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SPATIAL - TEMPORAL ORIENTATION AND BALANCE ABILITY AMONG PRIMARY SCHOOL STUDENTS: COMPARATIVE ANALYSIS ACCORDING TO GENDER

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Abstract: *Spatio-temporal orientation and balance ability at certain ages show the superiority of a certain gender type in terms of the level of performance recorded. The aim of this study was to investigate whether performance in spatial-temporal orientation and balance ability differs by gender. In order to determine the differences between genders, an analysis was carried out on a sample of 120 primary school pupils who were divided by gender into two groups: 58 girls (M=27,13, SD=6,50 kg; M=129,07, SD=6,58 cm) and 62 boys (M=29,39, SD=7,90 kg; M=130,92, SD =7,02 cm). The following tests were applied: Matorin and Flamingo Test. For the interpretation of the results the Independent Samples T Test was used. According to the results of the research, in the case of the Flamingo Test - the handy leg, the values (M=4.48, SD=4.21) are significantly higher (t=2.21, DF=118, two-tailed p=0.28) than those of boys (M=3.06, SD=2.62). Regarding the Matorin Test - skill part, boys' values (M=283.06, SD=82.04) are significantly higher (t=3.50, DF=118, two-tailed, p=0.001) than girls' (M=232.55, SD=75.35). It is recommended to develop spatial-temporal orientation and balance skills because these skills play a considerable role in sports and technical games where they are in high demand.*

Key Words: Static Balance; General Coordination; Primary School; Physical Education.

INTRODUCTION

Various factors influencing the development of spatial-temporal orientation and balance skills at certain ages have made this topic the focus of much discussion in the literature, which has established an undeniable link between them, highlighting the superiority of a particular gender type in terms of performance levels.

Specialists in the field consider that the ability to maintain a controlled position by means of compensatory movements of one's own body represents balance. In developing it, the child must develop a sense of balance and the ability to orientate his movements in space, enabling him to appreciate the position of his head in relation to his body and his body in relation to the environment.

In this context, specialists consider that the following notions can be worked with: balance; verticality and inclination of the body; rectilinear movement; rotation of segments, separately or considered as part of the whole.

Postural stability and dynamic balance can be gradual indicators of neurological dysfunctions or exceptional skills for performance shooting, circus arts or special professions, provided they are objectively measured. In their measurement, pertinent questions can be asked about the position of the landmark and the way of scaling. Measurable parameters of oscillations, by convention, can label instability into several categories. It is understood that zero instability is equivalent to perfect equilibrium, and the most unfavourable category of instability is unstable equilibrium" (Gagea, 2010).

It is often considered that the postural balance regulatory system is treated as a mathematical model of the inverted, double-jointed pendulum. Dynamic balance can improve the diagnosis and prognosis of recovery or recuperation in neuropsychological and non-humoral disorders. Objective postural stability and dynamic balance can improve diagnosis, and dynamic balance performs the same role. The training process of athletes focusing on balance and performance can be influenced, positively of course (Gagea, 2010, Pehoiu, 2010).

Movement performed in a coordinated way focuses on combining motor and sensory factors. Proprioceptive excitations reaching the bark, via the pathway of deep, conscious and unconscious sensitivity in the muscles, produce movement through a conditioned reflex.

The coordination of an individual's movements improves as the body grows and develops through constant repetition.

Movement is the set of functions that maintain posture and the execution of movements necessary to relate to oneself, others and the environment. The nervous command acts on the skeletal muscle system and the efficiency of movements is given by the coordination of the body segments.

Humans are endowed with: reflex movements, elementary and rapid, based in the spinal cord; automatic movements, based in the brainstem and basal ganglia (consisting of elementary motor functions as a manifestation of sensory stimulation); voluntary movements, based in the central nervous system, determined by the cognitive

component of the individual, the motivational and affective component (Pastai, 2004, Reilly, 2005).

This psychomotor component is also found in other sports, where general coordination is masifested by the smooth execution of movements. Taking into account this psychomotor component in various sports will give the movement flow, expressiveness and efficiency (Pastai, 2004, Guy, 2001, Hirtz, 2002, Van Dongen, 2004).

Through its objectives and curriculum, school physical education effectively develops the students' skills, particularly the coordinative skill component, which is the foundation for learning to move, for developing daily motility, and for developing the specialized, refined motility needed for participating in particular sports. The neurological and motor foundation necessary for the development of complex motor habits - a foundation that is crucial for the coordinative skill - is provided by middle school age. Individuals vary in terms of how well this function is carried out and how much it helps a person become flexible and adaptive to a wide range of challenging circumstances. In addition to movement combination and coupling, kinesthetic, balance, motor response, movement transformation, and spatiotemporal orientation, together with movement combination and coupling, and with kinesthetic, balance, motor reaction, movement transformation and rhythm differentiation form the coordinative skills (Pehoiu, 2010, Matchock, 2010).

