

Scientific Paper

**THE TRANSFORMATION OF STRENGTH, SPEED
AND COORDINATION UNDER THE INFLUENCE
OF SPORT DANCING**

UDC 793.3:796.012.11

Slavoljub Uzunović

University of Niš, The Faculty of Sport and Physical Education, Serbia

Abstract. *The aim of this research was to study the effects of a modern dance program on the changes in strength, speed and coordination. The sample of subjects consisted of 60 female subjects aged 13 and 14, who were divided into two sub-samples. The first one consisted of 30 female subjects who made up the experimental group, all of whom were members of the "La Luna" dance clubs in the towns of Vranje and Niš, while the other 30 female subjects, students of the "Ratko Vukičević" elementary school in Niš, made up the control group.*

The experimental program lasted for 18 weeks, and included two weekly training sessions, each lasting for a period of 60 minutes. The subjects trained using the "Disco-dance" technique which included simple and complex elements of technique, jumps and turns. The choreography of the "Disco-dance" included basic technical, elementary and complex combinations – multiplications. In addition, the subjects trained using elements of folk, sport, art, jazz and hip-hop dancing. The subjects in the control group regularly took part in their physical education classes.

Both groups were tested prior to and following the experimental program. The results were processed using an analysis of covariance, the MANCOVA and ANCOVA. The results showed that both groups had made improvements in the studied abilities, but that the changes among the members of the experimental group were more pronounced. The hierarchically highest changes that the program led to had to do with the motor skill of coordination, followed by speed and finally strength. The starting hypothesis of this research was confirmed, meaning that an experimental program of modern sport dancing has a significant effect on the changes in motor coordination, strength and speed.

Key words: *"Disco-dance", experimental program, female dancers, motor skills, effects*

1. INTRODUCTION

In order to be successful in sport, or in other words, to achieve good results, it is necessary to, among other things, develop certain motor skills. The development of motor skills is one of the primary concerns of sport training, and the development of motor skills necessary for dancing is a main topic of interest in dance training.

Dance is a highly complex motor activity. There is great interest among scientists and experts for the in-depth study of dance as an art form and as a sport-motor activity. Dance is excellent for recreational purposes. The modern day and age is a time of accumulation of capital and so the circumstances surrounding dance development are aimed in that direction. Professional dancing is increasingly becoming more of a struggle for medals and profit. The public is certainly demanding greater and greater achievements when it comes to dance movements (Haight, 1998), as is the case in other professional sports.

Professional dancers primarily use their expert performances of dance techniques and their looks to seek out engagements. These circumstances breed various topics for study in the field of training, diet, injury and the development of certain skills. For this reason, most of the available research focuses primarily on special dance techniques for a better understanding of the unique nature of movement as the prevention of certain specific injuries (Pedersen, Wilmering, Milani, & Mancha, 1999; Hamilton et al., 2005; Weisler et al., 1996).

The effects of a 12-week training program aimed at increasing the strength of the quadriceps and tendons of the knees were studied in order to obtain data which could prove helpful in preventing injuries, as well as answers to the question of influence on certain anthropometric characteristics. These training programs influenced the prevention of knee torsion, but did not lead to an increase in the aesthetic component of dancing (Koutedakis & Sharp, 2004). On the other hand, the evaluation of the effects of a 12-week aerobic and muscle strength training program on certain performance and fitness parameters showed positive effects, proving that the program led to an increase in aerobic capacity and leg strength (Koutedakis et al., 2007).

Professional dancing is the cause of certain anomalies and injuries among dancers. For this reason, it is necessary to study the medical problems of dancers. Some studies, for instance, deal with the physical deformities of dancers (Akella, Waren, Jonnavithula, & Brooks-Gunn, 1991; DeMann, 1997; Gannon & Bird, 1999).

