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Influence of power yoga on the explosive strength of upper and lower limbs and heart performance of dancers

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Abstract
This work was focused on the influence of 8-week power yoga training program on the explosion of upper and lower limbs, heart performance and cognitive processes of dancers of the main age category. The research group consisted of the experimental group which exercises through their dancing training the power yoga program 2 times a week for 60 minutes and control group which was concentrated only for dancing training. In both groups, there were 8 dancers from Stella Považská Bystrica and Lentilky Žilina dancing clubs. We provided the input measurements of both groups before the beginning of the 8-week phase of power yoga training program and output measurements at the end of the 8-week training program phase of power yoga. The practiced power yoga was focused on the exercise of strengthening the phasic muscles, stretching the postural muscles, cardiovascular and respiratory system and stress reduction. All factors were part of the limiting factors which largely influence the dancing sport performance.

Keywords: power yoga, explosive strength, performance, dance.

Introduction
Yoga is a centuries-old physical exercises from India. Nowadays is this physical activity popular and search all over the world. Depending on the purpose or instructor there are many different forms and sectors of yoga. One of the most popular forms of yoga is Ashtanga Vinyasa also called power yoga (Ramaswami, 2005) [9]. It was popularized by American author Beryl Bender Birch. In contrast with postural yoga which mainly focused on developing strength, power yoga developing strength through long-lasting isometric excercises. Emphasis is also placed on proper breathing techniques. The whole training is based on a psychological-physical principle (Suzanne, 2009) [11].
Regular exercise of power yoga leads to strengthening of phasic muscles and stretching of postural muscles. It also focused on stretching smaller, little used muscle groups that tend to hypotension or atrophy (Cunningham, 2017) [4]. The advantage of power yoga is the fact that the relaxation and activation effects interact, one part of the body stretches and the other part strengthens while the rest of body and mind relax.
Bártová and Stuchlík (2007) [2] deal with power yoga in term to improve fitness. They consider this kind of exercise to be practicularly useful because of using long muscle chains to focus on the complex of the whole body muscles as a yoga exercise. Power yoga uses positions and assemblies in a dynamic form, including advanced hops, leaps and jumps between positions. Dynamic changes in power yoga positions cause more stress on the cardiovascular and musculoskeletal system, which improve peripheral blood circulation, thermoregulation and sufficient load on flabby muscles. Yoga training has also shown that it increases aerobic strength and reduces anaerobic strength (Balasubramanian, 1991) [1].

Aim
Aim of our work is to find out the influence of the 8 -week power yoga training program as the strength and aerobic training to the explosive strength of upper and lower limbs and the heart performance of dancers in the experimental group and to compare the results with dancers from the control group who did not attend the yoga training program.

Material and Methods
The two-group time-parallel experiment consisted of 16 dancers divided into 2 groups - experimental (8) and control (8). Dancers were from the main age group category from dancing clubs Lentilky Žilina and Stella Považská Bystrica. The average age of experimental group was M = 22.5 years, SD = 1.07, average height M = 167 cm SD = 4.09 and average weight M = 58.2 kg, SD = 5.68. In control group was the average age M = 21.5 years, SD = 2.2, average height M = 59.75, SD = 4.14 cm and average weight M= 59.75 kg, SD = 6.58. Choose of the research group was deliberated based on approximately the same performance level, same calendar, and sports age. The group consisted only by female gender of the main age group category for eliminating of intrasexual differences. All dancers represent the Slovak Republic many years on the international competitions and have some medal placements.
For the characteristics of the research group, we used the method of measurement of the body weight (kg) and body height (cm). In the information system STO DIDO, we found the age of dancers and years of dance practice. We used the method of literary analysis for the study of the general literature, research works from the area of dancers training. We also used this method to study foreign literature about power yoga as the power and aerobic training and its influence on the chosen parameters of motor

skills. The measurement method was used to gain the input and output parameters of explosive strength of lower and upper limbs and aerobic abilities in the monitored group. We used the battery of tests to determinate the chosen motor skills. For the measurement of aerobic endurance, we used the 6 minutes test of fast walking (6 - MWT). For testing the strength abilities we used the jumping ergometer - Fitro Jumper-Fitronic for measuring the level of explosive strength of lower limbs and for the measuring of the level of explosive strength of upper limbs we used test of throwing the 2 kg medicine ball. Mathematical-statistical methods were used to evaluate the measurement data. We used the basic statistical characteristics - median (med), variation range (Vr), minimum (min) and maximum (max) of measured values, arithmetic average (M), standard deviation (SD). For the assessing of statistical significance between the individual measurements in the same group, we used the non-parametric Wilcoxon T-test for dependent files. We used a non-parametricm Mann-Whitney U-test for independent files to determine statistical significance between groups. Graphic methods were used to compare the input and output values of the monitored files.

