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EFFECTIVENESS OF PEDAGOGICAL METHODOLOGY FOR PREVENTION OF SPINAL DEFORMITIES

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ABSTRACT

The research *objective* of this study is to establish the pedagogical benefits of a proven spinal-corrective methodology in game situations in the educational direction of "Physical Culture" in kindergarten conditions on preschool children, as well as to track their attitudes during the implementation of the innovative methodology of spinal-corrective complexes. This experimental *study aims* to track the pedagogical effect of the applied spinal-corrective methodology for correcting and preventing spinal curvatures. *The subject* of the study is the application of the complexes of corrective exercises for the correction and prevention of spinal curvatures according to a specially developed pedagogical methodology with pedagogical and innovative aspects. *Research contingent*: 100 children aged 5-6 years were studied, divided into two target groups: control and experimental. During the study, an experimental methodology of two spinal-correcting complexes was applied to the experimental target group.

Keywords: effectiveness, pedagogical, prevention, spinal-corrective methodology

INTRODUCTION

The increasing immobility is taking on threatening proportions and has an increasingly adverse impact on educational practices, therefore it is essential to understand the impact and effectiveness of new methods for the prevention of postural and spinal curvatures in the growing child's organism (1-6). Based on an analysis of specialized sources, the study established several methods for conservative treatment of school-age children, in which various types of motor activity prevail (7). The fact is that there are relatively few and extremely insufficient studies on early correction of spinal curvatures in children between 5 and 6 years old, as well as on the possibilities of prevention through special corrective exercises (8). At this age, children have not yet developed motor habits and stereotypes (9-12). Most of their day is spent in kindergarten.

Despite the situation of physical culture following the state educational standards for preschool education, set out in the curricula of the Ministry of Education and Science, it should be noted that there is no requirement to conduct classes for the prevention and early correction of spinal curvatures (13-14). All this determines the hypothesis of the present study, namely: if complexes of special corrective exercises for preschool children are developed and tested, their growth and motor development can be stimulated, which will allow early correction and prevention of incorrect posture and spinal curvatures (15-18).

METHODS

The study started in January 2024. For one year, we worked with 100 children from a metropolitan kindergarten. We divided them into an experimental group (65 children) and a control group (35 children). After the informed consent of teachers and parents, the author's complexes of special corrective exercises were tested on an experimental target group for one year, 300 sessions. The control target group was left on the usual daily regimen, without applying special corrective exercises. In the educational direction of "Physical Culture" with the children of the experimental group, classes are held with children's teachers trained by us on the methodology of corrective exercises. The experimental method of two spinal-correcting

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complexes was applied to the experimental target group during the study. The study was conducted in a metropolitan kindergarten.

Conducting a research methodology - planning and organization
Developing a pedagogical concept and creating a specific organization for conducting the scientific experiment. Presentation and analysis of the results - tabular, graphical, and through statistical variables through statistical analysis.

Studying the possibility of application in practice.
At the beginning of the experimental study and after one year, the following functional parameters were studied:

- Pulse - beats/min
- Chest circumference during inspiration (inhalation) in (cm)
- Chest circumference during expiration (exhalation) in (cm)
- Difference between inhalation and exhalation in (cm)
- Balance test, time to straighten the right leg in (sec)
- Standing up and sitting down from a chair in 5 seconds (count)
- Squatting and standing up to standing in 10 seconds (count)
- Forced Vital Capacity – FVC in (ml)
- Peak flow rate – PFR $_{expiratory}$
- Dynamometry – right arm (kg)
- Dynamometry – left arm (kg)

Two experiments were conducted for each indicator, the better one being used. The results of the studied parameters were processed mathematically and statistically using the methods of correlation and variance analysis.

RESULTS

From the analysis of the results obtained, it can be concluded that the experimental target group improves statistically significantly most of the studied indicators, which can be considered as a subsequent effect of the applied experimental methodology for the prevention of spinal curvatures. In the control target group, a weak but uncertain improvement of most functional indicators is observed, except for the pulse. Therefore, we can assume that for one year of growth and development in both target groups, favorable changes are observed in most indicators, but only in the experimental group are they statistically significant and regular.

The justification for these conclusions is reflected in the empirical values of the summary **Table 1**, where a benchmarking analysis was performed, obtained after mathematical and statistical processing of the results of the functional tests conducted in the two cognitive stages of the study.

