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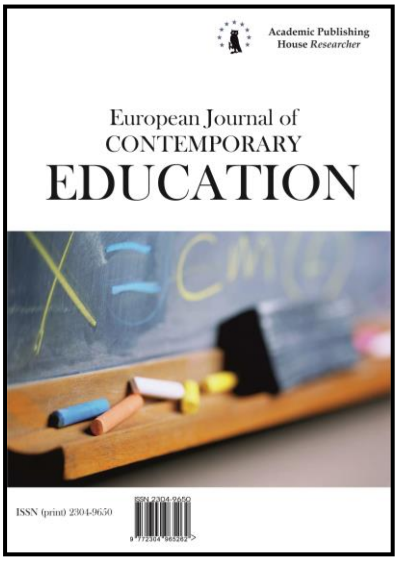

Effects of Education Programs on Dance Sport Performance in Youth Dancers

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Abstract

The aim of this study was to investigate the effects of education programs on dance performance in youth sports dancers. Fifty-four subjects (aged 9-11 years) volunteered to participate in a 12 wk education program and were randomly assigned to three groups. The experimental group one (EG-1) trained in Dance sport 2 d.wk^{-1} and performed physical training (i.e. track and field athletics, games, relays, and rhythmic gymnastics) 1 d.wk^{-1}. Experimental group two (EG-2) trained in Dance sport 2 d.wk^{-1} and performed aerobics and aerobic gymnastics exercises 1 d.wk^{-1}. The control group (CG) dancers developed their Dance sport-specific technical and tactical skills 3 d.wk^{-1}. Training occurred 3 d.wk^{-1} for a total of 54 hours. The dancers' anthropometric and physical fitness characteristics, as well as Dance sport performances were measured pre and post-intervention. No significant differences were observed at baseline between the three groups, except stature in EG-2 ($p > .005$). At post-intervention, the supplemental education sessions improved Dance sport performance scores of EG-1 ($p = .004$, $\eta^2 = .673$, $P = .943$) and EG-2 ($p = .001$, $\eta^2 = .778$, $P = .996$) dance pair; no change was observed in Dance sport performance in CG-1 ($p = .622$, $\eta^2 = .032$, $P = .074$). The application of Dance sport training combined with supplemental education improves development of Dance sport performance in youth sports dancers.

Keywords: juvenile dancers, ballroom dancing, education programs, sports performance.

1. Introduction

Dance sport is becoming increasingly popular among children and adolescents, and children have started to participate competitively (Liiv et al., 2013; Kostić et al,, 2002; Shannon, 2016). Education in dance sport is oriented toward achieving mastery in physical fitness, and in developing artistic abilities to express the ideas of dance through body movements (Malkogeorgos

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et al., 2013; Torrents et al., 2011; Walaszek, Nosal, 2014). It is a physically demanding sport (Liiv et al., 2013) that involves a significant relationship between technical fitness and motor abilities, such as body balance, flexibility, speed, endurance, and strength for performing movements of the upper and lower limbs (Kostić et al., 2002). During dance sport contests, pairs of dancers are evaluated according to movement rhythm and plasticity, dancing technique, movement coherence, body posture and hand positioning, and the harmony of movements among the pair (Kostić et al., 2002; Liiv et al., 2014; Lukić et al., 2012). The synchronicity of movements, interactions between dancers, repeated sequences of movements, and contact between dancers in a pair are of great importance (Torrents et al., 2011). Sports dancers perform nonstandard dynamic movements at varying intensities (Dornowski, Zabrocka, 2008). Because these capabilities are important predictors of success in competition, it seems reasonable to improve them early in education. Therefore, finding effective education modalities for juvenile sports dancers is of particular importance.