In order to ensure the best movement control and response to environmental fluctuations, coordination - which is a complex and multifaceted phenomenon - represents the qualitative component of psychomotor activity (Di Cagno et al., 2012, Vandorpe et al., 2012).

In many sports, especially in limited skill disciplines, coordination abilities are crucial for success. When it comes to the relationship between circadian cycles and coordination abilities, there is still a dearth of understanding, according to a review of the literature. Furthermore, there hasn't been much research done on how children's and adolescents' performance varies during the day. Coordination, flexibility, and reactive strength are crucial performance-enhancing factors in among the younger students from the first gradeand may help identify potential talent (Di Cango et all, 2012, Miletic et al, 2004, Forsman et al, 2007, Soussi et al., 2010, Wright et al., 2002, Douda et al., 2008).

Objectives

The aim of this study was to investigate whether spatial-temporal orientation and balance performance differed by gender.

MATERIAL AND METHODS

Experimental design

The following tests were applied in this study: ***The Matorin Test*** - in order to establish general coordination, balance and orientation in space and the ***Flamingo Test*** to establish static balance. ***The Independet - Samples T Test*** was used to interpret the results. These tests were performed by primary school students who do not practice any competitive sport.

Procedures

Matorin Test

Materials needed: chalk, teaching protractor.

Time/subject: 3 minutes / pupil.

Protocol: draw a circle on the ground with a diameter of 35 cm and a line dividing the circle into two equal halves. The pupils stand with their feet on either side of the line drawn on the ground and their arms down. They perform a straight jump with a turn around the longitudinal axis of the body to the right and then a jump with a turn to the left. During the jump the students must not lose their balance. After each jump, the pupils must land inside the circle with their feet close together. This will remain on the landing spot until the examiner measures the angle of the turn. If the pupil lands outside the circle, the jump will be cancelled. The aim is to establish general coordination, balance and orientation in space. To record the results, subjects perform the test twice and the best score is recorded (Tudor, 2013)

Flamingo Test

Materials needed: stopwatch; balance stand (50 cm long, 4 cm high and 3 cm high).

Time/subject: 3 minutes / pupil.

Protocol: the pupil stands on the favourite leg which will be oriented on the longitudinal axis of the balance stand. The hand on the same side will grasp the ankle of the other lower limb which is bent from the knee joint, the other arm is extended and held forward. The aim is to establish static balance. To record the results, subjects perform the test twice and the best score is recorded (Gavojdea, 2016).

Statistical analysis

In order to determine gender differences, an analysis was carried out on a sample of 120 primary school pupils who were divided by gender into two groups: 58 girls *(M = 27.13, SD = 6.50 kg and M = 129.07, SD = 6.58 cm)* and 62 *boys (M = 29.39, SD = 7.90 kg and M = 130.92, SD = 7.02 cm).*

A series of methods and indicators were used: *descriptive satistics* including ***arithmetic mean*** and ***standard deviation*** and computer graphing method for which Microsoft Office Excel was used.

The tests were carried out on both the skill and non-skill sides of the students.

For the interpretation of the results for the comparison of the sample means, ***the Independet - Samples T Test*** was used and a comparison between the results was made. ***SPSS version 23*** was used for statistical analysis of the data.

RESULTS AND DISCUSSIONS

Table 1 and Figures 1 and 2 compare the results of the two tests taken by primary school students in our research. The table shows the results obtained by boys and girls separately, both on the skill and on the skill part for both tests.

Tabel 1 Results obtained at the tests applied

Test applied	Girls		Boys		*t*	DF	*two-tailed p*
	n	Mean (Std. Deviation)	n	Mean Std. Deviation			
Height	58	27,13 (6,50)	62	29,38 (7,90)	-	-	-
Weight	58	129,07 (6,58)	62	130,92 (7,02)	-	-	-
Flamingo Test (Skillful Foot)	58	4,48 (4,21)	62	3,06 (2,62)	2,21	118	0.028
Matorin test (Skill part)	58	232,55 (73,35)	62	283,06 (82,04)	3,50	118	0.001

