DYNAMIC BALANCE IN GIRLS PRACTICING RECREATIONAL RHYTHMIC GYMNASTICS AND GREEK TRADITIONAL DANCES

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Abstract

Balance ability influences learning and implementation of new skills, constitutes the basic factor for success in all athletic activities, and is a reliable predicting factor regarding the development of basic motor skills, academic success and risk of athletic injuries. The purpose of the present study was to examine the effect of a rhythmic gymnastics program and of a Greek traditional dances program on the dynamic balance ability of girls. Twenty-seven girls took part in the study. They were divided in two groups: Group A, received a 12-week program of Greek traditional dances at a frequency of one lesson per week for 90 minutes, while Group B, received a 12-week program of rhythmic gymnastics at a frequency of three lessons per week, each for 60 minutes. The frequency of the lessons was the accustomed one to the clubs of Greek traditional dances as well as to the clubs of rhythmic gymnastics with no competitive purpose. The methods of data collection included pretest and posttest measurements of the dynamic balance for the subjects of both groups. Dynamic balance was measured by the stabilometer platform (Lafayette Instruments). The results showed that after the 12-week intervention programs dynamic balance increased from 33.31±9.51 sec to 38.24±9.46 sec (z=-2.67, p<0.01) for Group A and from 30.83±5.57 sec to 36.69±7.68 sec (z=-2.44, p<0.01) for Group B. Consequently, rhythmic gymnastics, as well as Greek traditional dances are two activities that, even in a non-competitive form, could be used in order to improve children's dynamic balance ability.

Keywords*: non-competive rhythmic gymnastics and dance, abilities, children.*

INTRODUCTION

Balance can be defined as the ability to maintain the body's center of gravity over its base of support within minimal way or maximal steadiness (Emery, 2003) and is distinguished into static and dynamic. Static balance is the ability to balance on a stable surface without any other movement, whereas dynamic balance is the ability to balance on a moving surface or to maintain balance while moving (Fleishman, 1972). Postural regulation is organized in hierarchic and stereotypic patterns (Horak &

Nashner, 1986) and requires the integration of afferent information from the visual, vestibular, and proprioceptive systems (Massion, 1998).

Balance ability considerably influences learning and implementation of new skills, constitutes the basic factor for success in all athletic activities (McGuine, Greene, Best & Leverson, 2000) and is a reliable predicting factor regarding the development of basic motor skills such as walking, running, and throwing, academic success and risk of athletic injuries (Butterfield & Loovis, 1994). Moreover, dynamic balance is strongly associated with wrist and forearm fracture risk in children, and may effect on fracture prevention strategies in children (Morley & Jones, 2004). Balance improvement is considered to be most important because its acquisition even at a minimal level provides the opportunity to walk, run, and jump in various ways, whereas individuals with good balance can turn their attention in more complex and demanding activities (Keogh & Sugden, 1985).

Regular participation in physical activity has a positive impact on balance. More specifically, sport training enhances the ability to use somatosensory and otolithic information, which improves postural capabilities (Bringoux, Marin, Nougier, Barraud & Raphel, 2000). Postural changes are different according to the sport practiced (Davlin, 2004). For example, judo training leads to greater importance being placed on somatosensory information, whereas dance training results in more attention to visual information (Perrin, Deviterne, Hugel, & Perrot, 2002). Moreover, nonspecific tasks such as bipedal stance are typically used in activities of daily living, (Asseman, Caron & Cremieux, 2004).

In agreement, Steadman, Donaldson and Kalra (2003) evaluated the effectiveness of a balance training program to see if it improves mobility in adults with balance issues. They concluded that an exercise program can significantly improve balance and mobility in people with balance problems and training may improve confidence and quality of life. In addition, Clary, Barnes, Bemden, Knehans and Bemden (2006) found that 'Ballates' training effectively improved dynamic balance, while step aerobics and walking programs improved both static and dynamic balance.

Static balance and dynamic balance are basal abilities for sports like gymnastics, rhythmic gymnastics, dance etc. (Fleishman, 1972). It could be said that performing complex motor skills, such as those performed by gymnasts or dancers, requires a great sense of balance. However, it still remains unclear if the dance- or rhythmic gymnastics-based training can improve balance. Moreover, although numerous studies have examined the effectiveness of many motor programs in improving balance (Bologun, Adesinasi & Marzouk, 1992; Fotiadou, Giagazoglou, Kokaridas, Angelopoulou, Tsimaras & Tsorbatzoudis, 2002; Freeman, Dean & Hanham, 1965; Gross & Thompson, 1957; Seidler & Martin, 1997) almost no study has examined the effectiveness of a Greek traditional dances program in comparison with a rhythmic gymnastics program as for the balance improvement in children. Thus, the purpose of the present study was to examine the effectiveness of a rhythmic gymnastics program and of a Greek traditional dances program on girl's dynamic balance.

