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DETERMINING DIFFERENCES IN POSTURAL, ANTHROPOMETRIC AND KINESICS AREA AT THE BEGINNING AND THE END OF A SCHOOL YEAR

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Abstract. *The study sample consisted of 149 third grade pupils of a primary school, 76 boys and 73 girls. An impaired bodily state (postural disturbances) is present with a great number of school boys and girls, that has been ascertained by numerous research studies of both our and foreign authors. The subject of this study refers to determining differences in postural, anthropometric, and kinesics area with 149 third grade pupils of the primary school "D.J. Stanko", at the beginning and the end of a school year. In the postural area, there were follow-up changes in the spinal cord in the frontal plane (scoliosis) and the instep arch of the foot (flatfoot). The research problem indicated the possibilities of organising a section of corrective gymnastics and tennis school in the school (physical education gym). The basic goal of this research implies establishing and evaluating bodily state (scoliosis, flat foot), anthropometric values and kinesics abilities, at the beginning and the end of a school year. The core objective of this research refers to establishing an activity-impact efficiency of a programmed corrective gymnastics workout and tennis training on the transformation of postura and, anthropometric features as well as kinesics abilities. Having the given results on the first (initial) and second (final) measuring carried out twelve months later, we can present this report. After a canonical, discriminative analysis has been done, and a statistically significant difference between the measured groups has been established, we can point out, according to the pre-set goal, that the evaluated body state of the third class pupils of the primary school "D.J. Stanko", indicated that there was a high percentage of pupils with a scoliotic bad body posture and and the feature of the flat foot. The given values at the final measure, especially with the pupils of the experimental groups, showed that the programme contents of corrective gymnastics and tennis sections had influenced a transformation of certain manifested variables. That is evident in the area of basic kinesics and anthropometrics area, and especially in the area of postural disturbances. Opening, organising and functioning of corrective gymnastics sections and tennis schools proved to be highly feasible and justifiable.*

Key words: *postural area, anthropometric area, kinesics area, corrective gymnastics section, tennis school*

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1. INTRODUCTION

Junior school age pupils are a very important sample, especially if research is focused on the evaluation of the postural and anthropometric state, as well the state of basic kinesics abilities.

A great number of home and foreign investigations focused on the evaluation of a bodily state of junior school age pointed out to a remarkably high percentage of pupils with postural disturbances and bodily deformities. Many of these studies dealt with relations of some anthropometric dimensions and postural disturbances, as well as the relation of certain kinesics abilities and postural disturbances. Bearing in mind these and similar studies, an attempt at determining the existence of differences between the tested groups in three manifest areas has been done in this study.

Koturović, & Jeričević (1986) specified a great choice of exercises and start positions, emphasising the importance of toning and invigorating weakened muscles of convex spinal spine.

Koturović (1962) clarified use of some terms, such as: rehabilitation, therapy-therapy, and corrective gymnastics.

Milenković, & Živković (1995a) determined relations of two manifest areas (postural disturbances and morphologic features) with the fifth and sixth grade pupils before and after the corrective routine.

Milenković, & Živković (1995b) determined an impact of corrective exercises on the rehabilitation of postural disturbances during a two-year period.

Radisavljević, & Ilić (1997) carried out control measuring of bodily state and foot state on a sample of 403 pupils of Belgrade primary schools.

Kovač, & Djordjević (1998) presented the reached research results on a sample of schoolboys 253 and schoolgirls 248 from Belgrade, Novi Sad and Nish.

Janković (1953) emphasises a necessity of knowing the bodily state of his pupils in order to acknowledge some bad posture.

Jeričević (1970) reminds on the ways of determining and selection of scoliosis.

Ulić (1995) indicated emersion of misbalance of musculature with young tennis players in the TC Vojvodina, where many changes of a spinal cord had been noticed – of a scoliosis type (total scoliosis, right pectoral scoliosis, uneven level of posterior iliac spines…).

On the basis of known physiological principles of growth and development of certain part of locomotion apparatus, some changes can be expected in anthropometric area after a year-long period. What could not be fully anticipated, it had to be tested in a year-long experiment.

2. SUBJECT, PROBLEM AND OBJECTIVE OF THE RESEARCH

2.1. The Research Subject

The research subject is determining differences in postural, anthropometric and kinesics areas with 149 third grade pupils (76 boys and 73 girls) of the primary school "D.J. Stanko", at the beginning and the end of a school year.

The above mentioned subject comprises the following areas:
1. postural state (scoliosis and flat foot),
2. anthropometric features,
3. kinesics abilities.

2.2. The Research Problem

1. To determine possibilities of organising corrective gymnastics, in a physical education school gym, as an optional activity.
2. To determine possibilities of organising a tennis school using a school gym parquet floor.

2.3. The Research Objectives

1. The research basic objective can be looked at from the point of view of determining and evaluating bodily states (postural disturbances – scoliosis, flat foot), anthropometric values and kinesics abilities, at the beginning and the end of a school year.
2. The research core objective refers to the assertion of the impact of a corrective gymnastics and tennis routine impact on the transformation of postural and anthropometric features and kinesics abilities, of the primary school third grade school boys and girls.