Table 1. *Benchmarking analysis of functional parameters - EG/CG - start/end*

№	Indicators / Research	Beginning of the study							End of the study						
		Experimental		Control group		X_1/X_2	t	p	Experimental		Control group		X_1/X_2	t	p
		X_1	S_1	X_2	S_2				X_1	S_1	X_2	S_2			
1	Pulse - beats/min	102.63	10.71	105.54	6.99	2.91	1.83	>0.100	95.45	8.60	109.06	7.77	13.61	9.47	<0.001
2	PFR expiratory	159.08	27.43	139.71	22.03	19.37	4.44	<0.001	171.17	28.28	144.86	22.41	26.31	5.88	<0.001
3	FVC ml	1.48	0.34	1.63	0.30	0.15	2.71	<0.050	1.58	0.31	1.66	0.29	0.08	1.56	>0.100
4	Inhalation/cm	60.94	4.12	60.20	3.95	0.74	1.04	>0.100	62.52	3.78	60.63	3.75	1.89	2.87	<0.020
5	Exhalation/cm	57.62	4.16	56.94	3.88	0.68	0.96	>0.100	59.17	3.89	57.63	3.87	1.54	2.26	<0.020
6	Difference / cm	3.32	0.04	3.26	0.66	0.06	0.77	>0.100	3.35	0.11	3.00	0.84	0.35	3.37	<0.010

The statistical interpretations of the differences between the two target groups at the beginning and the end of the study period provide objective information about the changes that occurred in the one-year study, conducted in parallel with the natural ontogenetic changes that occurred. **Table 1** shows that in the initial study, the differences between the two target groups were small and in most cases statistically insignificant. It was found that the pulse was higher by 2.91 beats/min in the control group, the peak expiratory flow rate (PFR exp.) was lower by 19.37 ml, the forced vital capacity (FVC) was higher in the control group, and for other indicators "inhalation", "exhalation" and "differences" the values were almost the same. It can be noted that only in the peak respiratory flow rate were the differences between the two groups statistically reliable (P<0.001).

In the latter study, the presence of more substantial and statistically significant differences between the two target groups was found. Thus, the difference in resting heart rate between the two groups increased by 13.61 beats/min (P<0.001), which is

due to the increased values of this functional parameter in the control group, in contrast to the experimental group, in which the heart rate slowed down statistically significantly at the end of the study period. Peak expiratory flow rate (PF) was better at the beginning in the experimental group. At the end of the study, the differences between the two groups deepened, and from 19.37 ml reached 26.31 ml (P<0.001), as can be seen from **Figure 1**.

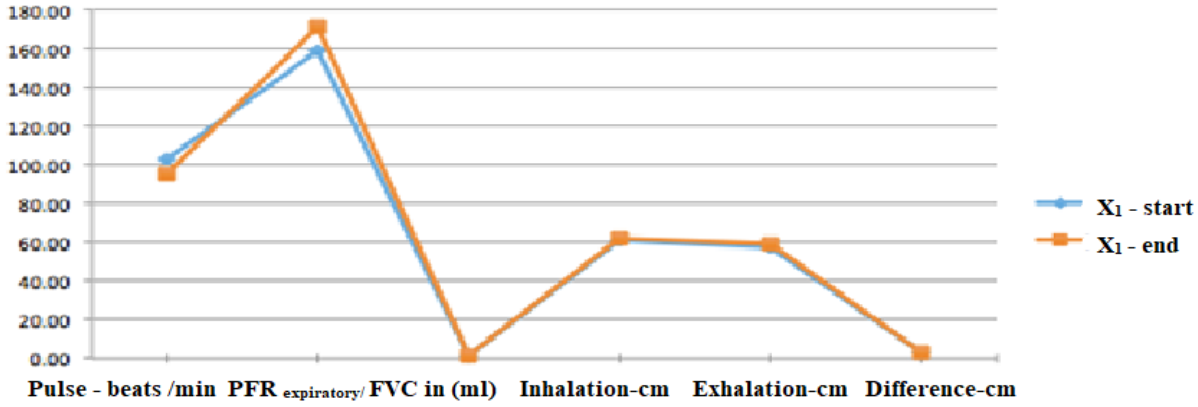

Figure 1. Functional parameters of EG – start/end

The situation is similar to FVC, where a greater increase in this indicator was found in the experimental group, but the differences at the end of the experiment were unreliable (P>0.10). The differences in the other indicators of external respiration (inhalation, exhalation, and differences) at the end of the study period deepened due to the more pronounced positive changes in the experimental group. The differences between the two target groups here are also statistically significant (P<0.001).

The following **Table 2** and **Figure 2** reflect the benchmarking analysis between the two target groups, followed by the two cognitive stages of the study concerning the functional state of the studied contingent.