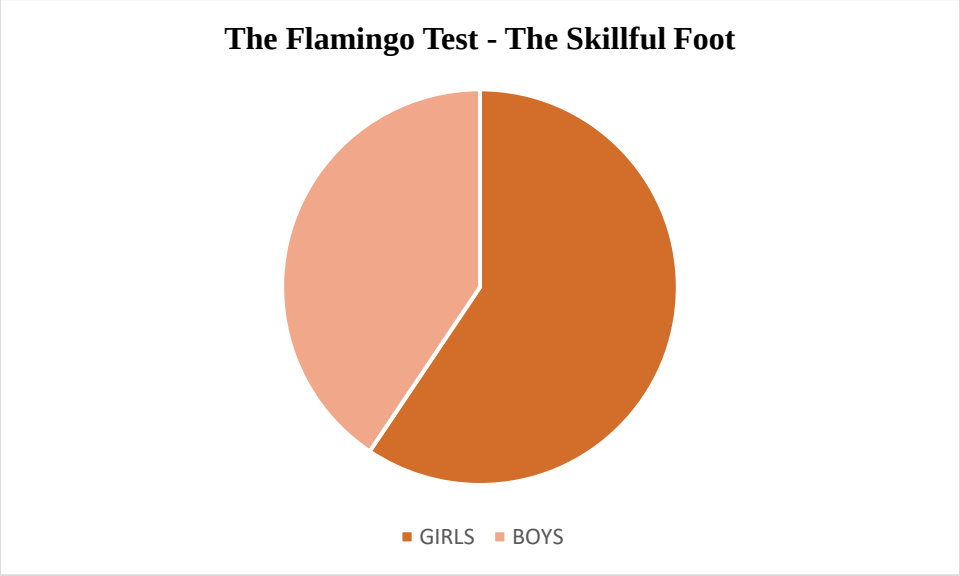

Fig. 1 The Flamingo Test - The Skillful Foot

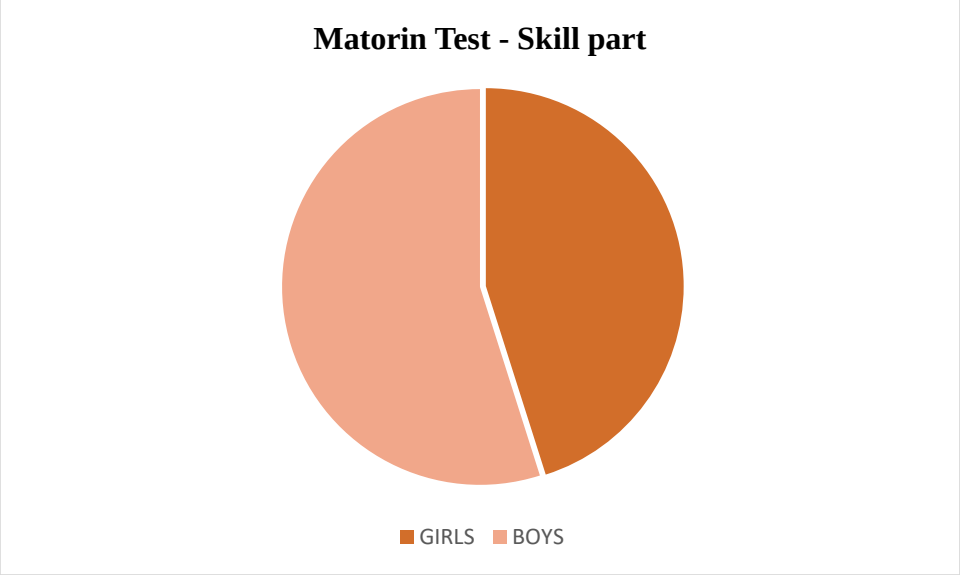

Fig. 2 Matorin Test - Skill part

According to the research results, in the case of Flamingo Test - girls, the clumsy leg, the values *(M = 4.48, SD = 4.21)* are significantly higher *(t = 2.21, DF = 118, two-tailed p = 0.28)* than those of boys *(M = 3.06, SD = 2.62)*, being statistically significant, in the case of the non-clumsy leg the data are statistically insignificant. As for the Matorin Test, the dexterous part, boys' values *(M = 283.06, SD = 82.04)* are significantly higher *(t = 3.50, DF = 118, two-tailed p = 0.01)* than girls' *(M = 232.55, SD = 75.35),* being statistically significant.