METHODS

From all the members of a Fitness Club and a Greek Dance Club, thirty (30) healthy girls, fifteen (15) girls of each club, were selected randomly and participated in the study voluntarily. All the subjects fulfilled the inclusion criteria such as being 6-to-12 years old, being member only in a Fitness Club or in a Greek Dance Club for non-competitive purpose and having a certification of medical control so that it could be certified that they could participate in exercise.

The subjects were assigned to two groups. Group A was consisted of fifteen girls (15), members of the Greek Dance Club and group B was consisted of fifteen girls (15), members of the Fitness Club. At the end of the research, the data of three participants of Group A were excluded because, due to illnesses, they were missing for more than two dance sessions. Finally, the studied subjects of Group A were twelve (12) girls, and of Group B were fifteen (15) girls. The two groups were in all respects identical. The somatometric characteristics of the two groups are presented in Table 1.

Table 1. *Sample's somatometric characteristics.*

Variables	Group A Greek traditional dances (N=12)		Group B Rythmic gymnastics (N=15)	
	M	SD	M	SD
Age (years)	7.83	1.99	8.10	1.75
Height (cm)	130.33	12.30	131.15	11.78
Weight (kg)	30.83	10.17	31.15	11.05
Body Mass Index (kg/m^2)	17.77	3.32	18.11	3.21

As for age, height, weight and body mass index (BMI), the *Mann Whitneytest* revealed no significant differences between the two groups.

Dynamic Balance was assessed by the stabilometer platform (Lafayette Instruments). Two electronic clocks recorded the duration of the trial (60 sec.) and the subjects' performance in sec. The performance clock stopped each time the platform deviated more than 15° from horizontal. A practice of 30 sec was given before the initiation of the test.

Physical measurements. - Measurements of girl's height and weight were performed. Height was measured using a portable stadiometer, to the nearest 0.1 cm. Weight was measured using an accurate scale, to the nearest 100g. All the girls removed their shoes and wear only light indoor clothing. Moreover, BMI was calculated dividing the weight in kg with height^2 in m.

An approval for the conduct of the research was given from the Fitness Club manager and Greek Dance Club manager, after the aim and the design of the research were described. Procedures were in agreement with ethical standards of the Declaration of Helsinki of the World Medical Association (2000).

Before the beginning of the research, a description of general requirements was given and, still, the aim of the research was described to the participants and their parents without any briefing relative to previous research findings. The need for regular participation was particularly emphasized on subjects of both groups. It was, also, noted that a subject missing for more than two exercise bouts, for any reason, would excluded from the research. In addition, a written informed consent for the participation in the research was obtained from the parents of each girl.

Group A, received a program which was constituted by the performance of Greek traditional dances, whereas Group B received a program which was constituted by the performance of rhythmic gymnastics. Teaching of the performed Greek traditional dances, as well as rhythmic gymnastics was conducted by teachers of physical education with extensive practical experience in the two forms of physical activity.

As for Group A, the duration of the Greek traditional dances program was 12 weeks, at a frequency of one lesson per week, for 90 min. The frequency of the lessons was the accustomed one to the clubs of Greek traditional dances. The performed Greek traditional dances were from all Greek geographic areas with music accompaniment. The program was designed according to certain basic dances, while the purpose was to enrich the program with a

variety of dances, regarding the rhythm, the kinetic repertoire, the style, the handgrips etc.

In order to begin to dance the subjects were holding each other using a variety of handholds, creating a hemi-cycle. Instead of warm-up exercises, each session started with one-or-two slow dances of 5 min duration aiming at the body preparation for avoiding possible injuries. Next, the main part of each session included Greek traditional dances (~80 min) from different areas of Greece and included a variety of simple kinetic patterns and alternations. The dances intensity ranged from low to vigorous (Pitsi, 2005). The duration of each dance was about 2.5 to 3.5 min. Essential breaks of approximately 10 sec in between dances in order to change dance and to give a fast verbal feedback as for the following dance were made.

The selection of Greek traditional dances was made according to the following criteria: (a) Simple steps and shapes in space, and more demanding movements (e.g., hops-rebounds). (b) A variety of handholds (simple -arms down-, W-shape, shoulder grip, etc) was preferred so as to increase participants' interest. (c) Familiar, desirable or pleasant hearings for participants. d) The selected dances were the appropriate, as for the degree of difficulty, according to the subjects' skill level.