Table 2. *Benchmarking analysis of functional parameters - EG/CG – start/end*

№	Indicators / Research	Beginning of the study							End of the study						
		Experimental		Control group		$X_1 - X_2$	t	p	Experimental		Control group		$X_1 - X_2$	t	p
		X_1	S_1	X_2	S_2				X_1	S_1	X_2	S_2			
1	Squat - count	9.34	1.12	8.69	1.05	0.65	3.40	<0.001	10.45	1.06	8.97	0.97	1.48	8.30	<0.001
2	Standing up-Sitting down	5.25	0.97	4.77	0.73	0.48	3.16	<0.001	5.97	0.90	5.03	0.62	0.94	6.93	<0.001
3	Dynamometry-right arm	7.44	2.06	5.49	1.90	1.95	5.61	<0.001	8.14	2.05	5.71	1.92	2.43	6.98	<0.001
4	Dynamometry-left arm	6.71	2.27	4.50	1.70	2.21	6.28	<0.001	7.36	2.33	4.91	1.76	2.45	6.76	<0.001
5	Balance test	27.22	10.80	24.26	9.26	2.96	1.68	>0.100	29.66	10.88	24.94	9.14	4.72	2.68	<0.020

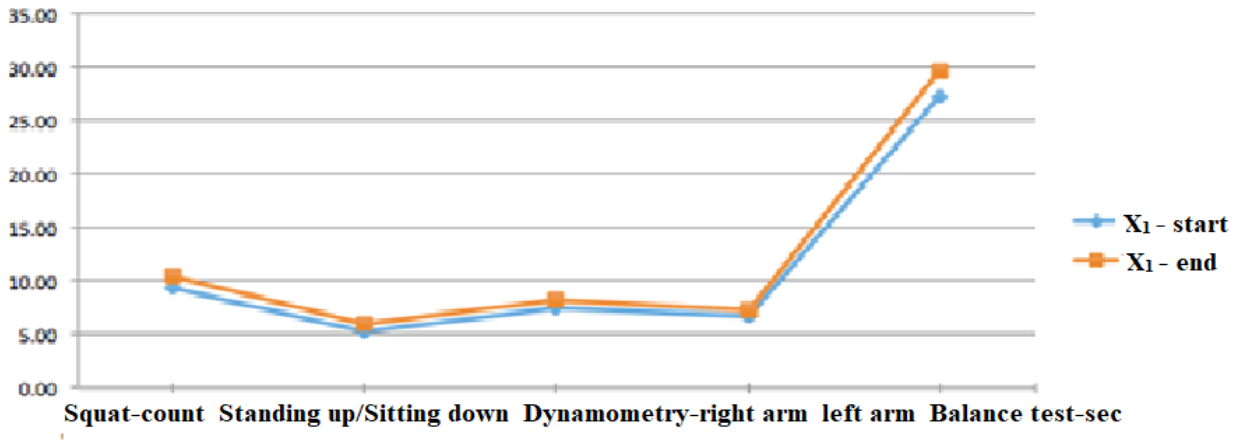

Figure 2. Functional parameters of EG – start/end

DISCUSSION

In absolute values, the results of the experimental group are better than those of the control group in all indicators, but the differences in most cases are not reliable. Therefore, at the beginning of the experiment, the functional state of the children from the experimental group is slightly better than that of the children from the control group. This finding applies mainly to the indicator "dynamometry". Based on the benchmarking analysis, it can be assumed that at the end of the study, the differences in the experimental and control groups in the functional indicators increase and deepen mainly due to the more pronounced improvement observed in the experimental group. The indicated changes in absolute values correlate with the percentage ratio in the studied functional indicators **(Table 3, Figure 3).**

Table 3. *Benchmarking analysis by absolute values*

Benchmarking analysis in percentages			
№	**Research indicators**	**EG**	**CG**
		X_1/X_2	**S_1/S_2**
1	**Pulse - beats/min**	**97**	**153**
2	**Peak Flow Rate – PFR expiratory**	**114**	**125**
3	**Forced Vital Capacity – FVC ml**	**91**	**113**
4	**Chest circumference – inhalation/cm**	**101**	**104**
5	**Chest circumference – exhalation/cm**	**101**	**107**
6	**Difference between inhalation - exhalation/cm**	**102**	**7**
7	**Standing up and sitting down from a chair in 5 seconds (count)**	**107**	**107**
8	**Squatting and standing up to standing in 10 seconds (count)**	**110%**	**133%**
9	**Dynamometry – right arm (kg)**	**135%**	**108%**
10	**Dynamometry – left arm (kg)**	**149%**	**133%**
11	**Balance test - seconds**	**112%**	**117%**