The medical problems of dancers were studied through the scope of the analysis of the isometric and dynamic bases of strength and endurance. The prerequisite for the definition of the sample was the absence of back pain in the subject's medical history. The obtained research results can be used to eliminate inconsistencies between certain dance moves and functional abilities (Parnianpour, Davoodi, Forman, & Rose, 1994). A study supporting this claim is one that proves that modern and sport dancers have fewer medical problems (Ramel, Moritz, & Gun-Britt, 1999; McMeeken et al., 2001; Alricsson & Wemer, 2004), but also suffer from dietary deficiency (Mittleman, Keegan, & Collins, 1992).

Studies concerning the use of certain forbidden substances in correlation with health have proven the negative effect of those substances (Sekulić, Kostić, & Miletić, 2008; Sekulić, Kostić, Rodek, Damjanović, & Ostojić, 2008).

It was shown that for the successful performance of dance structures, all motor functions were important to various extents, (Oreb, 1984; Jocić, 1991; Kostić, 1994; Uzuno-

vić, 2004; Srhoj, Katić, & Kaliterna, 2006). Evidence was found that supported the significant influence of cognitive abilities and music skills (Ross & Butterfield, 1989; Jocić, 1991), as well as the influence of connative characteristics (Leste & Rust 1990; Jocić 1991; Kostić 1994; Kostić, Jocić, & Uzunović, 1999; Lobo & Winsler, 2006). The results of the research indicated that certain characteristics do have a significant influence on the successful performance of dance structures (Wyon et al. 2006), as well as success at dance competitions (Kostić, Zagorc, & Uzunović, 2004; Uzunović & Kostić, 2005). A specific training method for certain dance disciplines can undoubtedly lead to dance success, and it is a fact that it is necessary to develop motor skills in order to achieve certain success. This has been supported by studies in the area of dance training (Koutedakis et al., 1999; Alricsson, Harms-Ringdahl, Eriksson, & Wemer, 2003; Koutedakis & Sharp, 2004; Cross, Hamilton, & Grafton, 2005; Brown, et al., 2007; Chockley, 2008; Weiss, 2008).

Many studies have paid special attention to the relations between dance and functional skills. The results of these studies have indicated that functional skills have a significant influence on dance success (Kostić, Zagorc, & Uzunović, 2004). Physiological reactions to creative jazz dancing were studied within the student population. Testing following the program uncovered a significant increase in the relative and absolute oxygen uptake of the maximum time spent on the treadmill (Galanti et al., 1993). A study of the cardio-respiratory and anthropometric characteristics of professional dancers (Wion et al., 2007) has shown that significant differences exist between explosive leg strength and maximal oxygen uptake, depending on the position within a dance troop, rank, sex and additional exercise.

The effects of functional abilities and cardiological status were also studied (Cohen, Gupta, Lichstein, & Chadda, 1980; Wyon et al., 2004; Mavridis et al., 2005; Gillet & Eisenman, 2007). The subject matter of the research also included different characteristics of the process of maturing (Wong & Chan, 1995; Bernadette et al., 2006).

"Disco-dance", as a "Street" dance category in the modern dance framework, is today's most popular kind of dance. This is indicated by the number of dancers and the organizations of dance contests and tournaments. Individual dance contests last for one minute precisely because of the great number of contestants. Nevertheless, during that minute, the dancer has to use all his energy and creativity in order to achieve a certain level of success. Considering the tempo of the performance (132 – 140 beats per minute), extreme speed is required, explosive strength and the strength of individual movements, and even endurance to a certain extent (anaerobic endurance primarily). The aforementioned indicates that for the successful execution of "Disco-dance" we need to develop motor skills as a whole. Dance technique is made up of typical movements classified into four categories, as well as hops, jumps and turns. Dance structures composed to music indicate that it is necessary to develop coordination skills and the ability to express rhythmic structures in particular. This research should give an answer to the question of how much modern sport "Disco-dance" training influences the development of coordination skills, strength and speed.

The aim of this research was to determine the effects of modern sport dance on motor strength, speed and coordination.