Studies have shown the beneficial effects of physical training on the motor abilities of juvenile sports dancers (Kostić et al., 2002). Thus, positive effects of the different dance styles used in dance sport education programs for improving physical fitness have also been reported (Koutedakis, Jamurtas, 2004). Dance education programs should include exercises to develop physical fitness, but there is little scientifically valid evidence of the acute effects of these exercises on performance in sports dancers aged 9–11 years (Torrents et al., 2011). The age range of the dancers examined here was selected by considering the optimal period of motor ability development (Armstrong et al., 2011; Lloyd et al., 2014) and the age (9–11 years) at which dancers begin to compete not only in friendly tournaments, but also as juveniles in dance sport contests with awards. Therefore, here we aimed to determine whether dance sport training would have an effect on motor performance and whether physical, aerobics, and aerobic gymnastics training combined with dance sport training might have acute effects on dance sport performance scores. A 12-week-long experimental program was conducted based on published recommendations (Kostić et al., 2002; Koutedakiset al., 2007).

The aim of this study was to investigate the effects of education programs on dance performance in youth sports dancers.

2. Research methods

Participants

Fifty-four sports dancers (girls and boys, in pairs) volunteered to participate in this study. They were divided into three groups and each group used a different education program during the 12-week study. Participants had been practicing dance sport as a leisure-time physical activity for 3 years with the same teacher, following the same education program at the same dance sport club. Composition of the body, physical fitness, and dance performances were evaluated. Pairs of participants were assigned randomly to two experimental groups: E-1 (n = 18) and E-2 (n = 18), and control group C (n = 18). In group E-1, girls were aged 9.7 ± .9 years and boys 9.9 ± .8 years; in group E-2, girls were aged 9.9 ± 1.0 years and boys 9.5 ± .9 years; and in group C, girls were aged 10.1 ± .9 years and boys 9.4 ± .7 years. We applied pre- and post-intervention physical fitness tests and dance sport performances based on competition ratings. No significant differences in physical fitness, body composition, or dance sport performance were found among the groups before intervention, except for height in group E-2. The participants and their parents were informed of the potential risks and benefits prior to signing an approved informed consent document to participate in the study. The experimental protocol was approved by our Institutional Review Board.

Education programs

The dancers trained three times per week for 12 weeks: in total 54 hours. This education program was performed while preparing for the competitive dance sport season.

Subjects in group E-1 participated in dance sport training and physical training with the schedule shown in Table 1. Physical training was in the following order: running/sprinting (sprint/hurdle shuttle relay); jumping (forward squat jumping, and cross-hopping); fitness games (run, run, chicken go home; wall-to-wall; and counting jumps); rhythmic gymnastics (hoop twisting and skipping-rope jumping); and dynamic stretching exercises. Instead of the usual 15- to 20-minute warm-up used in dance sport training twice per week, specific physical training program exercises were performed.

Subjects in group E-2 participated in dance sport training and physical training (Table 1).

Physical training sessions were in the following order: aerobics and aerobic gymnastics (basic steps, kicks, jumps, strength training exercises); stretching exercises (simple stretches and stretches with elastic bands); and aerobic exercise with relaxation. Instead of the usual 15- to 20-minute warm-up used in dance sport training twice weekly, specific aerobic and aerobic gymnastics training exercises were performed.

Subjects in control group C developed their dance sport-specific technical and tactical skills but did not participate in any special physical training (Table 1). They followed the dance sport education program of three sessions per week, each lasting 90 minutes. This training was focused on the development of technical and tactical skills. These skills, which included dance step improvement (e.g., one of the standard or Latin American basic dance steps) and dance routine development (e.g., one of the standard or Latin American dance contest routines), were performed for 60–70 minutes in three training sessions per week (Table 1). Dynamic stretching exercises for the main muscle groups were executed during the warm-up period, and static stretching exercises were performed during the cool-down period.