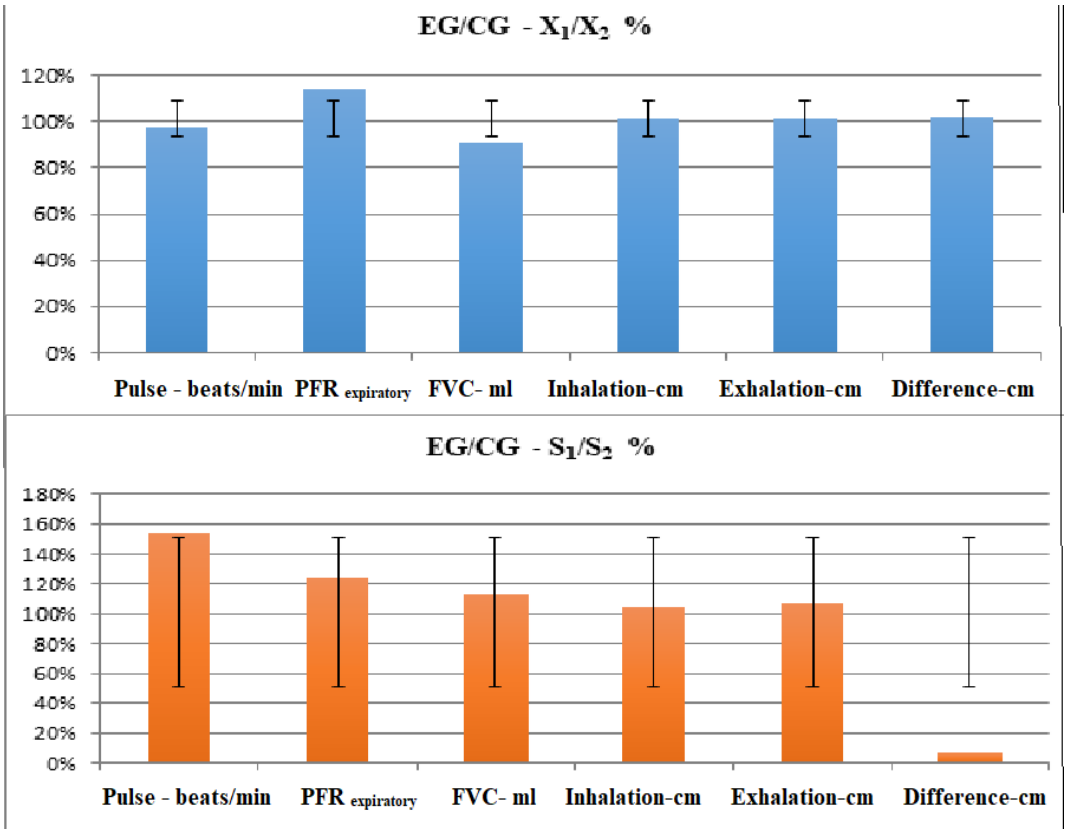

Figure 3. Benchmarking analysis by absolute values - %

A detailed review of the changes that occurred during the one year of statistically established growth in both target groups shows trends that can be formulated as follows:

- In the initial study, the functional state was similar in both target groups. The differences were insignificant and unreliable for most indicators.
- At the end of one year of study, the functional state improved in both groups, but the differences increased significantly, mainly due to the greater quantitative increase in the values in the experimental group, unlike the control group.

CONCLUSIONS

The differences were reliable in all indicators, which gives us reason to assume a unidirectionality in the improvement of all indicators.

The differences in the empirical values in the two groups are only in the added exercises within the routine physical activity module, and it can be concluded that the better functional state in the experimental group is due to the applied pedagogical methodology of spinal-corrective complexes.

The comparative analysis of functional indicators established the undeniable effectiveness of a proven experimental methodology for the prevention of spinal curvatures, applied to preschool children.

Thus, the research goal of this study was achieved. The pedagogical benefits of a proven spinal-corrective methodology in game situations from the educational direction of "Physical Culture" in kindergarten conditions on preschool children, as well as the positive attitudes when applying the innovative methodology of spinal-corrective complexes, have undoubtedly been established.

