LATIN AEROBICS: AN EXERCISE WORK-OUT FOR STATIC AND DYNAMIC BALANCE OF CONGENITALLY BLIND CHILDREN

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ABSTRACT
The purpose of this study was to investigate the effect of an 8-week Latin aerobics on the static and dynamic balance of children with congenital blindness. Ten (10) congenitally blind children participated in this single-group experimental research. This study tested the static balance of the participants through One Leg Stance (OLS) and the dynamic balance through Timed Up To Go (TUG). The data were analysed through paired t-test. Results of the study showed statistically significant differences during the OLS pre- and post-tests of the right and left legs. No statistically significant differences were observed when the OLS pre- and post-test scores of the right and left legs were compared. The result of the pre- and post-test in the TUG was statistically different. The findings highlighted the effectiveness of Latin aerobics in improving the static and dynamic balance of congenitally blind children.

KEYWORDS
Latin aerobics, exercise work-out, balance, congenitally blind

INTRODUCTION
Balance is the ability to maintain a stable position while standing, sitting, or lying (static balance) or while moving from one position to another (dynamic balance) (Lee & Scudds, 2003; Larsson & Frandin, 2006). It is a requisite of independent mobility (Colak, Bamanc, Aydin, Meric, & Ozbek, 2004; Cheung, Au, Lam, & Jones, 2008; Granacher, Muehlbauer, Bridenbaugh, Wolf, Roth, Gschwind, Wolf, Mata, & Kreesig, 2011; Surakka & Kivela, 2011) and in performing activities of daily living (Huxham, Goldie, & Patla, 2001; Lee & Scudds, 2003). Research studies (Shigematsu, Chang, Yabushita, Sakai, Nakagaichi, Nho, & Tanaka, 2002; Lee & Scudds, 2003; Cheung et al., 2008; Granacher et al., 2011) show that balance is a risk factor associated with falls which contributes to poor participation in physical activities. Persons with good balance show more confidence in exploring the environment (Campbell, Robertson, La Grow, Kerse, Sanderson, Jacobs, Sharp, & Hale, 2005) and spend lesser energy in performing a task.

Vision is an essential factor in the maintenance of balance (Lee & Scudds, 2003; Larsson & Frandin, 2006; Colak et al., 2004; Lord, 2006; Freeman, Broman, Turano & West, 2008; Surakka & Kivela, 2011; Melton, Horvat & Ray, 2011; Haibach, Lieberman & Pritchett, 2011; Mancinelli, Mandich & Utzman, 2011; Hashemi, Dehghani, Saboonchi, Roozbahani & Roonasi, 2012). It is noted that persons with visual impairment and blindness exhibit decreased balance (Lee & Scudds, 2003) which leads to their inactivity (Lieberman & McHugh, 2001; Surakka & Kivela, 2011). Vision enables a person to maintain the center of gravity in preparation for the necessary body position required by the nature of the environment and the task to be performed (Huxham...
et al., 2001). In addition, vision provides the opportunity to observe and imitate the proper execution of motor skills (Houwen, Visscher, Lemmink, & Hartman, 2007).

On one hand, the loss of vision does not completely operate independently of the other systems to increase the likelihood of poor balance. Other factor that may influence balance for instance is muscle strength (Cheung et al., 2008). Accordingly, Ringsberg, Gerdhem, Johansson, & Obrant, (1999) noted that weak leg muscles are likely to have poor balance. The contention on the important relationship between the muscular strength of the lower extremities and the maintenance of balance is proven in the study of Wu, Tsao, Hsu, Tu, & Yang (2011). From their literature review, Wu et al. (2011) found out that strong leg muscles help maintain balance which lead to lesser incidence of falls.

Meanwhile, the benefits of regular participation in exercise work-outs are well documented. Nevertheless, despite research recommendations, a great proportion of people do not actively engage in exercise programs. The inactivity is more prevalent among persons with disabilities most especially for those with visual impairments and blindness (Lieberman & McHugh, 2001; Miszko, Ramsey, & Blasch, 2004; Campbell et al., 2005; Hashemi et al., 2012). The sedentary lifestyle of persons with blindness leads to the poor muscular strength of their lower extremities which contributes to their poor balance (Houwen et al., 2007; Steinman, Nguyen, Pynoos, & Leland, 2011).

Several studies explored the effects of physical activities, exercise, dance and dance-based aerobics on the motivation to participate in physical activities (Chao, Au, Lam, & Jones, 2011), and on the enhancement of motor fitness, muscular strength, flexibility, posture, gait speed, and balance (Colak, 2004; Cheung et al., 2008; Surakka & Kivela, 2011; Dig-o, 2011; Jeter, Dagnelie, Khalsa, Haaz, Bittner, 2012) of persons with visual impairments. These studies showed positive results; however, the researcher in this study found limited researches that explored the effects of Latin Aerobics (LA) as an intervention to balance problems of congenitally blind children. The paucity of literature on the effects of LA in the enhancement of balance of congenitally blind children leaves a room for investigation. It is therefore the aim of this study to explore the effects of LA on the static and dynamic balance of congenitally blind children. It is expected that the introduction of LA to congenitally blind children will enhance their static and dynamic balance.