Table 1. Characteristics of the experimental (E-1, E-2) and control (C) group education programs

Training days	Groups		
	E-1	E-2	C
Warm-up (~15 min)			
Monday Wednesday Friday	Low-intensity running exercises, dynamic stretching exercises for the main muscle groups.	Low-intensity basic step aerobics; aerobic gymnastics exercises, dynamic stretching exercises for the main muscle groups.	Dynamic stretching exercises for the main muscle groups
Dance sport training (~60 min)			
Monday Wednesday	Development of technical and tactical skills in Standard (Monday) And Latin American (Wednesday) dances, such as dance step improvement and dance routine development.		
Friday	Physical training (~60 min)	Aerobics and aerobic gymnastics training (~60 min)	Dance sport training (~60 min)
	Running/sprinting, jumping, fitness games, rhythmic gymnastics and dynamic stretching exercises.	Basic steps, kicks, jumps, strength training exercises; stretching exercises (simple and using a band); and aerobic exercises with relaxation.	Development of technical and tactical skills in Standard and Latin American dances, such as dance step improvement and dance routine development.
Cool-down (~15 min)			
After every training	Static stretching exercises were performed.		
Total intervention education time (min)*	3240	3240	3240

Variables and measures

Independent variables were used in the three different programs. As the dependent variables, we used body composition measures including height, body mass, body mass index (BMI), body fat, free fat mass, and total body water; the physical fitness variables included plate-tapping speed endurance; one-foot lengthwise balance, vertical jumps, 20 repeated rebounding jumps, flexibility sit-and-reach tests, sit-ups, and dance sport performance scores.

Body composition characteristic measurements were performed using a Martin GPM anthropometer (DKSH, Zurich, Switzerland) for height (cm), and a Tanita Body Composition Analyzer BC-418MA (Tanita Corporation, Tokyo, Japan) for body mass (kg), BMI (kg/m^2), body fat (%), free fat mass (kg), and total body water (kg).

A speed endurance plate-tapping test (Fjortoft, 2010) was used to assess the speed endurance of upper limb movement. The intraclass correlation coefficient (ICC) of the plate-tapping test measurement was r = .990 (p < .001, standard error of the mean (SEM) ± .052).

A one-foot lengthwise balance test (Sheehan, Katz, 2013) was used to measure the ability of subjects to maintain body equilibrium. The ICC of this balance test was r = .994 (p < .001, SEM ± .162).

Vertical jumps (Carlock et al., 2004) were executed on a platform connected to a digital timer (Ergojump, Psion CM; MAGICA, Rome, Italy) that measured the flight time and calculated the jump height. The following four types of jumps were measured: a vertical jump with an arm swing, squat jumps with knees flexed at 90° or 135°, and 20 repeated jumps. The ICCs of the squat jump from 90° and 135° of knee flexion were r = .808 (p < .02, SEM ± .251) and r = .973 (p < .001, SEM ± .198), respectively. The ICC of the vertical jump with an arm swing was r = .976 (p < .001, SEM ± .147). The peak power (PP) was estimated in watts (W) using equation (Sayers et al., 1999):

$$\text{PP (W)} = (60.7) \times (\text{jump height, cm}) + 45.3 \times \text{BMI} - 2{,}055.$$

The ICC of the repeated jumps test was r = .929 (p < .001, SEM ± .224). To assess the level of fatigue during the 20 repeated jumps test, the fatigue index (FI) was calculated (the first jump was a preparation one) as recommended in (Naharudin, Yusof, 2013) using equation:

$$\text{FI} = \left[\frac{1^{st}\ jump\ (cm) - 20^{th}\ jump\ (cm)}{1^{st}\ jump\ (cm)} \times 100\% \right].$$

For flexibility, the sit-and-reach test (Castro-Piñero et al., 2010) was used. The ICC of this test was r = .952 (p < .001, SEM ± .153). The sit-up test (Armstrong et al., 2011) was also used. The ICC of this test was r = .837 (p < .001, SEM ± .295).

Dance sport performance in friendly tournaments held before and after the experiment was judged by three experts with national qualifications. The dancers were judged using scores of 3, 4, 5, and 6. The points given by all experts for each dance (slow waltz, quickstep, cha-cha-cha, and jive) were summed, and an arithmetic mean was calculated. The dancers performed the same routines at the beginning and end of the study and the assessment, as usual, was for girl and boy couples.