REFERENCES

1. Dimitrova, B. The Economic Impact of Brain Drain on the Development of Wellness and Spa Tourism in Bulgaria. *Trakia Journal of Sciences*, Vol. 21, Suppl. 3, 2023. eISSN 1313-3551, http://www.uni-sz.bg
2. Dimitrova, B. Sustainable quality of SPA programs through benchmarking the biomechanical profile of a new aqua spinning methodology. *Series on Biomechanics*, Vol.38, No.2, 23-28, 2024. DOI:10.7546/SB.03.02.2024
3. Dimitrova, B. A Wellness lifestyle enhances emotional intelligence. International scientific conference. *Expanding knowledge through interdisciplinary research*. Sydney, Australia. 27-28.02.2025. Proceeding, p.92-98, 2025.
4. Dimitrova, B. Niche tourism - innovations and quality culture in specialised workforce development. *German International Journal of Modern Science* V.100, p.24-30, 2025 ISSN (Online) 2701-8377
5. Dimitrova B. et al. Smart kognitiven instrumentarium. Vŭnshna otsenka na profesionalni kompetentsii za kadri v Nishov turizŭm. NSA Press, p. 110. 3. 2021.
6. Ignatova, D. Study the influence of yoga specialised practices on the Formation of correct body posture and corrections of spinal Deformities. *Smart Inovattions in Recreative & Wellness Industry and Niche Tourisum - Scientific Journal*, Vol. 4 Issue 1-2, ISSN: 2603-4921(online), page:17-22, Sofia, 2023. https://scjournal.globalwaterhealth.org/current-issue/
7. Ignatova, D. Smart Educational Models of Wellness Practices, Recreation, Wellness Industry and Niche Tourism, *International Scientific Journal for Smart Innovations*, Vol. 6, Is. 1, pp.15-23, 2024. ISSN: 2603-4921, Sofia. https://scjournal.globalwaterhealth.org/wp-content/uploads/2024/11/2.-IGNATOVA.D. SMART-EDUCATIONAL-MODELS-FOR-WELLNESS-CULTURE.pdf
8. Ignatova, D., Miletiev, S. Study the Influence of Athletics Exercises on the Development of Motor Qualities, *Scientific Journal - Smart Inovattions in Recreative & Wellness Industry and Niche Tourisum*, Vol. 3, Suppl. 1-2, pp 07-12, 2021.
9. Angelova P., Belomazheva-Dimitrova, S. Study on sports injuries among students volleyball athletes, *Trakia Journal of Sciences*, Vol. 21, Suppl. 1, pp 425-430, 2023. http://www.uni-sz.bg ISSN 1313-3551 (online) doi:10.15547/tjs.2023.s.01.071
10. Angelova, P., Petkov, P. Research of physiometric indicators of female students from trakia university, *Trakia Journal of Sciences*, Vol. 18, Suppl. 1, pp 695-698, 2020. http://www.uni-sz.bg ISSN 1313-3551 (online) doi:10.15547/tjs.2020s.01.112
11. Iliev, A. I. Emotion Recognition Using Glottal and Prosodic Features (*Doctoral dissertation*, University of Miami), 2009.
12. Iliev, A. I. Feature vectors for emotion recognition in speech. *In National Informatics Conference*, pp. 225-238, 2016.

13. Angelova P. Study some risk factors such as the cause of muscle imbalans and lumbar pain, *Trakia Journal of Sciences*, Vol. 17, Suppl. 1 pp 901-904, 2019. http://www.uni-sz.bg ISSN 1313-7069 (print) ISSN 1313-3551 (online) doi:10.15547/tjs.2019s.01.148
14. Miletiev, S. Evaluation of Bulgarian Physical School Education, 2022.
15. Ignatova, D. Implementation of motor complexes based on specialized application system blaze-pod trainer, *Bulgarian Educational Journal, Strategies for policy in science and education,*Volume 31, Number 6, 2023, www.azbuki.bg, www.azbuki.eu, ISSN 1310 – 0270 (Print), ISSN 1314 – 8575 (Online), pp. 653 - 667, Sofia, 2023. https://doi.org/10.53656/str2023-6-6-imp https://azbuki.bg/wp-content/uploads/2023/12/strategies_6_23_darinka-ignatova.pdf
16. Ignatova, D. Tracking functional dynamics in motor potential for development of Wellness Culture, *Trakia Journal of Sciences*, Vol. 21, Suppl. 1, pp 583-590, 2023. http://www.uni-sz.bg ISSN 1313-3551 (online) doi:10.15547/tjs.2023.s.01.097
17. Apturkar, A., Iliev, A. I., Anand, A., Oli, A., Siddenki, S. R., & Meka, V. R. Sentiment analysis of speech with application to various languages. *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 10, 103-118, 2020.
18. Ignatova, D. & Iliev, A. Current methods and models combining nutritional regimes with motor activity, Recreation, Wellness Industry and Niche Tourism, *International Scientific Journal for Smart Innovations*, ISSN: 2603-4921, 05 (1-2), pp. 08-14, 2023. https://scjournal.globalwaterhealth.org/wp content/uploads/2024/02/2.IGNATOVA_ILIEV_p.7-13_2023.pdf