Research studies that employed ballroom dancing as an intervention for fitness revealed improvements in balance among others. For example, an 8-week Salsa dance training improved the balance of older adults (Granacher et al., 2011). On one hand, compared to other forms of low impact aerobic exercises, with music ranging from 115-125b/minute, LA uses the combined basic steps of Latin Ballroom Dances (LBD) (Rumba, Cha Cha Cha, Jive & Samba) which greatly involves the feet, legs, hips, and trunk with intermittent hand movements. In addition, the performance of the steps on toes (Granacher et al., 2011), shoulder and hip isolation (Nagata, Okumoto, Iwai, Toro, & Inokuchi, 2004), bouncing movements, and intermittent arm movements adapted in LBD, adds challenge to the exercise which may increase the force to the contraction of the muscles. Theoretically, the contraction of the muscle stimulates the bone to develop (osteoblast); conversely, the immobility of the muscle results to bone resorption (osteoclast). Hence, the contraction of the muscles during the LA may increase the force applied to the bone
which may induce bone density. Accordingly, on the physiological aspect, bone density is a potential factor associated with balance (Weirich, Bemben, & Bemben, 2010).

The evidences on the effects of dance aerobic programs on the enhancement of balance clearly show the need to continue gaining insight into the interventions to be designed to address the problem of poor balance, most especially for children with visual impairment. Meanwhile, interventions on poor balance done during the early years is important in ensuring increased participation in physical activities and enhancement of motor skills which are critical factors in attaining physical fitness (Hardy, King, Farrell, Macniven, & Howlett, 2009; Hashemi et al., 2012). These factors contribute to the motivation of the researcher to involve the children with congenital blindness in LA.

RESEARCH METHOD

Research Design
This quantitative research employed the single-group experimental research design. The different balance tests were conducted to a single class of congenitally blind students. Pre-tests and post-tests were conducted to identify the effects of Latin Aerobics to the balance of congenitally blind students.

Research Participants and Setting
This study was conducted in one school for the blind in Baguio City, Philippines. It involved ten (10) congenitally blind children (five males and five females) with age ranging from 7 to 13 years. The limited number of the study recruits influenced the researcher to employ a single group experimental design.

Two from the ten study recruits were obese. Based on the assessment of the physical therapists, all participants were flat footed and have varying postural problems. One participant has severe postural problem which was aggravated with pigeon-breast. Nevertheless, no one from the ten study recruits was suffering from any illness and none of them were reported to have any injury or fracture. Moreover, none of the subjects had problems of mental retardation. All of the ten study recruits passed the eligibility criteria of this research.

Results of the interviews with the participants showed that they have poor stability. The participants attributed their walking difficulty and fall experiences to their poor balance. To maintain balance and prevent falls, the participants walk by sliding instead of lifting their foot. Seven of the participants further pointed out that due to poor balance, they don’t have confidence in exploring their environment; hence, they avoid participation in physical activities.

Data Gathering Tools and Procedures
It has been noted in research studies (Miszko et al., 2004) that an eight (8) week exercise program for persons with visual impairments was effective. Meanwhile, the duration of the exercise session (1 hour/session) and frequency per week (3x/ week) was based on the recommendation of the American College of Sports Medicine (ASCM) (2006). Each 60-minute session was composed of 10-15-minute warm-up, 30-minute proper work-out, and 10-15-minute cool-down. Such distribution of time on the phases of exercise showed positive results on the effects of dance-
based aerobic exercise to the enhancement of balance and locomotion of elderly women (Shigematsu et al., 2002).

The pre-tests were conducted as soon as the participants were able to perform the steps of the exercise work-out. The researcher adapted the methods and procedures used by (Larsson & Frandin, 2006) in measuring the static and dynamic balance of persons with acquired blindness. More specifically, the One Leg Stance (OLS) was used to assess the static balance while the Timed Up and Go (TUG) was used to assess the dynamic balance of congenitally blind children.