Data analyses

For raw data, we applied a Shapiro–Wilk test for assessing the normality of distribution. To compare the three different groups at the start of the program, we used one-way analysis of variance (ANOVA). To compare pre- and post-testing indices after the 12-week-long education programs (means and standard deviations) and the effects of training on each group, we used repeated measures one-way ANOVA (IBM SPSS Statistics, version 22.0; IBM Corp., Armonk, NY, USA), including initial values as variables, with η^2 for effect size and statistical power shown as P. The statistical significance level was set at p < .05.

3. Results

Physical fitness

Physical fitness scores during the 12-week education programs improved in the participants of intervention groups E-1 and E-2 compared with control group C scores. The results of one-way ANOVA are shown below.

The speed endurance plate-tapping test showed improved scores for girls in group E-1 (p < .05, η^2 = .397, P = .523). The flexibility sit-and-reach test showed improved scores for girls in group E-1 (p < .05, η^2 = .505, P = .707), girls in group E-2 (p < .05, η^2 = .310, P = .386), for boys in group E-1 (p < .05, η^2 = .309, P = .384), and boys in group E-2 (p < .05, η^2 = .250, P = .302). The one-foot lengthwise balance test showed improved scores for girls in group E-1 (p < .05, η^2 = .324, P = .407), boys in group E-1 (p < .05, η^2 = .675, P = .944), and boys in group E-2 (p < .05, η^2 = .592, P = .846). The sit-up test showed improved scores for girls in group E-1 (p < .05, η^2 = .074, P = .109). The squat jump at 90° of flexion showed improved scores for boys in group E-1 (p < .05, η^2 = .665, P = .935), boys in group E-2 (p < .05, η^2 = .094, P = .127), and the PP (W) result for boys in group

E-1 ($p < .05$, $\eta^2 = .705$, $P = .967$). The squat jump at 135° of flexion showed improved scores for boys in group E-1 ($p < .05$, $\eta^2 = .247$, $P = .298$), and boys in group E-2 ($p < .05$, $\eta^2 = .002$, $P = .051$); and the PP(W) result for this showed improved scores for boys in group E-1 ($p < .05$, $\eta^2 = .255$, $P = .308$) and boys in group E-2 ($p < .05$, $\eta^2 = .011$, $P = .058$). The vertical jump with an arm swing showed improved scores for girls in group E-1 ($p < .05$, $\eta^2 = .260$, $P = .315$) and boys in group E-1 ($p < .05$, $\eta^2 = .625$, $P = .890$); the PP(W) values for this test showed improved scores for boys in group E-1 ($p < .05$, $\eta^2 = .644$, $P = .913$). The 20 repeated rebounding jumps test with FI (%) showed improved scores for girls in group E-1 ($p < .05$, $\eta^2 = .253$, $P = .306$), girls in group E-2 ($p < .05$, $\eta^2 = .013$, $P = .060$), boys in group E-1 ($p < .05$, $\eta^2 = .197$, $P = .236$). and boys in group E-2 ($p < .05$, $\eta^2 = .041$, $P = .081$).

The male dancers of control group C showed significant improvements in their speed endurance plate-tapping test ($p < .05$, $\eta^2 = .319$, $P = .334$). No significant changes were observed for body composition characteristics between the three groups over the 12-week study period.

Dance sport performance

Dance sport performance pre- and post-intervention scores in friendly tournaments are shown in Table 2.

Table 2. Dance sport performance scores of the three groups for the 12-week-long education program (n = 54)

Dance sport performance scores							
Group	**Pre-intervention**		**Post-intervention**		Effect size	Observed power	Statistical significance level
	M	*SD*	*M*	*SD*	η^2	*P*	*p*
E-1 *(n = 18)*	48	8.35	53	5.95	.673	.943	.004
E-2 *(n = 18)*	49	1.83	51	1.73	.778	.996	.001
C *(n = 18)*	49	.78	49	.93	.032	.074	.622

Notes: M – mean; SD – standard deviation; E-1 and E-2 – experimental groups; C – control group