METHOD

Sample of subjects

The sample of subjects consisted of 60 female subjects aged 13 and 14, who were divided into two sub-samples. The first sub-sample consisted of 30 female subjects who made up the experimental group, and whose average height was 159.77cm (SD±5.88) and average weight was 50.05 kg (SD±8.27). The remaining 30 female subjects made up the control group, whose average height was 164.55cm (SD±7.42) and average weight was 55.06kg (SD±7.17). The subjects of the experimental group took part in a modern sport dance training process - "Disco-dance" at the "La Luna" dance clubs in Vranje and Niš, where they trained using the "Disco-dance" program and other dance techniques. The only physical activities other than their everyday routines that the subjects of the control group were involved in, were their physical education classes at the "Ratko Vukićević" elementary school in Niš.

The sample of variables

The following measuring instruments were used to evaluate coordination skills:

- Side steps, 20 steps forward with a baton, horizontal jump rope, turns to six squares, foot and hand drumming,

The following instruments were used to evaluate strength:

- the standing depth jump, 30 sec sit-ups, semi-squats (one leg), push-ups, throwing a medicine ball from a lying position.

The following measuring instruments were used to evaluate speed:

- foot tapping against a wall, hyper extensions, twists, touches, hand tapping, foot tapping and jumping over a gymnastics bar.

The experimental program

The experimental program included the basic dance techniques of modern sport "Disco-dancing". The experimental program lasted for 18 weeks, not counting the weeks used to evaluate the motor skills. The female subjects exercised twice a week for a period of 60 minutes, which amounted to a total of 36 hours of experimental modern sport dance program training – "Disco-dance". Prior to the start of the experimental program, the initial testing was carried out. The subjects of the experimental group practiced "Disco-dance" and practiced certain elements of other dance techniques. The subjects of the control group took part in their regular everyday activities and also took part in their physical education classes at school. The final testing took place after the completion of the program.

The structure of the training session of the experimental group consisted of an introductory, or warm-up part, the main part and the final part of the training session, or stretching exercises. The main part of the training session was the part where the "Disco-dance" program was realized. During the experimental program, the subjects learned a choreographed section which consisted of 32 eights which lasted for around two minutes. The frontal work method was used.

The experimental program included locomotors, movements and figures which were precisely defined and noted (an example is shown in Fig. 1, demonstrator: Snežana Jaćimović).



Fig 1. A photographic image of the construction of an "eight"

For the first four weeks, the main part of the training session lasted for around 30 minutes; for the following seven weeks it lasted for 35 - 40 minutes, and for the final seven, 45 minutes. The intensity during that time changed depending of how well the subjects had learned the concrete technique being practiced. During the first phase of instruction, the intensity was around 110 beats/min. The first phase required a basic familiarity with the technique being practiced, mainly done to counting, and with a great number of repetitions of each individual movement. During the second phase, the intensity of instruction was around 120 beats/min and the movements were systematized into a single choreographed whole. During the third phase, the intensity was the one prescribed by the rules of competition and was around 135 beats/min. The third phase of instruction required the performance of a specific choreographed eight (8 rhythmic beats lasting for 2/4 of a beat). The "Disco-dance" technique included both simple and complex technique elements, hops and turns. The "Disco-dance" choreography was composed of basic techniques, and basic and complex combinations – multiplications (Stanković, 2008).

The instruction on other types of dances included: **Hip Hop**: Hip hop bounce. **Jazz**: *Isolations*: isolations of the head, neck, isolation of the shoulders, isolation of the torso, isolation of the legs. *Locomotors*: the Cuban step, Boogie step, Balance step, Bounce step, Cat step, Double Lindy, Jazz square, Tap step, Kick change, Chasse step, Twinkle step, Suzy Q. **Ethno dance (folk dances)**: Kick forward, Kick backward, Tapping step, Grapevine step, Threestep. **Sport and social dances**: Samba (Natural Basic movement, Whisk, Bota-fogo), Cha-cha-cha (Chasse, Check from open, Spot Turn), the Jive (Basic in place, American spin), Charleston (Basic), the Viennese Waltz (Closed change). **Ballet jump techniques**: Jete entrelace, Cabriole, Grand jete.

