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Improvement of Physical Ability to Children Gymnasts in Tirana of Albania

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ABSTRACT: *Balance is one of the main physical components of the sport of gymnastics. This study aims to determine the improvement effect of balance in female gymnasts aged 6-8 years. Methodology: The study lasts for 16 weeks and includes 5 gymnasts of 6-8 years old. Training sessions take place six times a week, with duration of 2 hours for each session. The measurement of balance parameters is done at before and after of the experiment using the GRFP "Leonardo". Balance tests include the Romberg stand with eyes open and closed, semi-tangent stand with eyes open and closed, tangent stand with eyes open and eyes closed, one-legged stand with eyes open and with eyes closed. Results: The results are obtained for each test from GRFP; Std. Ellipse Area (cm 2); Std. Ellipse Angle (degree); Num. Eccentricity; dominant Freq (Hz); rel. Path length (mms); abs. Path length (mm); EQ(AP); Total Duration (s). Conclusion: The findings suggest that engaging in regular "Core Training" sessions can contribute to the development and improvement of balance skills in gymnasts of this age. Specific exercises aimed at core training have a direct impact on postural control and stability, which are essential for maintaining balance during various physical activities*.

Key words*: Balance, Gymnast, Gymnastics, Training.*

1. Introduction

Balance is one of the main physical components of the sport of gymnastics. The sport of gymnastics is quite attractive and physically demanding that includes a wide range of activities that contain components of strength, flexibility, dexterity and coordination. It combines art and athleticism, requiring athletes to perform various acrobatic and gymnastic movements with precision and control. In competitive sports, almost all sports exert force on external objects through the ends of human limbs to make the equipment move. The most significant aspects impacting an athlete's competitive abilities are his or her physical fitness. Skills appear to be particularly critical in light of the highly demanding and specialized proficiencies necessary for high performance in various sports (Wilson et al., 2017). Gymnastic training stimulates the development of balance and allows almost perfect stability, even under extreme conditions (Atilgan et al., 2012). There are numerous factors that affect balance, and the most important are genetic determinism, the state of the vestibular apparatus, age, area of support, the amount of body balance, the number of motor habits, their fitness, strength, coordination, flexibility, emotional state, muscle fatigue (Cetin et al., 2008; Popovic & Velickovic, 2021).The sports field's skill could be an event due to goals undertaken by a coordinated motor ability within a sport-specific scenario (Breivik, 2016). Understanding the benefits of participation in gymnastics training would provide pertinent information for this area. Терещенко et al. (2015) shows that Coordination training of sportsmen, specializing in sport gymnastic shall take one of priority places in system of physical education and sport training means. Trainees of sport gymnastic, calisthenics, sport acrobatic, jumping on trampoline, jumping on acrobatic track(i.e. sport kinds of gymnastic) fulfill exercises in complex conditions of static-dynamic and static-kinetic (vestibular)balance (in complex conditions of sensor-motor coordination). Thus, physical, technical and psychological skills, and motor control and harmony of movement are key factors in

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the performance of gymnasts (Frutuoso AS et al. 2016). In gymnastic disciplines, to perform a maximum number of strength elements in a competition routine, a high level of specific strength endurance is required (Schärer et al., 2019). Relative strength is considered to be a more important determinant of gymnastics performance than absolute strength (Sands, W. et al. 1991) which is why many training systems use the gymnasts' own body weight to prepare them (Sands, W. et al. 2000). As practical experience and scientific-methodic researches show sensor-motor coordination is not sufficiently effective in sportsmen's demonstration of gymnastic, acrobatic exercises in training and competitions' conditions. As a basic sport, artistic gymnastics affects the development of motor skills: strength, coordination, flexibility, and balance (Albuquerque & Farinatti, 2007; Carrick et al., 2007). Balance, along with other motor skills, plays an important role in the successful execution of sports skills, as well as in the prediction of sport injury (Sabin et al., 2010). Balance training is also used as a part of a rehabilitation program after injury of the ankle and knee joint (Hrysomallis, 2011). Balance is an important factor for success in many sports, particularly in gymnastics, because even minimal distortion affects the final score. Training programs should be composed to give enough time to practice and to develop motor skills (Marinsek & Velickovic, 2010).

This study aims to investigate the effect of 'core training' for 16 weeks on improving balance in 6-8-year-old gymnasts. By exploring the relationship between core training and balance, valuable insights can be gained regarding the potential benefits of incorporating specific exercises targeting the core muscles into the physical preparation of young gymnasts. The results of this research may contribute to the advancement of gymnastics training practices, potentially leading to improved performance and success in national competitions.

