Effect of a Selected Local Game on Dynamic Balance of Educable Students with Down Syndrome

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Abstract

The present study aimed to examine the effect of a selective local game on dynamic balance of male students with Down syndrome in Ghaemshahr County. This was a quasi-experimental study. The sample consisted of 16 boys with Down syndrome in Exceptional School in Ghaemshahr County (with an average IQ=59.62). The participants were selected randomly and were assigned to two control and experimental groups in a targeted manner. Each group consisted of 8 individuals. Such personal information as height, weight, age, IQ was collected from medical records of the students with Down syndrome. The heel to toe walking test was used to assess the dynamic balance. First, the participants in pre-test underwent the dynamic balance tests. In the next stage, the selected game was played for eight weeks, 3 times per week. In the end, both groups were retested. The collected data was analyzed using the t tests for both paired and independent samples at p<0.05. The findings suggested that the local game improved dynamic balance of the students with Down syndrome. Considering the findings of this study, the selected local game should be included in physical education program of elementary exceptional school students.

Keywords: local game, dynamic balance, educable Down syndrome

Introduction

Down syndrome was majorly considered by academics among various types of chromosomal abnormalities. The scholars conducted much behavioral and educational research on this disorder. Surprisingly, the individuals with Down syndrome have made progress on education to the extent that some of them even were able to take college courses (Deborah et al., 2007).

John Langdon discovered Down syndrome clinically for the first time in 1866. Down syndrome is the most common genetic disease with an incidence of 1 in 800 to 1,000 among live births. Causes of this disorder are chromosomal abnormalities (Melissa et al., 2008; Meneghetti et al., 2009). This disorder also causes one of the most common types of mental retardation (Bakhshi et al., 2005). Down syndrome is not only diagnosed by facial features but also some other clinical symptoms such as orthopedic, cardio-vascular, neural-muscular, visual, cognitive and perceptual defects. Studies have shown that the individuals with Down syndrome have difficulties in strength, balance, visual-motor coordination and lateralization (Connolly et al., 1986; Frith et al., 1974).

Balance refers to an ability and skill integrated by nervous system, using various body systems such as neural and muscular systems and different parts of the brain. In fact, the central nervous system activates muscle synergy patterns in the limbs by processing the data obtained from visual, vestibular and proprioceptive systems and taking into account those pre-learned movement patterns. The muscular patterns create movement strategies...
according to which the individual can keep his balance (Asgari, 2007). The individuals with Down syndrome suffer from balance disorders. Dynamic balance refers to maintaining body balance when the center of gravity is moving due to muscular activity. For example, there are few individuals with Down syndrome that can maintain their balance on one leg for a few seconds. These individuals cannot maintain their balance on one leg with their eyes closed (Cabeza – Ruiz, 2011). Balance disorders in the individuals with Down syndrome lead to increased range of stability while sitting, standing and walking (the individuals with Down syndrome are mostly static in standing, sitting and walking positions due to balance disorders) (Abdel Rahman, 2010).

Several factors effectively decrease balance in the individuals with Down syndrome such as hypotonia, muscular weakness, small-sized cerebellum and brain stem. Violations of muscular strength decreases balance in standing position, which consequently increases the risk of falls (Cabeza – Ruiz, 2011). Lower extremity muscle strength of these children is 50% less than other children with mental disorders (Lahtinen, 1986). Therefore, it is essential to maintain a desired level of muscular strength in these children (Lewis et al., 2005). Given muscle relaxation and balance disorders in patients with Down syndrome, some scholars studied strength and balance exercises in these individuals. A combination of strength and balance exercises significantly affects the individuals with Down syndrome. This issue was explored in many studies, Gupta et al. (2011) found out that six-week balance exercises significantly improved balance and strength of these individuals. These exercises included vertical and horizontal jumping, walking on a balance beam, jumping on Trampoline as well as strength exercises with at least 50% maximum force and increased training load. These parameters were measured using a dynamometer as well as Oseretsky Test (Gupta Sarar, 2011). In total, the authors showed that balance and strength exercises can improve these two parameters in patients with Down syndrome. Wang and Chang (1997) examined the effect of jumping skill on dynamic balance of the individuals with Down syndrome. The scholars expected that improvement in balance caused by jumping exercises could also affect walking skill. The results showed that jumping improved dynamic balance and this ability improved such skills as walking on a flat surface and on a balance beam (Wang, 1997). Wang Ju (2002) also showed that six-week vertical and horizontal jumping exercise in three to six years old children with Down syndrome (three sessions per week) significantly improved dynamic balance and strength (Wang, 2002). Kashi et al. (2012) also examined the effect of one-period of selective exercise on physical and motor cognitive abilities of the individuals with Down syndrome. Subscales of Bruininks Oseretsky Test of Motor Proficiency (BOTMP) were used to measure the balance variable. The results showed that implementation of 12-week training program significantly improved both static and dynamic balance in the experimental group (Kashi, 2013). Hamidian et al. (2012) reported that local games increase visual-motor perception of preschool and first grade primary school students with intellectual disability (Hamidian Jahromi., 2012).

