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Increasing performance in sports dance and developing the intervention program through the valuation of the physical factor in a technical and artistic context

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Abstract. In the field of sports science, monitoring and improving athlete performance, including that of sport dancers, is essential for training preparation. Sport dancing, which combines artistic expression with physical and technical skills, requires the development of explosive strength, flexibility, and balance. In this context, the present research aimed to validate an innovative training program, based on classical dance techniques, to improve dancers' balance and flexibility. The study involved a longitudinal experiment with 16 dancers, conducted over a period of 24 weeks. The program included exercises specific to classical dance and strength training, adapted for Latin dance. Balance evaluation was performed using advanced devices such as Gyko and the Y Balance Test, allowing precise real-time monitoring of progress. The results showed significant improvements in both static and dynamic balance for both legs, confirming the hypothesis that the applied program had a positive impact on essential motor skills. The differences in means between initial and final tests were statistically significant, supporting the effectiveness of the program. The research emphasizes the importance of integrating specific physical training into the preparation of sport dancers to enhance competitive performance. The originality of the study lies in the use of advanced technologies for monitoring progress and in the innovative structuring of the training program, thus contributing to the development of knowledge in the field and offering a valuable model for optimizing physical preparation in sport dancing. here…

1. Introduction

In the field of sports science, monitoring and improving athlete performance are critical components of training and competition preparation. Among the multitude of factors influencing athletic performance, physical preparation stands out as a fundamental element.

The popularity of sport dancing has rapidly increased, leading to a growing interest in deepening the understanding of essential phenomena in dancer training and evaluating the development level of motor skills necessary in competitions [1; 2].

Sport dancing, which comprises two sections, requires a unique combination of artistic expression, technical execution, and physical skill. In Latin dance styles, dancers frequently engage in high-energy steps and acrobatic movements that require bursts of power [3]. Explosive strength also aids in executing complex partner lifts, where smooth and controlled execution relies heavily on the dancers' ability to generate sufficient force quickly. This ability not only enhances the visual impact of the performance but also ensures that the movements are executed safely and efficiently [4].

Mobility and suppleness are associated with the concept of flexibility, with authors such as Weineck [5] and Teodorescu [6] considering these qualities as characterizing the amplitude of movements.

Balance, as a component of dance techniques, works synergistically with explosive strength to support dancers' ability to execute dynamic and fluid movements, thereby contributing to the artistic expression and visual impact of the performance.

1.2 Aim and Hypothesis

The aim of the research is to validate an original training program based on specific classical dance techniques, designed to objectively stimulate the development of balance and flexibility in dancers. Thus, we start from the hypothesis that the training program applied to sport dancers contributes to the development of balance and flexibility.

2. Methods

Balance Evaluation Using the GYKO Device: The GYKO device was attached to a special band positioned at the subjects' chest level. They were instructed to maintain balance on one leg for 30 seconds. Bilateral evaluation was performed, with all subjects starting the unipedal balance test on the left leg. The software records any deviation of the body from the vertical axis and provides real-time feedback on the screen.

The Y Balance Test: The Y Balance Test is a functional test that evaluates a person's balance, postural control, and proprioception. The test involves movements in three directions with the active leg, from a one-leg standing position, forming a "Y" shape.

We conducted a longitudinal experiment, with the independent variable being the application of the training program predominantly based on classical dance techniques. For 24 weeks, with a bi-weekly frequency, training programs incorporating classical dance techniques were applied, and once a week, the training plan included methods aimed at developing strength, mobility, suppleness, and balance, specifically adapted for sport dancing, and more precisely for Latin dances.

The experiment involved 16 dancers (8 girls and 8 boys) from the "Nicolae Rotaru" Sports High School in Constanța, aged between 14 and 18, who participate in competitions at different levels.

The sample of 16 dancers is statistically adequate due to the homogeneity of the group and the balanced gender distribution, facilitating a precise and comparable analysis of the effects. The manageable size allows for personalized interventions, making it suitable for identifying moderate and large effects relevant in the context of the study, despite limitations in statistical power for detecting smaller effects. As found in the specialized literature, precise control over movements is essential in sport dancing, and this control comes from well-developed musculature.