Table 2. *The main part of the rhythmic gymnastics program.*

Exercises	Initial Position	Exercise Description
1) with Running	a) Upright standing:	With the command- perform a turn and run forward.
	b) Prone- with the feet infront:	With the command- stand up and run forward.
	c) Supine- with the back infront:	With the command- stand up and run forward
2) with Music	Colorations: Running with music.	Stop unmoved with feet closed.
	Colorations: Running with music.	Stop on releve - hands on first position.
	Colorations: Running with music.	Stop with foot on passe.
3) with Ball	Upright standing:	Throw the ball up - Catch with the eyes closed.
	Upright standing:	Throw the ball up - perform a half turn and catch.
	Upright standing:	Stroke the ball down - Catch behind the back.
	On knees:	Roll the ball from one hand to the other.

The balls were rhythmic gymnastics balls.

Each training session concluded with a 5-minute cooldown period with one-or-two slow dances. All participants wore athletic shoes and sport clothes during each session.

As for Group B, the duration of the rhythmic gymnastics program was, also, 12 weeks, at a frequency of three lessons per week, for 60 min. The frequency of the lessons was the accustomed one to the clubs of rhythmic gymnastics with no competitive purpose. The selection of rhythmic gymnastics exercises was made according to the following criteria: (a) Familiar, desirable and pleasant music for the girls, (b) Simple steps and simple combinations of steps. (c) Basic body movement techniques, apparatus techniques and rhythm elements. (d) The selected elements in rhythmic gymnastics were the appropriate, as for the degree of difficulty, according to the subjects' skill level.

Each session started with a 5-minute warm-up period that included stretching exercises for avoiding possible injuries.

Next, the main part of each session included rhythmic gymnastics movements (~50 min). More specifically, the rhythmic gymnastics program contained exercises with running, music and ball, that repeated eight times each one (Table 2).

Essential breaks of approximately 10 sec in between exercises in order to change exercise and to give a fast verbal feedback as for the following exercise were made. Each training session concluded with a 5-minute cooldown period including stretching exercises. All participants wore special shoes and clothes for rhythmic gymnastics during each session.

The training sessions of both Groups were organized at the indoor gymnasium of the participants' club. The safe and comfortable environment provided by the indoor gymnasium facilities and minimum means (a CD player and a CD disc) required for running the whole program contributed to the trouble-free conduction of the program.

Testing for the participants of both groups included the same two (2) measurements (initial and final). More specifically, for Group A two measurements were carried out, that is before and after the application of the 12-week Greek traditional dances intervention program and for Group B before and after the application of the 12-week rhythmic gymnastics intervention program. The measurements of dynamic balance ability took place at the indoor gymnasium of the participants' club.

For the statistical analysis the Statistical Package for Social Sciences (SPSS) ver. 18.0 for windows was used. Descriptive analysis was used. In addition, a test was made in order to evaluate possible differences between initial and final measurements, that is before and after the 12-week participation in the two intervention programs. For this purpose the *non-parametric test Wilcoxon*, for correlated samples or samples from the same population for the test of statistical difference, was used. Moreover, a test was made in order to evaluate possible differences between groups, that is between Group A- that participated in the Greek Traditional Dances program and between Group B that participated in the rhythmic gymnastics program, as for somatometric characteristics and the studied variables before and after the 12-week intervention programs. For this purpose the *non-parametric test Mann Whitney*, for two independent samples for the test of statistical difference, was used. The level of significance was set to $p<0.05$.

RESULTS

In Figure 1, the mean difference as well as the Standard Deviation of the dynamic balance alteration after the Greek traditional dances program and the rhytmic gymnastics program are presented. It is obvious that there were similar increases in the dynamic balance scores after the 12-week programs of Greek traditional dances and rhythmic gymnastics, as well (Fig. 1).

In addition, the scores of the dynamic balance ability of the two groups, before and after the application of the intervention programs and the significance of any demonstrated change are presented in Table 3. As shown from the *Mahn Whitney test*, comparing the values of dynamic balance between the two groups before and after the application of the programs, no statistical difference was found ($p>0.05$).

In contrary, the *non-parametric Wilcoxon signed rank test* revealed that Group A and also Group B were significantly superior at the final measurement. Thus, after the 12-week dance program, as well as after the rhythmic gymnastics program there was a significant improvement in terms of dynamic balance ability (Table 3).