DISCUSSION

Given that obesity, lack of exercise and teenage interest in technology seem to be taking over their lives, the authors believe that addressing these issues is both necessary and topical. Researchers (Abalașei, Moraru, Popovici, 2018), believe that motor skills - with all its components - contribute to enriching the biological and psychological heritage of adolescents through a systematic and continuous action. Physical exercise, as the main tool, is the biological stimulus that through accumulation ensures both a harmonious physical development and a balanced education of motor qualities. In research studies, the aim was to influence the body shaping of secondary school students according to their level of psychomotor development. In order to carry out the research, it was assumed that applying an aerobic gymnastics program would highlight the role of psychomotor components in body shaping. The research subjects were 13 female students (11th grade) from a high school in Iasi. The researchers applied the following motor tests: the Flamingo balance test, and the Matorin test. The independent variable of the study was represented by aerobic gymnastics programs at an average level, according to the level of psychomotor development of high school students. Aerobic gymnastics sessions were held three times a week and lasted 50 minutes each. The statistical-mathematical interpretation of the data shows that in the Flamingo test, the subjects recorded an increase in values from 27.07 seconds to 34.61 seconds; in the Matorin test, they observed an improvement in the values recorded on the right side (360.38 degrees) compared to the left side (347.30 degrees), given that most of the subjects are right-handed. Exercises performed mainly using this side also had higher values. The test showed an increase in values from 2.75 movements to 5,625 movements performed correctly to the left and from 3,875 to 7,571 movements performed correctly to the right. In line with the above mentioned statements, the researchers concluded that the aerobic gymnastics routine was effective, thus improving the psychomotor components, namely the basic motor, neuromotor, perceptual-motor structures and ducts (Abalașei, Moraru, Popovici, 2018).

CONCLUSION

The results show that motor performance requires the development of spatial-temporal orientation and balance skills at an early age as these skills play a considerable role in sports and technical games as they are in high demand.

The results of the *psychomotor tests* also helped us to form an overall picture of the motor skills of primary school students and it can be said that all sports games, as well as technical games, by their structure, require an adequate level of balance because, in their composition, there are manifestations of both static and dynamic balance.

We believe that after the application of a training program, the results of students can show a better general coordination, spatial-temporal orientation and an evolution at the level of static and dynamic balance, and these can determine the degree of efficiency of the training process and the increase of sports performance.

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Other specifications

All the authors had equal contributions to this research.

REFERENCES

1. *Abalaşei, B.,A., Moraru, C.,E., Popovici, I.M. (2018). Role of Psychomotor Conducts in Bodily Modelling. The Impact of Sport and Physical Education Science on Today's Society, pp. 287 - 292.*
2. *Di Cango. A., Battaglia, A., Piazza, M., Giovani, F., Calcango, G., Pigozzi, F., Borrione, P. (2013). Time of Day - Effects on Motors Coordinatios and Reactive Strenght in Elite Athletes and Untrained Adolescent. Journal of Sport Science & Medicine, 12: 182 - 189.*

3. *Forsman, P., Haeggström, E., Wallin, A., Toppila, E. and Pyykkö, I. (2007). Daytime changes in postural stability and repeatability of posturographic measurements. Journal of Occupational and Environmental Medicine, 49: 591 - 596.*
4. *Gagea, A., 2010. Tratat de cercetare ştiinţifică in educaţie fizică si sport - suport de curs, pp. 75 - 141.*
5. *Gavojdea, A.M. (2016). Study Regarding Balance in 9 - 10 Years Old Gymnasts. The European Proceedings of Social & Behavioral Science, 10, 218 - 225.*
6. *Guy, J.A. and Micheli L.J. (2001). Strength training for children and adolescents. Journal of the American Academy of Orthopaedic Surgeons 9: 29 - 36.*
7. *Hirtz, P. and Starosta, W. (2002). Sensitive and critical periods of motor coordination development and its relation to motor learning. Available: Journal of Human Kinetics 7: 19 - 28.*
8. *Matchock, R.L. (2010). Circadian and sleep episode duration influences on cognitive performance following the process of awakening. International Review of Neurobiology 93: 129 - 151.*
9. *Miletić, Đ., Katić, R. and Maleš, B. (2004). Some anthropologic factors of performance in rhythmic gymnastics novices. Colegiuml Antropologicum, 28: 727 - 737.*
10. *Pehoiu, C. (2010). Spatio - temporal orientation development during the physical education class, with 5 th and 6 th form pupils. World Academy of Science, Engineering and Technology, 72: 76 - 85.*
11. *Reilly, T. and Ekblom, B. (2005). The use of recovery methods post - exercise. Journal of Sports Science, 23: 619 - 627.*
12. *Tudor, V. (2013). Măsurare şi evaluare în sport. Editura Discobolul, p. 161.*
13. *Van Dongen, H.P. (2004). Comparison of mathematical model predictions to experimental data of fatigue and performance. Aviation Space of Environmental Medicine 75: A15 - 36.*
14. *Vandorpe, B., Vandendriessche, J., Vaeyens, R., Pion, J., Matthys, S., Lefevre, J., Philippaerts, R. and Lenoir, M. (2012). Relationship between sports participation and the level of motor coordination in childhood: A longitudinal approach. Journal of Science and Medicine in Sport, 15: 220 - 225.*
15. *Wright, K.P., Hull, J.T. and Czeisler, C.A. (2002). Relationship between alertness, performance, and body temperature in humans. American Journal of Physiology Regulatory, Integrative and Comparative Physiology, 283: 1370 - 1377.*