In doing the One Leg Stance (OLS), the participant was asked to stand on one leg with the hands at the back and the head in an upright position. The hips were in a neutral position and the knee of the lifted leg was flexed 90 degrees. The test was interrupted after the subject left the standardized position even without reaching the 30 seconds. The test was done with three trials on each leg but only the best measurement on the right and left leg was used for the data analysis. On one hand, the Timed Up to Go (TUG) employed the following procedures: the participant was seated in a monoblock chair with arm rests with their back leaning at the back of the chair. On a given signal, the participant on his/her own pace stood up, walked forward to a horizontally placed rope three meters away, turned around, and returned to his/her the original position in the chair. The participants did not use cane in doing the test but were guided through cuing. To observe consistency in the instruction during the pre and posttest, the participants were only given the instructions “stand and go” (from seating position), “turn” (upon reaching the end), and “turn and sit” (upon reaching the chair). The participants were allowed to have a trial to get acquainted with the procedure and the environment. The score in the TUG was recorded in their second try.

The data gathered from the pre- and post-tests were treated through paired t-test to know the effect of LA on the static and dynamic balance of congenitally blind children (Lewicki & Hill, 2005). The effect size of areas with statistically significant differences was computed (Gravetter & Wallnou, 2009). All the study recruits actively participated and finished the entire Latin aerobic exercise program and the pre- and post-tests. Only three out of twenty-five sessions (12%) were recorded with absences. Post-tests were conducted on the 9th week.

Research Ethics
After the approval of the proposal by the panel members, the researcher sought endorsement from the director of the school for the bling for the conduct of the study. Upon endorsement, the researcher solicited the consent of the guardians (teachers and caregivers) of the stay-in children and the parents of the stay-out children to ensure full support on the participation and cooperation of their wards. The researcher explained to the guardians and parents of the children the purpose, nature, procedure, benefits of the study, and some possible difficulties that may be encountered by the participants during the course of the study. The researcher, together with Latin ballroom and Physical Education teachers taught the steps and movements of the aerobic exercise before the formal introduction of the eight (8) week LA exercise program to ensure safety of the participants, proper execution, and mastery of the steps. The LA steps were taught to the congenitally blind children through verbal cuing and assisted movements. These teaching strategies were proven to be effective in teaching Tai Chi to people with visual impairments (Miszko et al., 2004). The add-on method of choreography was employed to prevent boredom and monotony among the participants.
RESEARCH RESULT AND DISCUSSION

After the 8-week exercise program, large effects of changes were observed when the scores in the pre-tests and post-tests on the static and dynamic balance of the participants were compared. The mean changes in the length of time the children stood on one leg during the pre- and post-tests were significantly \((t_{\text{stat}} = -7.28 > t_{\text{critical}} = 2.26, \text{right leg}; t_{\text{stat}} = -8.40 > t_{\text{critical}} = 2.26, \text{left leg})\) different. Meanwhile, there were no statistically significant \((t_{\text{stat}} = .70 < t_{\text{critical}} = 2.26, \text{pre-tests}; t_{\text{stat}} = -0.94 < t_{\text{critical}} = 2.26, \text{post-tests})\) differences on the length of time the children stood on one leg when the pre- and post-tests scores of their right and left legs were compared. There was a statistically significant \((t_{\text{stat}} = 8.10 > t_{\text{critical}} = 2.26)\) difference observed in the length of time walked in the Timed Up To Go during the pre- and post-test. Results are shown in Table 1.

| Table 1: Outcome Measures of Static and Dynamic Balance of Children with Congenital Blindness at Pre- and Post-tests |
|--------------------------------------------------------|---------------------------------|-----------------|--------|------|--------|
| Static Balance                                         |                                |                 |        |      |        |
| Right Leg – One Leg Stance                             | Mean (n=10)                    | 1.38            | 2.92   | -7.28| 2.26   | S     | 0.85  | LE    |
| Left leg – One Leg Stance                              | Mean (n=10)                    | 1.37            | 2.98   | -8.40| 2.26   | S     | 0.89  | LE    |
| OLS – Pre-tests of R & L Leg                           | Mean (n=10)                    |                 | 0.70   | 2.26 | NS     |       |       |       |
| OLS – Post-tests of R & L Leg                          | Mean (n=10)                    |                 | -0.94  | 2.26 | NS     |       |       |       |
| Dynamic Balance                                        |                                |                 |        |      |        |
| Timed Up To Go                                         | Mean (n=10)                    | 30.65           | 24.46  | 8.10 | 2.26   | S     | 0.88  | LE    |

Legend: \(S = \) significant; \(NS =\) not significant; \(LE = \) large effect

The great increase in the mean scores in the post-tests of the right and left legs in the OLS and impressively large decrease in the mean scores in the post-test in the TUG clearly indicated that the static and dynamic balance of the children with congenital blindness improved after an 8-week LA intervention. The findings in this study are in consonance with the findings of Larsson and Frandin (2006) when they said that an 8-week danced-based training contributes to the enhancement of static balance of persons with visual impairments. No significant improvement in the dynamic balance however was observed by (Larsson & Frandin, 2006).