3. Results

The ability to control the intensity and direction of movements, especially in the hips and legs during the Latin section, is improved by the strength of the lower limbs. Therefore, the training program applied to the dancers included specific classical dance techniques adapted to the characteristics of Latin dances, as well as classical methods of developing muscle strength, mobility, and balance, also adapted according to the specifics of the discipline.

Table 1. Descriptive Statistics of the Static Balance Test - Surface – Left (Lf) and Right (R) Foot

	Min	Max	Mean	Standard deviation	Skewness	Kurtosis
Gyko_EA_Lf T1(cm)	.01	.06	.021	.0145	1.654	2.578
Gyko_EA_Lf T2 (cm)	.00	.01	.005	.0047	-.104	-1.945
Gyko_EA_R T1(cm)	.01	.04	.017	.0089	1.356	2.182
Gyko_EA_R T2 (cm)	.00	.02	.006	.0059	.711	.037

Table 1 presents the values obtained from the test evaluating static balance on the left and right foot. Thus, the initial testing recorded an average value of 0.021 cm for the left foot and 0.017 cm for the

right foot. In the final testing, the values improved for both feet, dropping below 0.01 cm, with some dancers achieving the performance of not losing balance at all (0 cm).

The Skewness and Kurtosis values recorded for this parameter do not fall between -1 and 1, indicating that the data distribution is abnormal. Consequently, the Wilcoxon non-parametric test was used for inferential statistics.

Table 2. Descriptive Statistics for the Static Balance Test - LENGTH - Left (Lf) and Right (R) Foot

	Min	Max	Mean	Standard deviation	Skewness	Kurtosis
GYKO_L_Lf_T1	1.00	2.80	1.656	.522	.395	.564
GYKO_L_Lf_T2	.10	1.80	1.143	.403	.387	.227
GYKO_L_R_T1	1.20	3.30	1.806	.613	.959	-.810
GYKO_L_R_T2	.75	3.10	1.200	.616	-.818	-.929

Table 2 shows the values obtained from the Sway test recorded with the Gyko device, with the following results for the left foot:

- The group's man at the initial test was 1.65 cm, with values ranging between 1 and 2.80 cm.
- At the final test, the values improved, and the group's average dropped to 1.14 cm.

For the right foot, the balance disturbances accumulated a displacement of 1.80 cm at the initial test, while this value decreased to 1.2 cm at the final test.

The Skewness and Kurtosis values recorded for this parameter fall between -1 and 1, indicating that the data distribution is normal, allowing for parametric tests.

Table 3. Inferential Statistics for the Static Balance Test - LENGTH - Left (Lf) and Right (R) Foot

	Difference T1-T2							
	Mean Diff.	Std. Deviation	Std. Mean Error	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Min	Max			
GYKO_L_LF_T1 GYKO_L_Lf_T2	.513	.398	.099	.300	.724	5.149	15	.000
GYKO_L_R_T1 GYKO_L_R_T2	.606	.339	.084	.425	.786	7.152	15	.000

The mean difference between the initial and final testing is 0.51 cm for balance on the left foot and 0.606 cm for balance on the right foot, with a t-value of -13.76 for the left foot and -15.4 for the right foot. The confidence intervals do not cross zero. This indicates that the mean differences are statistically significant, with a significance level of less than 0.01 (p=0.0001). Therefore, we can conclude that the methods applied during the experimental period positively influenced the static balance of both feet.

Table 4. Descriptive Statistics for the Dynamic Balance Test-Forward-Right (R) Foot and Left (Lf) Foot (Y Balance)

	Min	Max	Mean	Standard deviation	Skewness	Kurtosis

Y_Inainte_R_T1	55.00	70.00	62.437	4.441	-.025	-.079
Y_Inainte_R_T2	54.00	76.00	64.562	5.680	.147	-.760
Y_Inainte_Lf_T1	52.00	69.00	61.687	5.186	-.468	.052
Y_Inainte_Lf_T2	55.00	71.00	64.937	4.434	-.666	-.629

Table 4 presents the values obtained from the Y balance dynamic balance test in the forward direction, with the following recorded values for the initial and final testing:

- For the right foot – the average value at the initial test was 62.43 cm, and 64.56 cm at the second test.
- For the left foot – the average value at the initial test was 61.68 cm at the first test and 64.56 cm at the second, with values ranging between 55 and 71 cm.

