THE INFLUENCE OF CORRECTIVE GYMNASTICS ON THE CORRECTION OF BAD BODY POSTURE AND MOTOR ABILITY CHILDREN

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***Abstract**: Postural control enables the position of the body in space with the aim of orientation and stability against the force of gravity. The sample of respondents consisted of 27 respondents. All respondents are patients of the Master Fizikal Clinic in East Sarajevo. The average age of the subjects was 9 years (±2 years). Variables for determining disorders on the spinal column in the sagittal plane (kyphotic poor posture and lordotic poor posture) using the GPS Postural Lab 6.0 device and variables for determining the motor status of the examinee (nine motor tests for assessing flexibility, explosive and repetitive strength of the organism). The program of corrective gymnastics was used as an extracurricular activity, it lasted four months, with three hours a week. The implemented program of corrective gymnastics contributed to the complete rehabilitation of kyphotic and lordotic bad posture, as well as to the improvement of some motor skills.*
***Key words:** kyphosis, lordosis, posture, analysis, prevention.*

INTRODUCTION

The modern way of life, which is characterized by a decreasing presence and representation of physical movement and activity, increasingly frequent and longer stays indoors and a sedentary lifestyle, reflects on both children and their childhood. Due to environmental factors, children are less and less exposed to motor activities, free play and movement in nature, and they spend more and more time sitting in front of televisions, computers, various game consoles, and driving cars. The insufficiently developed awareness of educators and parents about this problem does not contribute to the correction and suppression of the ever-present irregular and poor posture of the child in standing and sitting positions, the development of the habit of proper posture and daily exercise (Kovačević, 2013).

Improper body posture, which has become a visibly significant and frequent problem today and at an increasingly younger age, needs to be spotted and recognized as early as possible and diagnosed precisely and accurately. This also includes the preschool period of the child. This will enable early detection of potentially serious difficulties, inclusion of the child in targeted preventive kinesiology activities and further monitoring of the development of the condition (Largo, 2013). In preschool institutions, health managers and educators should be trained and educated to assess and analyze the obtained data. The possibility and ability to perform as accurate and precise an assessment as possible of the position of the child's body requires the knowledge, skill and experience of the assessor (Nikšić, Mahmutović, & Rašidagić, 2015).

The correct posture is one in which the position of the head is exactly above the pelvis and in which the shoulder girdle is above its level. It is a position in which the weight of the body is properly distributed on both legs, and by observing the body in the sagittal plane, the imaginary line must pass through the middle of the ear, shoulder joint, hip joint and knee joint and end in the center of the ankle. In the frontal plane, the shoulders, hips and knees must be at the same height, and the head must be in an upright position, without bending or leaning forward. "When the body is in an upright position, there is constant action of the muscles under the influence of the human will" (Kosinac, 2008:115). For correct posture, there are many prerequisites such as: the strength of the postural muscles, the flexibility of the joints, and the muscular ability to maintain the correct position of the anatomical parts, kinesthetic and visual orientations that enable correct alignment and sufficient balance to straighten the body and stabilize it through the support" (Knezović Svetec, 2016: 171). "Postural control enables the position of the body in space with the aim of orientation and stability against the force of gravity. Postural control

is an automatic action, it is innate but improves over time. Postural control gives us stability in space at all times, it also gives us orientation, an image of ourselves and an internal representation of ourselves.

METHODS

Sample of respondents

The sample of respondents consisted of 27 respondents. All respondents are patients of the Master Physical Clinic in East Sarajevo. The average age of the subjects was 9 years (±2 years). The sample was targeted because all subjects were diagnosed with disorders of the spinal column in the sagittal plane. All respondents expressed voluntary participation in the research, i.e. to agree to the data being used for the purposes of scientific research.

Sample variables

The following variables were selected to assess postural status: kyphotic poor posture (KKIF) and lordotic poor posture (KLOR). The motoric status of the subjects was evaluated with the following tests: for the assessment of flexibility, the baton kick (MISK), prone lunge (MZLE) and deep bench bend (MDPR), for the assessment of explosive power, the lying medical throw (MBME), long jump from a standing position (MDSK) and high jump from a standing position (MVSK)) and for the assessment of repetitive strength (push-ups on the ground (MSKL), forward bend from lying down (MTRB) and lunge from lying down (MLED).