Methods of data analysis

In order to determine the multivariate statistical significance of the differences between the experimental and control group at the final measuring, we used the multivariate analysis of covariance (MANCOVA), while at the univariate level of analysis we used the ANCOVA (based on the similar means of the individual groups).

RESEARCH RESULTS

Table 1 shows the means of the variables of motor strength, speed and coordination for the experimental and control group of subjects at the initial and final measuring, following the completion of the experimental treatment consisting of modern sport dance.

Table 2 shows the multivariate analysis of covariance calculated for the purpose of determining the realized effects of dancing among the subjects of the experimental group in relation to the control group at the final measuring, with a previously conducted neutralization of the differences at the initial testing. From the results in the table we can conclude that there is a statistically significant difference at the multivariate level between the studied groups ($p = .000$), so we can conclude that the used dance program has contributed to these differences.

Table 1. The means and standard deviations of the initial and final measuring of the experimental and control group

Variables	Initial				Final			
	Exp.		Control		Exp.		Control	
	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.
Side-steps	15.85	1.68	13.18	2.17	13.50	1.09	12.68	2.19
20 steps forward with a baton	19.31	1.98	19.20	4.09	14.58	1.34	17.98	3.93
Horizontal jump rope	11.47	3.37	11.13	5.54	15.13	2.94	13.57	5.85
Turns to 6 squares	4.17	1.34	4.57	2.19	7.27	0.94	5.53	1.80
Foot and hand drumming	8.37	2.19	8.13	3.29	14.10	2.07	9.70	3.20
Standing depth jump	129.23	20.92	145.40	23.72	138.03	20.96	150.30	23.03
Sit-ups in 30 sec.	17.63	3.05	19.20	3.51	21.17	3.51	21.17	3.13
Semi-squat (one leg)	67.37	7.03	68.33	14.87	73.93	8.99	73.73	14.36
Push-ups	23.93	7.57	22.83	10.17	29.57	8.77	28.80	11.72
Throwing a medicine ball from a lying position	34.37	5.45	39.53	5.21	38.70	5.43	40.60	4.94
Foot tapping against a wall	16.83	1.74	17.50	2.80	20.30	2.23	19.77	2.67
Hyper-extension, twist, touch	12.50	1.43	13.63	2.09	15.27	1.39	14.93	1.98
Hand tapping	40.43	4.80	42.63	6.27	47.37	6.06	47.60	5.63
Foot tapping	31.97	3.23	30.67	2.56	35.63	2.48	33.53	2.97
Jumping over a gymnastics bar	7.63	2.03	9.00	2.88	9.73	1.36	9.63	2.88

Table 2. The effects of the modern sports dance program at the multivariate level

Wilks' Lambda	F	df 1	df 2	p-level
.166	9.68	15	29	.000

Legend : Wilks' Lambda – value of the coefficient of the Wilk's test for the equality of group centroids; F – the value of the F-test coefficient for the significance of Wilk's Lambda; p – the coefficient of the significance of the difference between the centroids; df1 and df2 – degree of freedom

Individual intergroup differences were tested by means of the univariate analysis of variance (Table 3). We can conclude that the greatest contribution to the aforementioned differences comes from the variables for the evaluation of movement coordination. In other words, of all the variables used for the evaluation of the abilities for coordination, only the Side-step did not contribute to the statistical significance. A significant contribution was made by the variables for the evaluation of speed, including the Hyper-extension, twist and touch, Foot tapping and Jumping over a gymnastics bar. A significant contribution, but to a lesser extent, was made by the variables for strength. Of the five studied variables, only two were statistically significant, including the variables for the evaluation of explosive leg and shoulder strength: the Standing depth jump, and Throwing a medicine ball from a lying position.