Results

In the experimental group in the test of aerobic endurance (6 minutes of fast walking) was the average performance in meters and standard deviation on the beginning of the monitored period on the level M = 705, SD = 43.73. After the completion of 8-weeks mesocycle with the experimental program of power yoga, the average performance has improved to M = 778.13, SD = 53.45. The shortest traveled distance was 705 meters and the longest distance was 855 meters. The range variation was 150 meters. When comparing the training effect, we can state that at the beginning of the 8-week mesocycle, both sets of performance were balanced and no statistical significance of p>.05 was demonstrated. By the influence of control and experimental stimulus (power yoga), there was a 73.13-meter improvement in the experimental set which was 10.37%, and this improvement proved to be statistically significant at 5% T (7) = -2.52, p =.012. In the control group where only classical dance training (control stimulus) was included, the performance was improved by 67.5 meters, which was 10.27% and this change was also statistically significant at 5% T (7) = -2.36. p =.018. However, at the end of the mesocycle, the experimental group showed greater improvement and the performance over the control group and it was statistically significant at 5% U (7) = 13, p =.045 (Figure 1). In the experimental group in the test of explosive strength of lower limbs (10 seconds of vertical jumps), the average power in watts per kilogram and the standard deviation at the beginning of the observation period were at M = 40.16, SD = 7.08. The lowest performance was 26.7 W / kg and the highest performance was 47.2 W / kg. After completing the 8-week intermediate cycle, including the experimental power yoga program, the average performance improved to M = 45.28, SD = 4.87. The lowest performance power was 35.5 W / kg and the highest performance was 50.3 W / kg. The standard deviation of performances was 14.8 W/kg. In the control group in the test of explosion strength of lower limbs (10 seconds of vertical jumps), the average power in watts per kilogram and the standard deviation at the beginning of the reference period was at M = 34.89, SD = 6.34. The lowest performance was 28.9 W/kg and the highest performance was 47 W/kg. The power variation range was 18.1 W / kg. After completing the 8-week mesocycle, the average performance improved to M = 39.59, SD = 9.73. The lowest performance was 30.5 W/kg and the highest was 56.6 W/kg. The variation rage of performances was 26.1 W/kg.

When comparing the training effect, we can state that at the beginning of the 8-week mesocycle, both sets of performance were balanced and no statistical significance of p>.05 was demonstrated. Due to the control and experimental stimulus (power yoga), there was an improvement in the performance by 5.11 W / kg in the experimental set, which was 12.73%, and this improvement was shown to be statistically significant at 5% T (7) = -2.52, p =.012. In the control group, where only classical dance training (control stimulus) was included, the performance was improved by 4.7 W / kg, which was 13.47% and this change was also statistically significant at 5% T (7) = -2.52, p =.012. At the end of the mesocycle, the experimental and control groups showed similar improvement and the performance of both groups was not statistically significantly different p>.05 (Fig. 2). In the experimental group in the test of explosive strength of upper limbs (medicine ball throw), the average performance in meters and the standard deviation at the beginning of the observation period were at the level M = 7.45, SD = 0.86. The lowest distance was 6.3 m and the highest distance was 9 m. The variation range of performance was 2.7 meters. After completing the 8-week mesocycle, including the experimental power yoga program, the average performance improved to M = 8.31, SD = 0.7. The lowest thrown distance was 7.4 m and the highest thrown distance was 9.7 m. The variation range of performance was 2.3 meters. In the control group in the test of explosive strength of upper limbs (medicine ball throw), the average performance in meters and the standard deviation at the beginning of the reference period were at the level M = 7.13, SD = 0.87. The lowest measured distance was 6 meters and the highest distance was 8.2 meters. The variation range of performances was at the level of 2.2 meters. After completing the 8-week intermediate cycle, the average performance improved to M = 7.5, SD = 1.01. The lowest thrown distance was 6.3 m and the highest throw distance was 9.1 m. The variation range of performance was 2.8 meters. When comparing the training effect, we can state that at the beginning of the 8-week mesocycle, both sets of performance were balanced and no statistical significance of p>.05 was demonstrated. Due to the control and experimental stimulus (power yoga), there was an improvement of 0.86 meters in the experimental set, which was 11.58%, and this improvement was shown to be statistically significant at 5% T (7) = -2.53, p =.011. In the control group, where only classical dance training (control stimulus) was included, the performance was improved by 0.38 meters, which was 5.26%, and this change was not shown to be statistically significant p>.05. At the end of the mesocycle, the experimental group showed significant improvement but the performance of both groups was not significantly different from p>.05 (Figure 3).