2. Material & Methods

2.1. Participants

The study will focus on female gymnasts in the age group of 6-8 years. This age range was chosen to target a specific developmental stage where children are typically engaged in gymnastics training and are able to understand and follow instructions effectively. Selecting a homogeneous group of participants within a narrow age range helps minimize confounding factors and ensures that the results are specific to this age group.

2.2. Procedure

The study will last a period of 16 weeks. This duration was chosen to allow a sufficient training period to observe potential improvements in balance parameters. 16 weeks is a reasonable time frame for evaluating the effectiveness of a training program, as it provides sufficient time for adaptation and skill development.

2.3. Training sessions

Participants will engage in training sessions six times a week, with each session lasting 2 hours. The frequency and duration of the training program are designed to provide adequate training stimulus to the participants. By conducting training sessions six times a week, a consistent and regular practice schedule is ensured, which is essential for mastering and improving skills.

2.4. Test protocol/Instruments

Balance parameters will be measured at the beginning and end of the 12-week experiment using the GRFP "Leonardo" force platform. This device is a reliable and valid tool for assessing various aspects of balance and provides objective measurement of its parameters. It provides accurate data on participants' postural control and stability during various balance tests. The balance tests included in the study are:

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Figure 1.

- Romberg posture, eyes open (EO): Participants hold a static posture with eyes open, which assesses their ability to maintain balance under visual feedback.
- Romberg posture, eyes closed (EC): Participants maintain a static posture with their eyes closed, which challenges their reliance on proprioceptive and vestibular inputs for balance.
- Semi-tangent stance (EO): Participants stand in a semi-tangent position with their eyes open, assessing their ability to maintain balance during a slightly challenging stance.
- Semi-tangent stance (EC): Participants stand in a semi-tangent stance with their eyes closed, assessing their balance control under reduced visual input.
- Tangent stance (EO): Participants stand in a tangent position with their eyes open, testing their ability to maintain balance in a more challenging position.

2.5. Data Analysis

Balance parameters collected during the Pre-test and Post-test will be analyzed using appropriate statistical methods. Descriptive statistics, such as mean and standard deviation, will be calculated for each balance parameter to summarize the data. Paired t-tests or other appropriate statistical tests will be performed to determine whether there are significant improvements in balance parameters after the 16-week baseline training program. Statistical analysis will allow a comparison of participants' balance performance before and after the intervention. By analyzing the data, they can identify any significant changes in balance parameters, providing valuable insight into the effectiveness of the 16-week core training program.

3. Results

In this part of the study, the data extracted from the tests for 5 gymnasts aged 9-10 years were analyzed. The analysis is based on balance tests: Romberg's stance, eyes open (EO), Romberg's stance and eyes closed (EC), Semi-tangent stance, eyes open (EO), Semi-tangent stance, eyes closed (EC), Tangent stance, eyes open (EO), Tangent stance, eyes closed (EC), One leg stance, eyes open (EO), One leg stance, eyes closed (EC). For each test, the following data were obtained: Std. Ellipse Area (cm 2); Std. Ellipse Angle (degree); Num. Eccentricity; dominant Freq (Hz); rel. Path length (mms); abs. Path length (mm); EQ (AP); Total Duration (s).

Table 1. Test "Romberg position, week 1".

Age	Body Weight	Std.Ell Area RomE	Std. Ellipse Angle RomEO	Num. Excent RomE	Domin Freq. RomEO	Rel. Pathlen RomEO	Abs. PathleRomEO	EQ)RomEO	Total Duratio RomEO
7	24.1	2.26	-32.01	0.8	0.6	49.62	248.1	97	5
6	36.5	3.39	0.5	0.73	1.6	54.72	273.6	85.5	5
7	27.7	0.97	-9.99	0.78	1.4	23.58	117.9	91	5
6	23.8	2.94	-17.12	0.88	0.4	26.49	132.5	62.1	5
8	26.5	1.96	18.08	0.87	0.4	33.23	166.1	86	5

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Table 2. Test "Romberg's stance, week 12".