Table 3. The effects of the modern sport dance program at the univariate level

	GROUPS	N	Mean	F-relation	p-level
Side-steps	E	30	12.81	1.70	.199
	C	30	13.37		
20 steps forward with a baton	E	30	14.19	55.09	.000
	C	30	18.37		
Horizontal jump rope	E	30	15.59	7.84	.008
	C	30	13.11		
Turns to 6 squares	E	30	7.45	37.59	.000
	C	30	5.35		
Foot and hand drumming	E	30	14.36	40.91	.000
	C	30	9.44		
Standing depth jump	E	30	146.92	5.28	.027
	C	30	141.42		
Sit-ups in 30 sec.	E	30	21.40	.30	.589
	C	30	20.93		
Semi-squats (one leg)	E	30	73.88	.00	.971
	C	30	73.79		
Push-ups	E	30	29.51	.16	.692
	C	30	28.86		
Throwing a medicine ball from a lying position	E	30	40.87	8.48	.006
	C	30	38.43		
Foot tapping against a wall	E	30	20.50	1.75	.192
	C	30	19.57		
Hyper-extension, twist, touch	E	30	16.02	20.88	.000
	C	30	14.18		
Hand tapping	E	30	46.61	.97	.329
	C	30	48.36		
Foot tapping	E	30	36.08	17.48	.000
	C	30	33.09		
Jumping over a gymnastics bar	E	30	10.39	11.16	.002
	C	30	8.97		

Legend: F- value, p- value

DISCUSSION

Previous research has proven that there is a connection between motor skills and dance, or rather that there is mutual conditioning between dance-motor skills and dance success (Uzunović & Kostić 2005; Uzunović, Kostić, Zagorc, Oreb, & Jocić, 2005).

This study had as its aim to determine the effects of dance on the changes in certain motor skills. The result of the used sport dance program is the transformation of strength, speed and coordination.

The results are directly related to the experimental "Disco-dance" program. Mainly, the experimental program contained a basic "Disco-dance" program and the basic techniques of other dances. It has already been mentioned that the "Disco-dance" technique consists of various types of movements. In order to successfully perform the set dance structures, the dancer must have a sense of rhythm, orientation in space, coordination in

performing individual moves and movement in general. The permitted movements and figures include slides, jumps, hops, turns, pirouettes, kicks. The aforementioned techniques are performed with a maximum synchronization of body parts in space and time, accompanied by the harmony among energetic movement parameters. The greatest hierarchical contribution to the difference between the initial and final measuring in relation to the studied skills was for the values of the variable of coordination.

The main part of the used program was made up of techniques of folk, art, sport, jazz and hip-hop dancing. The aforementioned dances contain various moves, movements and figures which can accompany simple and complex rhythms. It can be assumed that the practice of these techniques has contributed to the difference from the initial to the final measuring in the numeric values of the variable for the evaluation of coordination.

The elements of the "Disco-dance" technique are carried out at the speed prescribed by the rules of competition (135 beats/min). This speed was the basis for the explanation of the contribution of segmentary speed and frequency speed to the differences noted between the initial and final measuring of the experimental group.

On the basis of the analyzed results, we can conclude that the experimental modern sport "Disco-dance" program made a significant contribution to the changes in coordination, strength and speed, which confirms the basic hypothesis of this research. In addition, the program caused the greatest hierarchical changes to the motor skill of coordination, followed by speed, then strength. For the duration of the study, the subjects of the control group showed signs of significant improvement in the studied skills. Nevertheless, after the duration of the experimental program, it was evident that the changes among the subjects of the experimental group were more pronounced. This means that the experimental program affected the aforementioned changes to a greater degree. The reasons for this should be found in the structure of the experimental program. The used dance structures contain various movements and figures which are performed to different rhythms and at different speeds, so this probably led to greater change in the motor skill of coordination. The interrelation between coordination and dance success has already been established in a joint study by Uzunović, Kostić, Zagorc, Oreb, & Jocić (2005). The "Disco-dance" technique elements are performed relatively quickly and very explosively, or in accordance to the rules of competition and the characteristics of the dance itself. This is the reason behind the changes in segmentary speed and frequency speed as well as explosive leg and shoulder strength.