DISCUSSION

The primary objective of the present study was to examine whether a Greek traditional dances program, as well as a rhythmic gymnastics program results in positive effects on girls' dynamic balance.

Moreover, the effectiveness of the Greek traditional dances program was contrasted with that of the rhythmic gymnastics program. Thus, girls taking Greek dance training were compared to girls who were taking rhythmic gymnastics training. The results overall indicate that Greek traditional dances and, also, rhythmic gymnastics possess properties improving young girls' dynamic balance. In addition, the results of the Greek traditional dances are comparable to those of the rhythmic gymnastics. So, it could be said that practice or experience appears to modify scores on abilities needed for skilled performance (Magill, 1993; Regnier & Salmela, 1987; Schmidt, 1991; Thomas & Halliwell, 1976).

Table 3. *Values of dynamic balance pre and post the Greek traditional dances program (Group A) and the rhythmic gymnastics program (Group B).*

Measures	*Pre-program*		*After-program*		*p*	
	M (sec)	*SD*	*M (sec)*	*SD*	*z & p*	
Group A	33.31	9.51	38.24	9.46	-2.67	<0.01
Group B	30.83	5.57	36.69	7.68	-2.44	<0.01
*p**	*NS*		*NS*			

p: between measurements pre/post, *p**: between groups

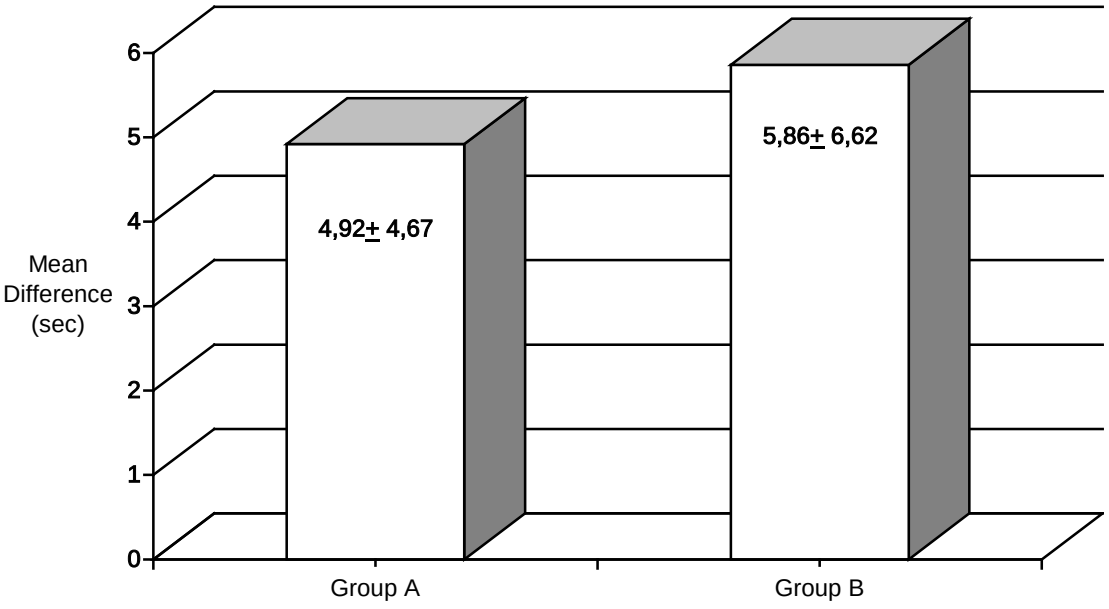

Figure 1. *Mean Difference of the Dynamic Balance alteration after the Greek traditional dances program-Group A and Rhytmic Gymnastics program-Group B.*

More specifically, in the present study was found out that Greek traditional dances increased dynamic balance. In agreement, Mouchnino, Aurenty, Massion and Pedotti (1992) found that the lateral sway of the center of pressure, during unilateral leg movements performed while standing was smaller in dancers than in untrained subjects, indicating the effect of dance practice. Dancers maintain balance when turning by using a technique called spotting. The eyes focus on a stationary object and the head turns slightly ahead of the rotation of the body (Horvat, Ray, Ramscy, Miszko, Keeney & Blasch, 2003). So, dance and creative dance, influences static and dynamic balance to a great extent, affects motor performance and self-concept and consequently seems to be an ideal physical activity for children (Loeffler, 2007), for older people (Birkel, 1998; Federici, Bellagamba & Rocchi, 2005; Kravitz, 1994; Mavrovouniotis & Argiriadou, 2008; Mavrovouniotis, Argiriadou & Papaioannou, 2010), for persons with balance, and/or kinaesthetic problems (Kephart, 1971; Pennella, 1979), or for hearing impaired persons (Reber & Sherrill, 1981; Wisher, 1979). Thereby, dance can be considered not only as a supplementary vehicle in the learning process, but also as an indispensable tool that facilitates self-actualization, especially the awareness of the body to appreciate its ability for movement (Hottendorf, 1989; Wisher, 1979).