Std. Ellipse Area (1L_EC)	Std. Ellipse Angle (1L_EC)	Num. Excenticity (1L_EC)	Dominat Freq. (1L_EC)	Rel. Pathlength (1L_EC)	Abs. Pathleng (1L_EC)	EQ (AP) (1L_EC)	Total Duration (1L_EC)
24.57	-71.31	0.85	0.4	184.88	924.4	70.6	5
22.68	-10.1	0.8	1.4	147.22	736.1	60.2	5
12.22	-2.92	0.82	0.4	124.16	620.8	66.1	5
7.54	-0.64	0.78	1.2	139.73	698.7	77.3	5
8.2	-75.94	0.8	0.4	109.61	548.1	82.5	5

To analyze the overall average for the test, the descriptive data were analyzed. Based on the data presented in the descriptive data table, we can draw some important conclusions. These findings help us understand the characteristics and performance of the five children tested in gymnastics during the first week. Some of the summarized findings are:

1. For Rom EO tests (Romberg position with eyes open):

- The mean standard area of the ellipse is 2.304 cm², with a standard deviation of 0.933 cm².
- The mean standard angle of the ellipse is -8.108 degrees, with a standard deviation of 18.815 degrees.
- The average eccentricity is 0.812, with a standard deviation of 0.063.
- The dominant frequency ranges from 0.400 Hz to 1.600 Hz.
- The relative length of the road varies from 23,580 mm to 54,720 mm.
- Mean absolute road length is 187,640 mm, with a standard deviation of 69,665 mm.
- EQ (AP) (Rom EO) ranges from 62,100 to 97,000.
- The total duration of Rom EO tests is fixed at 5,000 seconds.

4. Discussion

To understand the differences between the 16 weeks of training, an analysis of the differences between the first week and the twelfth week was done for the first test, which shows different overall results for each measurement. The independent t-test table shows the t-value and degrees of freedom (df) for each measurement, as well as the p-value for the difference between week one and week twelve. In p-values, a value less than 0.05 indicate statistically significant differences. For differences in normality, the results of the normality test (Shapiro-Ëilk) show the Ë-value and the p-value for each measurement. If the p-value is less than 0.05, there is reason to say that the values do not conform to a normal distribution.

T-test for independent samples: For all tested variables (Std. Ellipse Area, Std. Ellipse Angle, Num. Eccentricity, Dominant Freq., Rel. Path length, Abs. Path leng, EQ (AP)), p-values (p-values) are above the level of significance 0.05. This means that there are no statistically significant differences between week 1 and week 16 for these balance variables. Check prerequisites: For all the tested variables, the results of the Normality Test (Shapiro-Ëilk) show that unlike the precondition aspect of the t-test, the data do not follow a normal distribution. This result indicates that the precondition of normality is not met for these data. In conclusion, the analysis shows that there are no statistically significant differences between the first week and the 16th week for all balance variables tested in gymnasts aged 6-8 years. However, it is important to note that the data does not follow a normal distribution, so the results may have an impact on the evaluation of the differences between these two weeks, even though the differences are small and not statistically significant. Based on specific exercises targeting applied balance and a focus on core muscle strengthening, the study expects to observe improvements in balance parameters in participants. Through the 16-week core training program, participants are expected to experience improved postural control, stability and neuromuscular coordination, leading to improved balance performance. The main exercises included in the training program aim to rebalance the kinetic chains, promoting optimal muscle activation and coordination, which is expected to have a positive impact on the participants' balance abilities. Furthermore, the improved neuromuscular control resulting from the training program is expected to minimize the risk of injury during gymnastic performance, as participants will develop better motor control and proprioception. Overall, the study aims to demonstrate the effectiveness of the 16-week basic training program in improving balance parameters in 9-10-year-old female high school gymnasts. The detailed methodology, including participant selection, training sessions, balance measurement tools, and data analysis, provides a rigorous approach to investigate the impact

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of core training on improving balance in this specific population. In summary, the results suggest that for most measures there are no statistically significant differences between week one and week twelve. However, the measure "dominate Freq. (SemTan EO)" shows statistically significant differences between the two weeks. So, in summary, the data manage to show us statistically significant differences for the part of the measurements above. So in particular, there are statistically significant differences in the variables of frequency of dominants, relative and absolute length of the path and area of the standard ellipse, number of eccentricities and EQ (AP), in specific tests. These differences show discernible variation between the two weeks. For the other data, we have non-statistically significant differences, that is, small differences in the improvement of balance after 12 weeks of training. These data also prove the hypothesis of the study that there is an improvement in balance among children aged 6-8, through core training.

5. Conclusion

The results showed significant improvements in some of the balance tests, while smaller but still noticeable improvements were noted in other tests. Based on the study conducted with 6-8 year old gymnasts, it can be concluded that a 16-week Core training program has a positive effect on improving balance. This shows that core training is useful for increasing balance in this age group. The findings suggest that engaging in regular Core training sessions may contribute to the development and refinement of balance skills in gymnasts of this age. Specific exercises aimed at core training have a direct impact on postural control and stability, which are essential for maintaining balance during various physical activities.

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