CONCLUSION

The realized experimental program had as its aim to determine the effects of the experimental program of modern sport dance on the changes in certain motor skills. The experimental program encompassed the basic dance techniques of modern sport "Disco-dance" and the techniques of folk, sport, art, jazz and hip-hop dancing. The aforementioned program was realized over a period of 18 weeks. The results of the multivariate analysis have indicated that the practiced dance techniques had a significant effect on the transformation of motor coordination, strength and speed.

REFERENCES

1. Akella, P., Warren, M., Jonnavithula, S., & Brooks-Gunn, J. (1991). Scoliosis in Ballet Dancers. *Medical Problems of Performing Artists*, 6 (3), 84-86.
2. Alricsson, M., & Wemer, S. (2004). The effect of pre-season dance training on physical indices and back pain in elite cross-country skiers. *British Journal of Sports Medicine*, 38 (2), 148-153.
3. Brown, A.C., Wels, T.J., Schade, M.L., Smith, D.L. & Fehling, P.C. (2007). Effects of Plyometric Training Versus Traditional Weight Training on Strength, Power, and Aesthetic Jumping Ability in Female Collegiate Dancers. *Journal of Dance Medicine & Science*, 11 (2), 38-44.
4. Chocckley, C. (2008). 5 Ground Reaction Force Comparison between Jumps Landing on the Full Foot and Jumps Landing en Pointe in Ballet Dancers. *Journal of Dance Medicine & Science*, 12 (1), 5-8.
5. Cohen, J., Gupta, P., Lichstein, E., & Chadda, K. (1980). The heart of a dancer: Noninvasive cardiac evaluation of professional ballet dancers. *The American Journal of Cardiology*, 45 (5), 959-965.
6. Cross, E., Hamilton, A., & Grafton, S. (2005). Building a motor simulation de novo: Observation of dance by dancers. *NeuroImage*, 31 (3), 1257-1267.
7. DeMann, L.E. Jr. (1997). Sacroiliac dysfunction in dancers with low back pain. *Manual Therapy*, 2 (1), 2-10.
8. Galanti, A.M., Holland, G.J., Shafranski, P., Loy, S.F., Vincent, W.J., & Heng, M.K. (1993). Physiological Effects of Training for a Jazz Dance Performance. *J Strength Cond Res*, 7 (4), 206-210.
9. Gannon, L.M. & Bird, H.A. (1999). The quantification of joint laxity in dancers and gymnasts. *Journal of Sports Sciences*, 17 (9), 743-750.
10. Gillet, P., & Eisenman, P. (2007). The Effect of Intensity controlled Aerobic Dance Exercise on Aerobic Capacity of Middle-Aged, Overweight Women. *Research in Nursing & Health*, 10 (6), 383-390.
11. Haight, H. (1998). Morphologic, Physiologic and Functional Interactions in Elite Female Ballet Dancers. *Medical Problems of Performing Artists*, 13 (1), 4-13.
12. Hamilton, D., Aronsen, P., Loken, J.H., Berg, M., Skotheim, R., et al. (2005). Dance Training Intensity at 11-14 years is associated with Femoral Torsion in Classical Ballet Dancers. *British Journal of Sports Medicine*, 40, 299-303.
13. Jocić, D. (1991). *Predviđanje uspeha u plesovima na osnovu morfološkog, motornog, kognitivnog i konativnog statusa* (The prediction of dance success on the basis of morphological, motor, cognitive and connative status). Unpublished PhD thesis, Belgrade: The Faculty of Physical Education, The University of Belgrade.
14. Kostić, R. (1994). Predikcija izvođenja narodnih i društvenih plesova (Prediction of the performance of folk and social dances). *Physical Education*, 48 (4), 354-358.
15. Kostić, R., Jocić, D., & Uzunović, S. (1999). Relacije konativnih karakteristika i uspešnosti izvođenja plesnih struktura (The relations between connative characteristics and the success of dance structure performance). *Facta Univ Phys Educ Sport*, 1 (6), 15-23.
16. Kostić, R., Zagorc, R., & Uzunović, S. (2004). Prediction of success in sports dancing based on morphological characteristics and functional capabilities. *Acta Universitatis Palackianae Olomucensis GIMNICA*, 34 (1), 59-64.
17. Koutedakis, Y., Myszkewycz, L., Soulas, D., Papapostolou, V., Sullivan, I., & Sharp, N.C. (1999). The effects of rest and subsequent training on selected physiological parameters in professional female classical dancers. *Int J Sports Med*, 20 (6), 379-383.
18. Koutedakis, Y., & Sharp N.C. (2004). High-muscles strength training, dance exercise, dynamometry, and anthropometry in professional ballerinas. *J Strength Cond Res*, 18 (4), 714-718.
19. Koutedakis, Y., Hukam, H., Metsios, G., Nevill, A., Giakas, G. et al. (2007). The Effects of Three Months of Aerobic and Strength Training on Selected Performance – and Fitness-Related Parameters in Modern Dance Students. *J Strength Cond Res*, 21 (3), 808-812.
20. Leste, A., & Rust, J. (1990). Effects of Dance on Anxiety. *American Journal of Dance Therapy*, 12 (1), 19-25.
21. Lobo, Y. & Winsler, A. (2006). The Effects of Creative Dance Movement Program on the Social Competence of Head Start Preschoolers. *Wiley InterScience J*, 15 (3), 501-519.
22. Mavridis, G., Filippou, F., Laios, A., Rokka, S.T., Bousiou, S.T., Mavridis, K., & Varsami, D. (2005). The effect of a health-related aerobic dance program in the physical abilities of boys and girls of age 6 and 7 years. *The Cyprus Journal of Sciences*, 3, 33-45.