In addition, via dancing a safety and confidence climate created in which sentiments expression attained via movement (Cooper & Thomas, 2002). An environment, absolutely adapted to young girls' faculties was offered. This happened because the Greek traditional dances program included a variety of simple kinetic patterns, was of low, moderate and high intensity, depending on the participants' capacities, with appropriate intervals and frequent rhythm alternations.

Moreover, in the present study was, also, found out that rhythmic gymnastics increased dynamic balance. In agreement, other authors suggest that gymnasts or/and subjects who are training in gymnastics have better dynamic and static balance than inexperienced athletes and than novices (Kioumourtzoglou, Derri, Mertzanidou & Tzetzis, 1997; Robertson, Collins, Elliot & Starkes, 1994), indicating the effect of rhythmic gymnastics practice. On the contrary, Vuillerme, Danion, Martin, Boyadjian, Prieur, Weise and Nougier (2001) showed no direct evidence that gymnasts would possess a better sense of balance than any other sportsmen during bi- and unipedal standing. Nevertheless, gymnasts present the particularity of being less dependent on visual cues than other sportsmen for maintaining balance in challenging postures.

Age and more practice improve balance control, leading to better postural control and decreased postural sway (Rival, Ceyte & Olivier, 2005). In agreement, the girls in the present study after practising in Greek traditional dances, as well as in rhythmic gymnastics for 12 weeks achieved significant improvement in terms of dynamic balance ability, proving that practice is an important element to balance improvement. However, it is not only the practice but mainly it is practicing on dance and on rhythmic gymnastics, the performance of complex motor skills that require a great sense of balance (Vuillerme, Danion, Martin, Boyadjian, Prieur, Weise & Nougier, 2001), that improved girl's balance. According to Shumway-Cook and Woollacott (2001), creative movement helps children to control their bodies and develop awareness of moving in a space with other children.

In addition, optimally coordinated functioning of the muscles and the entire kinetic chain is important for balance and effective walking. Optimal twist of the trunk, shoulder rotation and reciprocal arm swings are necessary for good balance and gait (Whittle, 2007). In optimal posture and balance, body segments are aligned one on top of the other, so that the centre of gravity of each segment is directly above the centre of gravity of the one below (Rosen, 1997).

Body segments are sequentially activated to perform functional or athletic tasks (Kibler, 1998**;** Kibler, McMullen, & Uhi, 2001).

So, practice in a task like dance or rhythmic gymnastics can help girls to demonstrate a better sense of balance in non-dancing tasks, like standing on the platform of the stabilometer. Thus, the present revealed balance improvement, as a result of the two different 12-week programs- Greek traditional dances and non-competitive rhythmic gymnastics- can be supported by the theory for the transfer of motor abilities. That is the capability for performance in one task could be a result of practice on some other task. Thereby, based on the general motor ability hypothesis (Adams, 1987), the better sense of balance as a human motor skill, should remain observable among various tests requiring balance skills. In addition, Hatzitaki, Zisi, Kollias and Kioumourtzoglou **(**2002) found out that balancing under static conditions was strongly associated with the ability to perceive and process visual information, which is important for feedback-based control of balance. On the other hand, when greater task demands were imposed on the system under dynamic balancing conditions, the ability to respond to the destabilizing hip abductions–adductions in order to maintain equilibrium was associated with motor response speed, suggesting the use of a descending, feedforward control strategy.

Moreover, music contribution is also important. Music is an integral element of dance and of rhythmic gymnastics. Music and movement are linked even from birth and infancy (Kulich, 1989). Undeniably, music in many forms is an accessible accompaniment to either improvised or more structure movement sequences (Loeffler, 2007). It has, however, been proved that rhythmical music improves walking co-ordination and movement proprioceptive control and leads in increase of stability and mobility (Kravitz, 1994; Staum, 1983).

Consequently, from the results of the present study it is clear that the dynamic balance ability can be significantly and, also, similarly improved for these two groups of girls, after a Greek traditional dances program, as well as after a rhythmic gymnastics program.

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