The success of the intervention is probably associated to high exercise adherence of the participants. Contrary to the findings in literatures that children with visual impairments have poor exercise adherence, in the present study, all the study recruits finished the 8-week program with only three (3) days (12%) recorded with absences. Meanwhile, one reason for the high adherence of the participants in LA is most likely because it is a dance-based group aerobics. Moving as a group provided the participants with more socialization opportunities which helped promote the feeling of emotional security. Accordingly, Green and Miyahara (2008) cited that organized group activities are motivating to persons with visual impairments. Moreover, compared to other forms of exercises, the steps of LA were based from the Latin dances which according to Kattenstroth et al. (2010) as cited by Kim, Kim, Ahn, Lim, Kang, Cho, Park, and Song (2011) have the additional
benefits of stimulating emotions, promoting social interaction, and exposing participants to acoustic stimulation and music. LA was also a new experience to the participants which they enjoyed doing. According to Allender, Cowburn, and Foster (2006) fun, enjoyment, and social support are necessary considerations in motivating participation to physical activities.

As cited by Chao et al. (2011), children with visual impairments like music; hence, it is a good motivation for them to engage in dance exercise. In a study conducted by Gfeller (1988) on the attitudes of young adults concerning the influence of various types of music on aerobic fitness activities, she concluded that music can be a motivation as it serves as a distraction from the discomforts of physical exertion.

It has also been noted earlier that the children mastered the steps of the exercise as a result of the teaching strategies used and the add-on method of choreography. This was probably one of the factors that sustained the participation of the children in the intervention program. The mastery of the exercise steps and movements can be associated to task-self-efficacy which refers to the confidence in one’s ability to perform the elemental aspects of a task. Cumming and Hall (2004) for example found out that exercisers with high levels of task orientation have higher levels of self-efficacy than those with low levels of task orientation.

Despite the statistically significant increase in the post-intervention, the time stood with the right and left legs of the participants in the one leg stance are still far behind par. Moreover, the statistical results evidently showed that both right and left legs of the participants have poor static balance as there were no significant differences in the mean scores obtained in the pre- and post-tests. According to Shumway-Cook and Horak (1986) as cited by (Madureira, Takayam, Gallinano, Caparbo, Costa, and Pereira (2007), a person who cannot remain for at least 30 seconds in each of the six conditions has poor balance. In the TUG which was used to test the dynamic balance of the participants in the present study, the mean score of 24.46 is high compared to the baseline time spent (10 seconds) by the elderly regardless of visual impairment (Larsson and Frandin (2006). These findings indicated that the children with visual impairment have poor static and dynamic balance. These findings were consistent with the observations of previous researchers that persons with visual impairments have poor balance (Lee and Scudds, 2003; Houwen et al., 2007; Dig-o, 2011; Steinman et al., 2011).

Meanwhile, aside from the loss of vision which has been pointed out in several studies as the primary reason for poor balance among blind persons, the findings in this study also proved that flat footedness is a contributory factor to poor balance. This is in agreement with the finding of Menz, Morris, and Lord (2005) that foot and ankle characteristics significantly contribute to balance and functional ability in older people. The relationship of flat-foot and balance is further demonstrated in the energy requirement of the foot due to its lack of stability (Galli, Cimolin, Pau, Costici, & Albertini, 2013). According to Collins & Kou (2010) as cited by Galli, Cimolin, Pau, Costici, and Albertini (2013), the foot arch lessens muscle fatigue and reduces energy consumption.

Another interesting specific finding in this study is the effect of obesity and postural problem to balance. In the performance of the one leg stance, three (two obese and one with severe postural problem) scored lower than one (1) second on the right and left legs during the pre-tests. The
same participants scored two (2) seconds and below on the right and left legs during the post-tests. The findings in this study may support the findings of previous researches (Hue, Simoneau, Marcotte, Berrigan, Dore, Marceau, Marceau, Tremblay, & Teasdale, 2006; Teasdale, Hue, Marcotte, Berrigan, Simoneau, Dore, Marceau, Marceau, & Tremblay, 2007; Sinaki, Brey, Hughes, Larson, & Kaufman, 2005) that an increase in body weight and osteoporosis and postural problems correlate with greater balance instability.

CONCLUSION

Latin aerobics is an effective intervention for enhancing static and dynamic balance of congenitally blind children. Significant changes can be observed from an intervention program that is performed three times a week for the duration of eight weeks. The poor balance of children with congenital blindness is not only due to loss of vision but also of physiological problems.

Certain limitations of the study were acknowledged. Although OLS and TUG are valid measures of balance, future researchers may consider using varied types of balance measurement tools to identify specific balance components. Moreover, future researchers may consider conducting the research to a larger population and apply other research designs for more conclusive results.

REFERENCES