23. McMeeken, J., Tully, E., Stillman, B., Natrass, C., Bygott, I-L., & Story, I. (2001). The experience of back pain in young Australians. *Manual Therapy J*, 6 (4), 213-220.
24. Mittleman, K., Keegan, M., & Collins, C. (1992). Physiological, Nutritional, and Training Profile of University Modern Dancers. *Medical Problems of Performing Artists*, 7 (3), 92-96.
25. Oreb, G. (1984). *Relacije između primarnih motoričkih sposobnosti i efikasnosti izvođenja plesnih struktura kod selekcioniranog uzorka ispitanika (The relations between primary motor skills and the efficiency of performing dance structures on a sample of selected subjects)*. Unpublished MA thesis. Zagreb: The Faculty of Physical Education.
26. Parnianpour, M., Davoodi, M., Forman, M., & Rose, D. (1994). The Normative Database for the Quantitative Trunk Performance of Female Dancers: Isometric and Dynamic Trunk Strength and Endurance. *Medical Problems of Performing Artists*, 9 (2), 50-57.
27. Pedersen, E., Wilmerding, V., Milani, J., & Mancha, J. (1999). Measures of Plantar Flexion and Dorsiflexion Strength in Flamenco Dancers. *Medical Problems of Performing Artists*, 14 (3), 107-112.
28. Ramel, E., Moritz, & Gun-Britt, J. (1999). Validation of a pain Questionnaire (SEFIP) for Dancers with a Specially Created Battery. *Medical Problems of Performing Artists*, 14 (4), 196-203.
29. Ross, A., & Butterfield, A. (1989). The Effects of a Dance Movement Education Curriculum on Selected Psychomotor Skills of Children in Grades K-8. *Research in Rural Education*, 6 (1), 51-56.
30. Sekulić, D., Kostić, R., & Miletić, Đ. (2008). Substance Use in Dance Sport. *Medical Problems of Performing Artists*, 23 (2), 66-71.
31. Sekulić, D., Kostić, R., Rodek, J., Damjanović, V., & Ostojić, Z. (2008). Religiousness as a Protective Factor for Substance Use in Dance Sport. *J Relig Health*, DOI 10. 1007/s 10943-008-9193-y.
32. Srhoj, L., Katić, R., & Kaliterna, A. (2006). Motor abilities in dance structure performance in female students. *Coll Anrop*, 30 (2), 335-341.
33. Stanković, M. (2008). *Klasifikacija i opis tehnike modernog sportskog plesa na primeru Disco-dance (The classification and description of the technique of modern sport dance: the case of Disco-dance)*. Unpublished bachelor's thesis. Niš: The Faculty of Sport and Physical Education.
34. Uzunović, S. (2004). *Uticaj antropometričkih sposobnosti na uspešnost u sportskom plesu (The influence of anthropometric characteristics on the success in sports dance)*. Unpublished MA thesis. Niš: The Faculty of Physical Education.
35. Uzunović, S., & Kostić, R. (2005). A study of success in Latin American sport dancing. *Facta Univ Phys Educ Sport*, 2(1), 35-45.
36. Uzunović, S., Kostić, R., Zagorc, M., Oreb, G. & Jocić, D. (2005). The effect of coordination skills on the success in standard sports dancing. *European college of sport science 10th annual congress (32)*. Belgrade.
37. Weisler, E., Hunter, D.M., Martin, D.F., Curl, W.W., & Hoen, H. (1996). Ankle Flexibility and Injury Patterns in Dancers. *The American Journal of Sports Medicine*, 24, 754-757.
38. Weiss, D.S., Shah, S., & Burchette, R.J. (2008). A Profile of the Demographics and Training Characteristics of Professional Modern Dancers. *Journal of Dance Medicine & Science*, 12 (2), 41-46.
39. Wyon, M., Abt, G., Redding, E., Head, A., & Sharp, N.C.C. (2004). Oxygen Uptake during Modern Dance Class, Rehearsal, and Performance. *J Strength Cond Res*, 18 (3), 646-649.
40. Wyon, M., Allen, N., Angioi, M., Nevill, A., & Twitchett, E. (2006). Anthropometric factors affecting vertical jump height in ballet dancers. *Journal of Dance Medicine and Science*, 10 (3-4), 106-110.
41. Wyon, M., Deighan, M., Nevill, A., Doherty, M., Morrison, S., et al. (2007). The Cardiorespiratory, Anthropometric, and Performance Characteristics of an International/National Touring Ballet Company. *J Strength Cond Res*, 21 (2), 389-393.