Measurements of the deviation of the spinal column in the sagittal plane were performed in the morning with the use of a modern device GPS Postural Lab 6.0 - Chinesport. All results that had values greater than 3.5 cm in the thoracic region, and values greater than 4.5 cm in the lumbar region, were subjected to further treatment. To measure motor abilities, generally accepted tests were used, the validity of which has been proven through previous research. The group of subjects, which was formed on the basis of established disorders, did exercises to correct them in the following order: exercises to increase the mobility of the spinal column, exercises to strengthen weakened (stretched) musculature (agonists), exercises to stretch shortened musculature (antagonists) and breathing exercises .

The exercise program for strengthening weakened muscles, up to the control measurement and from the control to the final measurement, differs in initial positions, volume and intensity. The differences are in the direction of increasing the workload of the examinees (practitioners) with the approach of the end of the experiment, which is determined by the work plan. The work with the subjects began after the measurements of the postural and motor status were carried out. The experimental program lasted four months, after which the final measurement was performed.

Data processing methods

Discriminative analysis is one of the more complete and superior methods in group comparison analyzes because it takes into account not only the quantitative values of individual variables or systems of variables, but also their mutual relations. In addition, through discriminant analysis, the hierarchy of variables that contribute to the differentiation of groups can be seen.

Discriminant analysis has two main goals:

- to determine whether there is a statistically significant difference in the means of two or more groups, and then to determine which of the variables makes the greatest contribution to the determined difference, i.e. discrimination or separation of groups, and
- to determine the procedure for the classification of observations based on the values of several variables into two or more separated, predefined groups, known as the classification or allocation of observations.

Depending on the research, discriminative analysis can be performed in several ways, but it is most often used in kinesiological anthropological research:

Linear discrimination of two groups and canonical discriminative analysis:

- determine the differences between samples from two distinct populations (men-women),

- determine the differences between the two examined groups (able-disabled, healthy-sick, delinquent-non-delinquent, etc.), and
- based on an n-dimensional system of manifest or latent variables, which are treated as predictors, make forecasts in which group a respondent will be included or in which group it is best to include him.

Canonical discriminant analysis:

- define the characteristics of groups of respondents in manifest or latent space,
- on the basis of an n-dimensional system of manifest or latent variables (as a system of predictor variables), optimally determine the affiliation of a respondent to a group of respondents, and
- transform latent or manifest variables into a system of independent canonical variables, which maximally separate groups of respondents.

RESEARCH RESULTS WITH DISCUSSION

The measurement results were processed by canonical discriminant analysis, and the relationships obtained were explained through discussion.

Table 1 Canonical discriminant functions

Fcn	Eigen V.	Pct of Var	Cum pct	Can Cor	Wilks λ	χ2	DF	Sig
1	1.19	86.82	86.82	.73	.38	96.48	14	.00
2	.18	13.18	100.00	.39	.84	16.88	06	.01

Legend: Isolated discriminative variable (Eigen V.), intergroup variability (Pct of Var), discriminative coefficient (Cum pct), canonical correlation (Can Cor), Wilks lambda (Wilksλ), Bartlett's chi-square (χ2), degree of freedom (DF), statistical significance (Sig).

Table 2 Correlation functions

Test	FUNC 1	FUNC 2
KKIF	.33*	-.23
KLOR	.26*	.20
MZLE	-.09	-.05
MBME	.10	-.55*
MDSK	.01	-.53*
MSKL	-.47	-.51*
MTRB	-.12	-.42*
MISK	-.20	.38*
MVSK	-.02	-.37*
MLED	-.02	-.26*
MDPR	.06	-.20*

Table 3 Centroids of groups

Grupe	FUNC 1	FUNC 2
1	1.40	-.28
2	-.11	-.30
3	-1.31	-.36

The results of the discriminative analysis of the experimental group, i.e. of their postural and motor status, show great progress in correcting poor posture, while the motor status results improved slightly from the initial to the final measurement.

In the motor space and the space of postural disorders on the spinal column, by condensation of variables, two statistically significant discriminative variables were isolated, one of which explains the space of postural disorders on the spinal column, and the other the motor space.

