin, 2004; Lochbaum and Crews, (2003) reported the physical benefits of exercise for children with ASD to include improvements in cardiorespiratory functioning, motor skill performance, and muscular strength, as well as a reduction in Body Mass Index. Taylor, (2009) study found that exercise can enhance attention, in addition to fitness and skills, and might serve as a safe, inexpensive, widely accessible new tool for managing behavioural symptoms. Yilmaz, Yanardag, Birkan, and Bumin (2004) found that swimming training is effective for developing physical fitness and water orientation in autistic children. Verret, Guay, Berthiaume, Gardiner and Béliveau, (2012) study on the effects of a moderate- to high-intensity physical activity programme showed that fitness level and motor skills, assessed by standardised tests, as well as behaviour reports by parents and teachers, and level of information processing were all improved in children with ADHD after a 10-week training compared to a control period. Peters and Wright (1999) reported improved motor competence using the M-ABC in a group of fourteen children with Developmental Coordination Disorders after participating in a 10-week (1 hour a week).

Conclusion

Based on the findings, it was concluded that regular aerobics exercise improves static balance, flexibility, bilateral coordination, reaction time, reduces Body Mass Index but does not have effects on muscular strength of children with Autism Spectrum Disorders.

Recommendations

Based on the findings from the study, it was concluded and recommended that:

1. Balance activities should be included in physical education programmes of children with Autism Spectrum Disorders to enhance their physical fitness level and well-beings.
2. Aerobic dance and other manipulative exercise/activities should be included in Special School physical education programme.
3. Throwing and catching of small balls and bean bag should be added to Special School children physical education programme/activities.

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