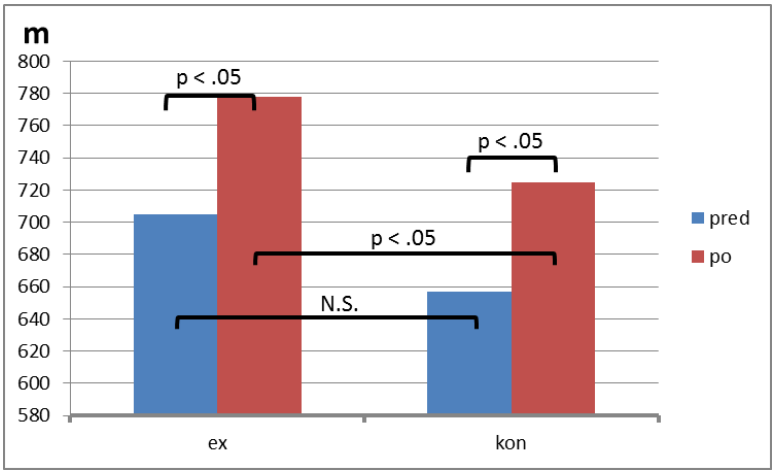

Fig 1: Average performance and statistical significance in the experimental and control groups before and after the completion of mesocycle in 6 min fast walking test.

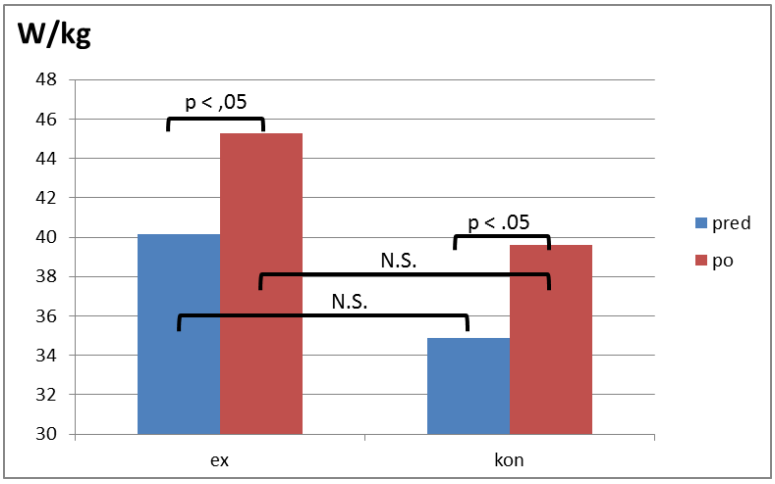

Fig 2: Average performance and statistical significance in the experimental and control groups before and after the completion of mesocycle in test of explosive strength of lower limbs

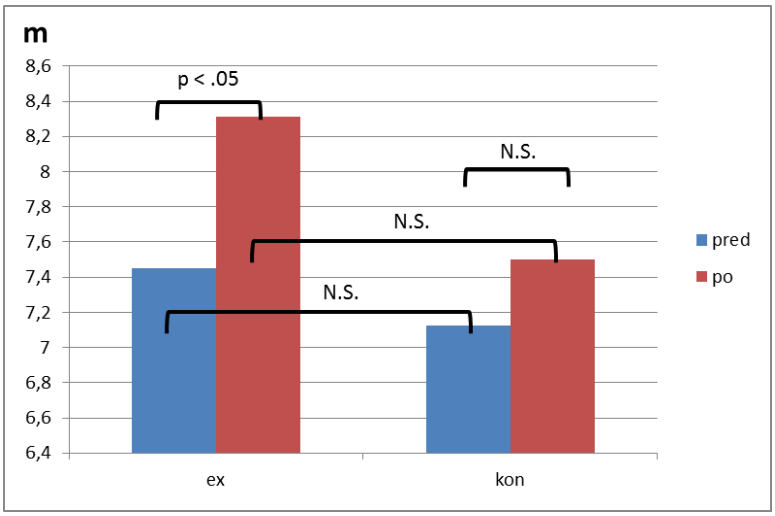

Fig 3: Average performance and statistical significance in the experimental and control groups before and after the completion of mesocycle in test of explosive strength of upper limbs