The first isolated discriminative variable (Eigen V.=1.19), separates spinal disorders based on discriminative coefficients (cum pct=86.82) and its canonical correlation is .73 (can cor=.73). The significance of this discrimination was tested by Wilks' lambda test (λ=.38) and Bartlett's chi-square test (χ2=96.48) with 14 (DF=14) degrees of freedom. The first of the isolated discriminative functions explains the differences with 86.82% of intergroup variability (pct of var=86.82). Based on the size and sign of the projection of the centroid on the first discriminative function, it can be concluded that postural disorders on the spinal column, kyphosis (KKIF=.33) and lordosis (KLOR=.26), which have a positive sign on the first measurement (1.40), the application of the corrective treatment improved the boy's postural status, as shown by the second (control) and third (final) measurements. Already in the control measurement, the result of the projection of the centroid on the discriminative function has a negative sign (-.11), which proves the success of the corrective treatment.

The final measurement, by increasing the negative projection of the centroid on the discriminative function (-1.31), proved that we managed to completely rehabilitate the spinal column disorders in the sagittal plane with the corrective gymnastics exercises applied. The second isolated discriminative variable (Eigen V.=.18), separates the motor space based on discriminative coefficients (cum pct=100.00) and whose canonical correlation is .39 (can cor=.39). The significance of this discrimination was tested by Wiks lambda test (λ=.84) and Bartlett's xi-square test (χ2=16.88) with 6 (DF=6) degrees of freedom. The second isolated discriminant function explains the differences with 13.18% of intergroup variability (pct of var=13.18).

Based on the size and sign of the projection of the centroid on the second discriminative function, it can be concluded that the motor tests, except the flexibility tests, showed a slight improvement from the initial to the final measurement. The highest projection has the tests MBME=-.55, MDSK=-.53, MSKL=-.51 and MTRB=-.42, MVSK=-.37, while the tests MLED=-.26 and MDPR=-.20 with some weaker projections. The motor test for assessing the flexibility of the shoulder girdle (MISK=.38) does not have an adequate projection on the second (control) and third (final) measurements and disrupts the continuity of other variables, which, given the poor projections of other flexibility tests, may represent a bad influence of the programmed exercises on development of this motor area. Regardless of this, the tests (their projections) for evaluating the explosive strength of the shoulder girdle (MBME) and legs (MVSK and MDSK), as well as the tests for evaluating the repetitive strength of the shoulder girdle (MSKL), abdominal musculature (MTRB) and spinal extensors, ie troop (MLED), show a slight improvement, seen from the first (initial) to the third (final) measurement.

CONCLUSION

Based on this discussion of the measurement results, it can be concluded that the application of the corrective treatment succeeded in rehabilitating the poor posture, by strengthening the weakened muscle groups with a slight improvement in the flexibility of some joints and muscle groups. The reason for the poor results of the flexibility assessment tests should be found in the work program itself, in which the emphasis is placed on strengthening the musculature and not stretching, because the problem was the rehabilitation of the first degree of lordotic and kyphotic bad posture.

The influence of the selected corrective exercises and the observance of principles in corrective gymnastics contributed to the achievement of the set goal, i.e. solving the problem.

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UTICAJ KOREKTIVNE GIMNASTIKE NA KOREKCIJU LOŠEG DRŽANJA TIJELA I MOTORIČKE SPOSOBNOSTI DJECE

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Abstrakt*: Posturalna kontrola omogućava poziciju tijela u prostoru sa ciljem orijentacije i stabilnosti protiv sile teže. Uzorak ispitanika činilo je 27 ispitanika. Svi ispitanici su pacijenti klinike Master fizikal u Istočnom Sarajevu. Prosječna starost ispitanika bila je 9 godina (±2 godine). Varijable za utvrdjivanje poremećaja na kičmenom stubu u sagitalnoj ravni (kifotično loše držanje i lordotično loše držanje) uređajem GPS Postural Lab 6.0 i varijable za utvrdjivanje motoričkog statusa ispitanika (devet motoričkih testova za ocenu fleskibilnosti, eksplozivne i repetitivne snage organizma). Program korektivne gimnastike je korišćen kao vančasovna aktivnost, trajao je četiri mjeseca, sa tri sata nedeljno. Primenjeni program korektivne gimnastike doprinJeo potpunom saniranju kifotičnog i lordotičnog lošeg držanja, kao i poboljšanju nekih motoričkog sposobnosti.*
Ključne riječi: *kifoza, lordoza, postura, analiza, prevencija.*