4. Discussion

It has been suggested that sports dancers must be experts in the technical aspects of their sport but must also be physically fit (Koutedakis et al., 2007). The main finding of this study was that dance sport training combined with track and field exercises, games, relays, rhythmic gymnastics, aerobics, and aerobic gymnastics increased the children's dance sport performance indices. According to the literature (Armstrong et al., 2011; Hartman, Looney, 2003), in the middle period of childhood (age 9–11 years), children have great abilities to perform gross motor skills and demanding sports activities. Children in this age range are very active and willingly participate in games, relays, and other sports. The resultant enjoyment of performing various sports activities is related to the development of motor abilities (Flatters et al., 2014). Research in the dance field has corroborated the great influence of basic motoric abilities on successful dance expression (Kostić et al., 2002; Lukić et al., 2012; Aujla et al., 2014; Chua, 2014). Motor strength in dance activities plays an important role in this. Strength as a motor ability in Latin American dancers becomes apparent with the increase in bodily expression while presenting the character of the dance that is being performed. A significant relationship was found for the muscle strength of adolescent dancers in terms of Latin American and standard dance competitions (Lukić et al., 2012).

The boys in group E-1 had significantly increased scores in the 20 repeated rebounding jumps, squat jump at 90°, a vertical jump with an arm swing, the one-foot lengthwise balance test, and the speed endurance plate-tapping test after 12 weeks of education. The girls in group E-1 exhibited significantly improved flexibility in the sit-and-reach test and sit-up test indices. Thus, the education program had a positive and acute effect on the physical fitness of male dancers; however, no significant effect was found for the girls in this study. These differences in training effects might be related to the discrepancy in maturation between girls and boys, which might in turn impact on their physical and technical fitness levels (Koutedakis et al., 2007; Aujla et al., 2014;

Walker et al., 2010). Additionally, the rapidity of growth and maturity can differ for each person (Sherar et al., 2010). The physical activity levels in children and adolescents undertaking dance sport training is considered too low, and to increase training intensiveness it is recommended to use various education programs (Cain et al., 2015). If such training could support the psychological need for autonomy, competence, and related factors, it should increase the motivation for dance sport training in girls more than boys (Amado et al., 2017). These suggestions are corroborated by our results and observations on the attendance and intensity of training. Some studies have shown a positive effect of different dance styles used in dance sport training programs on improvements in physical fitness (Koutedakis, Jamurtas, 2004). An aerobics and aerobic gymnastics training program was used for the E-2 group, and the boys in this group showed an improvement in their one-foot lengthwise balance test. Balancing ability is one of the main factors that determine technical fitness in sports that demand difficult coordinated movements (Chua, 2014; Hrysomallis, 2011). Dance sport is a noncyclic sport involving a variety of movements and demands on performance quality (Lukić et al., 2012). Static balancing ability enables the maintenance of a constant body position in required postures (Sekulic et al., 2013).

The control group of subjects only participated in the dance sport training program for 12 weeks. Nevertheless, the boys showed significant improvements in their speed endurance plate-tapping test. These improvements might be related to their age range, which corresponds to a period of increased sensitivity for speed development (Mackey et al., 2011; Dawes, Roozen, 2012). According to the literature (Uzunović et al 2009), speed endurance ability is very important in dance sport because dances are performed at intensive tempos of up to 50 measures per minute.

After 12 weeks of education, the indices of dancers' flexibility in the sit-and-reach test, one-foot lengthwise balance test, squat jumping at 90° of knee flexion, and a vertical jump with an arm swing, were increased significantly ($p < .05$) in the E-1 and E-2 groups compared with the control group. At the beginning of this study, no significant differences in physical fitness were found among the groups. Thus, the education programs used for the E-1 and E-2 groups were more effective than in the C group.

5. Conclusion

Our findings confirm the possibility of improvements in young dancers' performance by varying education programs without adding training time. Adding physical training or aerobics plus aerobic gymnastic training resulted in significant improvements in the dance sport performance scores with the same physical fitness results. Dance sport training alone did not improve the performance scores of the control group of dancers. The potential of these study findings should be studied in intervention studies recruiting young dancers from other age groups.

The limitations of this study were that only one age group was studied and only one dance sport teacher was trained in the techniques involved. Future studies should include more age groups and more physical fitness and dance sport teachers of both genders.

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