3. BASIC POSTULATES

P1 – It is expected there will be a statistically significant difference between the tested groups in all the three manifest areas at the initial and final measuring.

P2 – Poorer results are expected from pupils K-g, in relation to the pupils E-1 and E-2g, in postural and kinesics areas.

4. RESEARCH METHODS

A complete experimental programme content is construed to be carried out at the school age between 10 and 11. The sample was heterogeneous, consisting of boys and girls of the same age. A whole grade was included in the experiment, i.e. five classrooms. Thus, the total number of pupils included in the experiment is 149. All pupils are classified into three groups. The exact no. of boys and girls within a group is presented in Table 1.

Table 1.

Group	All	Boys	Girls
I (E1)	49	26	23
II (E2)	50	24	26
III (K)	50	26	24
Sum	149	76	73

Group I pupils (E1) had 45-minute tennis school activities, twice a week, and 45-minute corrective gymnastics routine three times a week.

Group II pupils (E2) had 45-minute tennis school activities, twice a week.

Group III pupils (K) had 45-minute regular curriculum PE classes twice a week.

1. The variables for evaluation of postural state:
– bad scoliosis posture (BSP)
– lowered instep arch of the foot (LIAF)

To determine a bad scoliosis posture, we used somatoscopy and somamometry methods by the authors Koturović and Jeričević whereas for determining a level of the lowered instep arch of a foot, Cisin's method (Koturović, & Jericević, 1986) was used on a foot print (using "plantogram").

2. The variables for the evaluation of anthropometric values:
– body height (BH) in cm
– body weight (BW) in kg
– arm length (AL) in cm
– foot length (FL) in cm
– rib cage average size (RCAS) in cm
– stretched out upper arm size (SOUAS) in cm
– thigh size (TS) in cm
– abdomen fat fold size (AFFS) in mm
– back fat fold size (BFFS) in mm
– upper arm fat fold size (UAFFS) in mm

To obtain anthropometric parameters values, the International Biology Programme (IBP) was used.

3. Tests for determining kinesics abilities:
– throwing full-rubber ball from an upright start position (TFRB) in cm
– thirty-meter dash from half-bent position in seconds (DHB3O)
– leading three tennis balls with hand between skittles of positioned at a two-meter distance, on a ten-metre long run (L3TB) in seconds
– turn with a racquet with stretched out arms (TRSA) in cm

The tests for determining kinesics abilities were taken over from "Monograph" by Kurelić et all. (1975) with balls modifications (tennis balls).

Starting from the fact that the essence of anthropology is linked to body exercises and the transformation effects on particular abilities and characteristics, applied in a given period of time, for establishing quantitative changes, and differences of psychosomatic state, a canonical discriminative analysis is applied as a superior method for resolving this problem. These should obtain values of discriminative analyses (Canon.Cor), Wilkinson lambda (Will.Lam.), significance level (Q), as well as group centroids and values of each individual variable that contributes to group discrimination.

5. RESEARCH RESULTS WITH DISSCUSION

With the aim of determining possible differences between the tested groups at the initial measuring, a canonical discriminative analysis between the tested groups has been carried out.

Table 2. Canonical discriminative analysis between the groups E1, E2 and K at the initial measuring

Function	Eigenvalue	% of Varia.	Cumul. %	Canon. Cor.
1	.62	63.5	63.5	.62
2	.36	36.5	100.0	.51

Will. Lam.	Chi-square	df	Sig
.45	110.28	32	.00
.73	42.74	15	.00

Structure Matrix

	Function	
	1	2
GROWTH	.33	−.03
DHB30	.27	.17
SKOL	.24	−.07
BH	−.21	−.03
TFRB	.21	.01
BW	−.19	.09
BFFS	.17	.15
FL	−.09	−.03
L3TB	.06	−.00
AFFS	.04	−.02
TS	.02	−.00
AL	−.10	−.34
TRSA	.10	.31
SOUAS	−.05	.22
UAFFS	.17	.21
RCAS	.08	.14

Functions at Group Centroids

	Function	
Group	1	2
E1	1.12	1.12
E2	−.51	−.74
K	−.58	.71

In Table 2, the results of the canonical discriminative analysis of the groups E1, E2 and K at the initial measuring in the areas of basic kinesics abilities, anthropometric characteristics and postural disturbances are given. The values of isolated characteristic roots, percentages of the explained inter-group variability, coefficients of the cannoned discriminative values Wil.Lam. and Chi-squ., indicate that two significant discriminative variables are obtained that max. separate the tested groups individuals.

Analysing the obtained values, it can be concluded that the analogy of the results between the tested groups is high and ranges from .62 for the first discriminative function, that is statistically significant at the level Q = .00, to .51 for the second discriminative function, that is also statistically significant at the level Q = .00.