Although physical fitness in the underlying component of the planning made to promote health of mentally retarded individuals, few scholars assessed these factors and their relationship with each other, especially sports scientists in the country. Many studies were conducted in the field of intelligence, social issues and cognitive aspects of mentally retarded individuals. The results of these studies showed that children with Down syndrome have balance disorder and weakness. Since selective training programs effectively improved balance of these individuals and emphasis on the fact that children are more enthusiastic about a game rather than other opportunities, playing various games may effectively improve the balance of these children. Given the above-mentioned materials and the importance of motor development and resolving problems of the children with Down syndrome, it is wondered whether local games can improve the balance of these children or not. In this study, we selected the hopscotch game, which both includes standing on one leg and jumping. In the present study, the effect of one-period of playing a local game was examined on dynamic balance of 9 to 11 years old boys in Ghaemshahr County.

Materials and Methods

Participants: this was a quasi-experimental study with pre-test and post-test. The statistical population consisted of all students in Javad Al-Aleme Exceptional School in Ghaemshahr County in 2013-2014 academic year (N=98). In this study, 16 children with Down syndrome were selected and participated in the study using a targeted convenience sampling method. After initial selection, the participants were divided into two control and experimental groups (8 members) based on dynamic balance scores at pretest and homogeneity.

In this section, demographic information such as age, weight, height and IQ of the experimental and control groups are presented in the table (Table 1).
**Table 1: demographic data of the groups**

<table>
<thead>
<tr>
<th>Group/Characteristic</th>
<th>Experimental group</th>
<th>Control group</th>
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<tbody>
<tr>
<td>Age</td>
<td>9.38±1.92</td>
<td>9.50±1.99</td>
</tr>
<tr>
<td>Height</td>
<td>133.88±4.82</td>
<td>132.62±5.47</td>
</tr>
<tr>
<td>Weight</td>
<td>36.25±5.312</td>
<td>35.75±4.77</td>
</tr>
<tr>
<td>IQ</td>
<td>59.62±4.71</td>
<td>59.12±6.10</td>
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**Measurement Tool**

Villamonte (2009) evaluated reliability of sixteen balance tests in the patients with Down syndrome. He found out that seven tests had acceptable reliability. These tests include standing with the optional leg on a balance board with both open and closed eyes, standing with the optional leg on a flat surface, walking heel to toe on the balance beam, walking heel to toe on drawing lines and CGS values in the test of standing on hard and soft surfaces with open eyes. Researchers have shown that the seven tests help to diagnose clinical symptoms of the patients with Down syndrome because these tests are both safe and adequately reliable (Kashi et al., 2013). In this research, we used Heel-to-Toe Dynamic Balance Test to assess the dynamic balance \( r = 0.91 \). In this test, the individual ability to walk in a straight line from heel to toe is evaluated. The test procedures are as follows. The participants are asked to walk in a straight line from heel to toe by taking 15 steps. The hands freely move on sides. The maximum test score is 15. The test is stopped whenever a participant deviates from the path before taking 15 steps. The number of steps is registered as a record. This test is done twice by every participant. The best score is recorded as an individual record (Lahtinen, U. (1986).

**Method of conducting the research:**

First, a license was taken from education management of Ghaemshahr County. The parents also consented to procedures of the study. Personal information such as height, weight, age, IQ and medical history were collected from medical records of the children with Down syndrome. Then, hopscotch was selected after a preliminary study on local games. Training sessions included 10 minutes stretching and walking for warm up stage and 35 minutes for main exercises and five minutes for cooling down stage. The experimental group played the selected game for 8 weeks in teamwork, three sessions per week. The control group was excluded from playing the selected game and was engaged in normal activities. The overall goals of hopscotch lies in maintain balance and strengthening the leg muscles. The game is mostly played by girls. The principles of the game were as follows: jumping on several squares drawn on the ground. Each square is given a number. The first participant drops a stone on a numbered square. If the participant can accurately drop the stone on a pre-specified square, he will jump on the squares except the one square he had dropped the stone on and retrieve the stone.

**Statistical Methods**

Descriptive statistics were used to calculate mean and standard deviation of the collected data. The t-test for paired and independent samples was used to determine the difference between pre-test and post-test at \( p<0.05 \). SPSS version 19 was used for statistical analysis at \( p<0.05 \).

**Results**

The results showed that dynamic balance scores were significantly increased in the experimental group compared to the control group at posttest \( p<0.002 \). However, no significant difference was observed between the experimental and control groups in dynamic balance scores at pretest \( p<0.745 \) (Table 2). The results showed no significant difference in dynamic balance scores before and after the training period \( p=0.000 \) (Table 3).
The results showed that hopscotch improved the balance of these students. The results also show that the selected local game had a great significant effect on balance compared to normal activities. The results of this study were in line with those obtained by Kashi et al. (2012). The latter examined the impact of a selected motor program on cognitive – motor and physical abilities of the individuals with Down syndrome. The results of this study also showed that those individuals participating in the intervention program had higher dynamic balance scores than static balance scores. Implementation of a selected motor program improves proprioception, balance and muscular strength in the individuals with Down syndrome. Therefore, a selected motor program can effectively improve balance of the individuals with Down syndrome.