No significant differences were identified between the execution of the lower limbs, allowing us to conclude that there were no significant asymmetries for anterior balance.

The Skewness and Kurtosis values recorded for this parameter fall between -1 and 1, indicating that the data distribution is normal, allowing for parametric tests.

Table 5. Inferential Statistics for the Dynamic Balance Test - Forward - Right Foot (Y Balance)

	Difference T1-T2							
	Mean Diff.	**Std. Deviation**	**Std. Mean Error**	**95% Confidence Interval of the Difference**		**t**	**df**	**Sig. (2-tailed)**
				Min	**Max**			
Y_Inainte_R_T1 Y_Inainte_R_T2	-2.125	3.422	.855	-3.948	-.301	-2.4	15	.025
Y_Inainte_Lf_T1 Y_Inainte_Lf_T2	-3.250	3.109	.777	-4.906	-1.59	-4.1	15	.001

The mean difference between the initial and final testing is 2.12 cm for balance on the right foot and 3.25 cm for balance on the left foot, with a t-value of -2.4 for the right and -4.1 for the left, with confidence intervals not crossing zero. This indicates that the mean differences are statistically significant, with a significance level of less than 0.05 (p=0.025), leading us to conclude that the methods applied during the experimental period positively influenced the manifestation of dynamic balance in the lower limbs.

Table 6. Descriptive Statistics for the Dynamic Balance Test - Posteromedial - Right Foot (Y Balance)

	Min	**Max**	**Mean**	**Standard deviation**	**Skewness**	**Kurtosis**
Y_Posteromedial_R_T1	86.00	123.00	108.00	11.916	-.593	-.891
Y_Posteromedial_r_T2	91.00	129.00	111.68	11.625	-.425	-.875
Y_Posteromedial_Lf_T1	90.00	128.00	105.06	10.535	.497	.159
Y_Posteromedial_Lf_T2	95.00	126.00	109.18	9.093	.398	-.111

Table 6 presents the values obtained from the Y balance dynamic balance test in the posteromedial direction, with the following recorded values for the initial and final testing:

- For the right foot – the average value at the initial test was 108 cm at the first test and 111.68 cm at the second.
- For the left foot – the average value at the initial test was 105.06 cm at the first test and 109.18 cm at the second, with values ranging between 95 and 126 cm.

Again, no significant differences were identified between the execution of the lower limbs, allowing us to conclude that there were no significant asymmetries for posterior balance.

The Skewness and Kurtosis values recorded for this parameter fall between -1 and 1, indicating that the data distribution is normal, allowing for parametric tests.

Table 7. Inferential Statistics for the Dynamic Balance Test - Posteromedial - Right Foot (Y Balance)

	Difference T1-T2							
	Mean Diff.	Std. Deviation	Std. Mean Error	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Min	Max			
Y_Posteromed_R_T1 Y_Posteromed _R_T2	-3.687	1.815	.453	-4.654	-2.720	-8.12	15	.000
Y_ Posteromed_Lf_T1 Y_ Posteromed _Lf_T2	-4.125	3.364	.841	-5.917	-2.332	-4.90	15	.000

The mean difference between the initial and final testing in dynamic posteromedial balance is 3.68 cm for balance on the right foot and 4.12 cm for balance on the left foot, with a t-value of -8.1 for the right and -4.9 for the left, with confidence intervals not crossing zero.

This indicates that the mean differences are statistically significant, with a significance level of less than 0.01 (p=0.0001), allowing us to conclude that the methods applied during the experimental period positively influenced the manifestation of dynamic posteromedial balance in the lower limbs.