Discussion

In our thesis,,Influence of power yoga on the explosive strength of upper and lower limbs and
heart performance of dancers“ we focused on the positive effects of power yoga as a strength and aerobic training of disco dancers. The results of our work have shown the positive effects of power yoga on the explosive power of the upper limbs and endurance abilities, while the significant changes in the explosive strength of the lower limbs of dancers have not been confirmed. As we said in the theoretical part, yoga practice has a positive effect on the human body, especially the musculoskeletal system, respiratory system, cardiovascular system, memory and perception. Many studies dealing with the issue of yoga and

its effects have had a positive effect on the individual components of the body. However, the effects of power yoga have not been explored with as much intensity as the effects of yoga, we can say that they are largely similar. The impact of power yoga was also published by Alena Melegová
(2014) [8], whose research was focused on probands of age 20-30. They practised power yoga twice a week, sixty minutes for four months. The results confirmed the reduction in number of weakened muscle group, the improvement of the breath stereotype and the test of dynamic stability. Research by Madanmohana (2004) [7] has shown that in the long-term practise of yoga breathing exercises beyond one year, there was a reduction in oxygen consuption, heart rate and diactolic pressure in examined patients. It also demonstrated the effects of breathing excercise in an interval of 6-10 weeks. The results of studies by Miroslava Žáková (2012) [12] recorded a positive impact of power yoga on the mental area of seniors. Training took place once a week for 6 months. All the probands who participated in the research noted an improvement in perception, contrentration and attention. Positive results have been also shown in improvement memory and breathing. In contrast to other studies, Sheena L. Flores
(2015) [10] observed the effect of Vinyasa flow joga on aerobic capacity (VO2max) of 19-25 years old students. They did this type of yoga twice a week for 45 minutes whole 6 weeks.

The research results did not show a statistically significant difference between the input and output measurements of the experimental group and Vinyasa flow yoga were confirmed as a low load intensity exercise. However, power yoga is more dynamic and challenging than this exercise. Čajka (2014) [5] presents the results of the research from the Clinic of Physical Medicine in Olomouc in 2010. There were 58 persons examined who had been practicing yoga daily for 60 minutes. The research group consisted of probands aged 26-68, 17 males and 41 females. The control group consisted of randomly selected patients of a general practitioner in Nový Malín. There were 58 patients in the control group, including 17 males and 41 females aged 28-65. Based on the completed questionnaire, positive changes were demonstrated after 2 years in the experimental group. Probands began to change their eating habits, avoiding heavy meals and mostly going to lacto-vegetarian food. They also had statistically significant lower body weight, BMI, spirits and coffe consumption. The blood triglycerides have significantly decreased and the results of cardiovasculardisease and metabolic syndrome have improved. According to one study of Lavretski (2013) [6] we can also use yoga for people with dementia who show signs of depression. The research has explored the effects of daily short yoga meditation on mental health and cognitive abilities. A random selection of porbands in average age of 60 was conducted to Kirtan Kriya – listening to relaxing music 12 minutes per day for 8 weeks. Symptoms of depression, mental and cognitive function were evaluated at the beginning and end of the monitoring. The meditation group has shown significantly better mental health and cognitive abilities compared to the relaxations group. The results of our work confirmed the claims of previous research, studies of experts and the importance of the impact of power yoga on the human body. Due to the personal experience and literature we have assumed a higher effect of power yoga on explosive power of the upper limbs than the lower limbs. Most of the asanas are performed through the upper limbs in a dynamic, static sequence as well as transitions between positions
(Cramer, *et al*., 2016) [3]. We constantly use exercise to develop the strength of the upper limbs- plank, cobra, support, press-ups, push-ups, props on the bladeboness, headstands and handstand etc. Unlike the upper limbs, the lower limbs engage less during training. We use
asanas for the development of lower limbs only in a dynamic sequence and in advanced positions, as well as transitions between positions. Our research file was limited by size. The experimental ensemble consisted of 8 dancers as well as a control ensemble. We focused on the age limit of 19-25 years. Work with more probands could lead to more extensive research and more accurate data.

Conclusion

According to the results, we can prove the positive influence of power yoga to the explosive strength of upper limbs, endurance abilities, and heart performance. The output results on the end of the 8 - week intervention showed a greater improvement in anaerobic endurance in the experimental group in comparison with the control group on 5% level $U(7) = 13$, $p \leq 0.045$.

In the explosive power of the upper limbs, the experimental group at the end of mesocycle shows the greater improvement but the performance in both groups was not statistically different $p = 0.114$. The output tests of explosive strength of lower limbs at the end of mesocycle showed a similar level in both experimental and control groups, and the performance in both groups was not statistically significant $p = 0.172$. This can be justified by the fact that power yoga is not so much focused on the explosive power of the lower limbs. In disco dance training dancers constantly use the explosive power of lower limbs due to jumps, skipping, leaping, rotating and many more. Therefore, although the explosive power of lower limbs was significantly improved in both groups, the performance difference between groups was not statistically significant.

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