As mentioned earlier, hypotonia and weakness in the lower extremity muscular strength effectively reduce balance of the individuals with Down syndrome. Therefore, participation in local games can improve balance and strength of the individuals with Down syndrome. The results have shown that since hopscotch is associated with jumping, it improves proprioception and balance in the individuals with Down syndrome. The results of this study are in line with those obtained by Wang and Chang (1997). The latter examined the effect of jumping skills on dynamic balance of the patients with Down syndrome. In this study, dynamic balance scores were compared after a period of playing hopscotch between the experimental and control groups among the individuals with Down syndrome. The results showed that dynamic balance was significantly different after one period of playing hopscotch in the experimental group compared to the control group. These results were consistent with those obtained by Gupta et al. (2011) and Vincent et al. (2010). Gupta et al. (2011) and Vincent et al. (2010) examined the impact of compound and balance training (strength and balance) on balance index of the individuals with Down syndrome.

Having the opportunity to practice is one main reason why local games are more effective than routine activities (Akbari, 2006). Such factors as facilities, equipment, time and proper encouragement provide training opportunities for the children in order to improve their fundamental skills. Many training opportunities may be lost due to lack of facilities. For example, high cost of equipment and facilities may be a barrier to these opportunities. As mentioned earlier, unavailable facilities such as lack of proper sports environment as well as a long distance between training and sports environments can restrict benefiting from these opportunities. Lack of proper encouragement can also tarnish training opportunities. A child not encouraged and guided properly by the surrounding people can be disappointed with the first unpleasant experience and may lose the training opportunities. Meanwhile, time can be the most decisive factor in training opportunities (Akbari, 2006).

Many children do not have enough time to develop their basic skills because most of their times are occupied with going to school, watching TV, doing homework, etc. Therefore, they have no time to participate in regular training programs. In fact, proper facilities, equipment as well as adequate time and encouragement are vital factors for development of manipulation and fundamental motor skills but these factors alone cannot provide the context for development of motor skills in children. Many children can never grow their fundamental motor skills without an adequate growth program (Gallahue, 2003). Therefore, considering a proper motor program and suitable games with acceptable growth quality is the least expensive method to compensate the above-mentioned problems as much as possible. Similarities between components of learning motor tasks also

<table>
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<th>Table 2: t test results for independent samples in terms of dynamic balance in the two experimental and control groups</th>
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<tr>
<td>Index</td>
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<td>dynamic balance</td>
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<th>Table 3: t test results for paired samples to examine the effect of the selected local game on dynamic balance</th>
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<td>Test stage</td>
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<tr>
<td>Before training</td>
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<td>After training</td>
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Discussion and Conclusion

The present study aimed to evaluate the effect of a selected local game on improvement of dynamic balance in male students with Down syndrome. The results showed that hopscotch improved the balance of these students. The results also show that the selected local game had a great significant effect on balance compared to normal activities. The results of this study were in line with those obtained by Kashi et al. (2012). The latter examined the impact of a selected motor program on cognitive – motor and physical abilities of the individuals with Down syndrome. The results of this study also showed that those individuals participating in the intervention program had higher dynamic balance scores than static balance scores. Implementation of a selected motor program improves proprioception, balance and muscular strength in the individuals with Down syndrome. Therefore, a selected motor program can effectively improve balance of the individuals with Down syndrome.

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contribute to superiority of performance of local games compared to conventional activities. In accordance with this principle, it can be concluded that local games are a set of repetitive movements that have better performance than conventional games due to similarity with the model skills (balance skill). This is because an appropriate motor behavior is caused by involvement of such factors as the individual, environment and task (the needs relevant to motion) according to theory of dynamic systems (Kosari et al., 2013; Galaho et al., 2006; Haywood, 2009). Thus, features of a task greatly contribute to both learning and improving motor patterns.

It can also be stated that when local games are matched with characteristics and capabilities of children, such as children with Down syndrome, the children will be able to benefit from their capabilities proportional to type of the game. Thus, hidden skills will be developed if one hidden skill was found in a child. In addition, new skills will be developed if no skill was found in a child. Helping children to find the right tools and proper physical postures allow the children to experience various activities and games, which lead to children growth. Thus, it seems logical that local games meet the needs relevant to balance patterns better than conventional activities due to the above-mentioned reasons. Local games also lead to significant development of these skills among the participants in this study.

Given the above-mentioned materials and the results of this research, we found out that the local game used in this research properly improved balance of the individuals with Down syndrome. Moreover, the parents, teachers and coaches should enrich the environment and design appropriate motor programs such as local games for development of basic skills of the children, especially children with Down syndrome. As a result, the children will increasingly progress in various skills. It should be stated that single-sex nature of the study was one limitations of the present study. Therefore, the academics are suggested to investigate the impact of these types of games on girls and other skills as well as on other periods of life and age groups in the future.

Conflict of interest

The authors declare no conflict of interest

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Bakhshi A, 2005. Comparison between motor skills of 6.5-7.5 years old children with Down syndrome and normal children in Tehran. Thesis of MSc in Iran University of Medical Science