Table 8. Descriptive Statistics for the Dynamic Balance Test - Posterolateral - Right Foot (Y Balance)

	Min	Max	Mean	Standard deviation	Skewness	Kurtosis
Y_Posterolat_R_T1	90.00	125.00	106.562	9.486	.052	-.067
Y_Posterolat_R_T2	95.00	128.00	111.187	9.453	-.018	-.802
Y_Posterolat_Lf_T1	91.00	128.00	108.750	9.902	.105	-.220
Y_Posterolat_Lf_T2	98.00	135.00	113.562	10.487	.363	-.164

Table 8 presents the values obtained from the Y balance dynamic balance test in the posteromedial direction, with the following recorded values for the initial and final testing:

- For the right foot – the average value at the initial test was 106.56 cm at the first test and 111.18 cm at the second.
- For the left foot – the average value at the initial test was 108.75 cm at the first test and 113.56 cm at the second, with values ranging between 95 and 126 cm.

Again, no significant differences were identified between the execution of the lower limbs, allowing us to conclude that there were no significant asymmetries for posterolateral balance. The Skewness and Kurtosis values recorded for this parameter fall between -1 and 1, indicating that the data distribution is normal, allowing for parametric tests.

Table 9. Inferential Statistics for the Dynamic Balance Test - Posteromedial - Right Foot (Y Balance)

	Difference T1-T2							
	Mean Diff.	Std. Deviation	Std. Mean Error	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Min	Max			
Y_Posteromed_R_T1 Y_Posteromed_R_T2	-4.625	4.349	1.087	-6.942	-2.307	-4.25	15	.001
Y_Posteromed_Lf_T1 Y_Posteromed_Lf_T2	-4.812	2.455	.613	-6.120	-3.504	-7.84	15	.000

The mean difference between the initial and final testing in dynamic posteromedial balance is 4.62 cm for balance on the right foot and 4.81 cm for balance on the left foot, with a t-value of -4.25 for the right and -7.84 for the left, with confidence intervals not crossing zero. This indicates that the mean differences are statistically significant, with a significance level of less than 0.01 (p=0.0001), allowing us to conclude that the methods applied during the experimental period positively influenced the manifestation of dynamic posteromedial balance in the lower limbs.

3. Conclusions

Teodorescu [7] argues that sports training should be structured into four stages of preparation. This staging is necessary because training is a long-term process that must be adapted according to age characteristics and the body's general adaptability.

Thus, the participants in our research fall into stage III - Intensive Specialization and High-Performance Training. In sports dancing, it is a critical and extremely challenging period to transition to stage IV – High-Performance Training, making physical preparation extremely important for achieving correct and controlled movements.

The programs we implemented during the 24-week experimental period were designed based on Brown's idea [8], emphasizing the impact of specific strength training exercises on developing lower limb power for dancers competing in the Latin section. His proposed methods include squats, lunges, and calf raises, designed to improve muscle strength, power, and movement control, ultimately leading to better dance performance. Our programs adapted these methods by incorporating artistic execution and tailoring them to the individual needs of the participants in our research.

In competitive sports dancing, judges often look for these qualities when evaluating performances. The study demonstrated that specific physical preparation tailored to dancers' needs can significantly improve their performance in terms of both physical conditioning and technical execution.

Our research aligns with the conclusions of Grossman & Wilmerding [9], who recommend integrating physical conditioning into technical training to meet all general physical development needs.

The hypothesis that the applied program contributes to the development of balance and flexibility, directly impacting competitive performance, was also supported by the results obtained in the Open competitions. Incorporating training methods based on techniques borrowed from artistic preparation helps dancers develop explosive strength, balance, and mobility, which are essential for excelling in performances and ultimately lead to greater success in the highly competitive world of sports.

The originality of our research is highlighted by the innovative structuring of the work programs and the rigorous monitoring of their effectiveness. Using advanced technological equipment such as Gyko and Y Balance, we collected precise and real-time data on various motor development parameters of the dancers. This methodological approach not only enhances the accuracy of our findings but also contributes to the development of knowledge in the field by providing empirical evidence supporting the effectiveness of personalized training programs.

Our study offers a new perspective on optimizing physical preparation in sports dancing and can be valuable at the level of the Romanian Federation of Sports Dancing, which currently lacks specific tests for its evaluation.

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