TRANSFORMACIJA SNAGE, BRZINE I KOORDINACIJE POD UTICAJEM MODERNOG SPORTSKOG PLESA

Slavoljub Uzunović

Cilj istraživanja je bio da se istraže efekti programa modernog sportskog plesa na promene snage, brzine i koordinacije. Uzorak ispitanika je činilo 60 ispitanica uzrasta 13 do 14 godina, podjeljenih na dva subuzorka. Prvi je činilo 30 ispitanica eksperimentalne grupe, članica P.K. "La Luna" u Vranju i Nišu, a drugi 30 ispitanica kontrolne grupe učenica OŠ "Ratko Vukičević" u Nišu. Eksperimentalni program je trajao 18 nedelja, dva puta nedeljno po 60 minuta. Ispitanice su trenirale tehniku "Disko densa" koja je obuhvatila jednostavne i složene elemente tehnike, poskoke i okrete. Koreografiju "Disko densa" sačinjavale su bazične tehnike, osnovne i složene kombinacije – multiplikacije, a pored navedenog ispitanice su trenirale i elemente tehnike narodnog, sportskog, umetničkog, džez plesa i hip-hopa. Ispitanice kontrolne grupe imale su redovnu nastavu fizičkog vaspitanja. Obe grupe su testirane pre i posle eksperimentalnog programa. Rezultati su obrađeni analizom kovarijanse MANKOVA i ANKOVA. Rezultati su pokazali da su obe grupe značajno napredovale u ispitivanim sposobnostima ali su promene kod ispitanica eksperimentalne grupe bile izraženije. Program je hijerarhijski najveće promene izazvao u motoričkoj sposobnosti koordinacije, potom brzine, pa snage. Potvrđena je osnovna pretpostavka ovog istraživanja da eksperimentalni program modernog sportskog plesa značajno utiče na promene motoričke koordinacije, snage i brzine.

Ključne reči: "Disko dens", eksperimentalni program, plesačice, motoričke sposobnosti, efekti