The first discriminative function explains the differences between the tested individuals with 63.5% variability in the area of applied discriminative variables. Having an insight into the coefficients which discriminate the first discriminative function, it can be noticed that it discriminates group E1 from groups E2 and K, on the basis of the variable LIAF (.33), DHB3O (.27), BSP (.24), TFRB (.21), BFFS (.17), and UAFFS (.17). It can be concluded that group E1 individuals from the beginning of the experiment, at the initial measuring, had more distinctive postural disturbances (BSP, LIAF), increased fat deposits in thoracic back part area (BFFS) and upper arm (UAFFS), more distinctive speed ability (DHB30), and an explosivity of arm and shoulder area (TFRB).

The variables that discriminated groups E2 and K from the group E1, besides the above mentioned are BH (–.21) and BW (–.19). These groups individuals had higher growth and increased body mass.

On the basis of the prognostics and size of the groups centroids, it can be concluded that there is no difference between groups E2 (C = –.51) and K (C = –.58), however group E1 is separated in relation to the other two (C = 1.12).

The second discriminative function explains the differences between groups with approximately half less percentage of the variant of 36.5% of the variability, in the area of applied variables. On the basis of the coefficients that determine the second discriminative function, the groups are discriminated on the basis of the variable DHB30 (.17), TRSA (.31), SOUAS (.22), BFFS (.21), and AL (–.34). On the basis of the prognosis and the size of the groups centroids E1 (C = 1.12), E2 (C = –.74), K (C = .71), it can be concluded that in the second discriminative function, the group E2 is discriminated in relation to the other two, which are with no differences.

It can be pointed out that the difference between the groups is evident in the area of basic kinesics. The tested subjects in groups E1 and K possessed a more efficient mechanism of excitement, more flexible shoulder joints, an increased circular dimensionality (upper arm size), as well as increased fat deposits in the area of the upper arm. What separated group E2 tested subjects from the other two groups is the arm length.

On the basis of the obtained discriminative function, and on the basis of the coefficients which determined these functions, it can be concluded that P1 (It is expected that at the initial measuring there will be no statistically significant difference between the groups E1, E2, and K pupils in postural area), can be rejected because of the fact that there has been a statistically significant difference between the groups at the initial measuring.

Out of the given values in Table 3., it can be concluded that in the whole system of the applied variables, of the postural and anthropometric area, as well the area of basic kinesics, the differences between the tested groups are statistically significant.

On the basis of the variables of the obtained isolated characteristic roots, percentages of the explained inter-group variability, coefficients of cannoned correlations, values Will.Lam., and Chi-squ., it can be concluded that two discriminative functions are extracted.

The first discriminative function is at the level of statistical significance (Q = .00), and the other discriminative function is at the level of statistical significance (Q = .03).

Table 3. Canonical discriminative analysis between E1, E2 and K groups at the control measuring

Function	Eigenvalue	% of Varia.	Cumul. %	Canon. Cor.
1	.57	66.7	66.7	.60
2	.28	33.3	100.0	.47

Will. Lam.	Chi-square	df	Sig
.49	97.39	32	.00
.77	34.75	15	.00

Structure Matrix

	Function	
	1	2
L3TB	.45	–.28
TRSA	.37	–.28
LIAF	.31	.21
UAFFS	.30	–.04
BFFS	.29	–.19
TS	–.14	–.06
FL	–.10	–.03
AFFS	.07	–.07
BH	–.06	–.04
DHB30	.07	–.49
AL	–.11	.27
BSP	–.01	.27
BW	–.07	–.25
RCAS	–.11	–.22
SOUAS	–.03	–.17
TFRB	–.11	.14

Function at Group Centroids

Group	Function	
	1	2
E1	1.00	.25
E2	–.80	.48
K	–.18	–.73

The first discriminative function explains the differences between the groups with 66.7% variability in the area of the applied discriminative variables. Having insight at the coefficients which determine the first discriminative function, as well the sizes and prognosis of the groups centroids, it can be noticed that it discriminates the group E1 (C=1.00), from the groups E2 (C = –.80) and K (C = –.18), on the basis of the variables L3TB (.45), TRSA (.37), LIAF (.31), UAFFS (.30) and BFFS (.29).

On the basis of these values, it can be concluded that boys and girls at the control measuring showed improved coordination abilities, loss of fat deposits on their thoracic back part and on their upper arm, as well a significant improvement of postural disturbance – flat foot. Regarding the locomotion at the shoulder joint (flexibility-elasticity), there has been a decrease of this ability.

The second discriminative function explains the differences between the groups with a significantly lower percentage of variance of 33.3%, variability at the area of applied discriminative variables. On the basis of the size of the obtained coefficients which determine the second discriminative function, it can be concluded that the group K (C = –.73) discriminates from the two experimental groups E1 (C = .25) and E2 (C = .48), on the basis of the variables L3TB (–.28), TRSA (–.28), BFFS (–.19), DHB30 (–.49), BW (–.25), RCAS (–.22), and SOUAS (–.17). The obtained values in the presented variables imply that group K tested subjects after the first twelve months showed significantly decreased characteristics and impaired coordination abilities in relation to the abilities of the other two groups.

School boys and girls of the experimental groups are - on the basis of the obtained coefficients in three variables that determined the second discriminative function – separated from their peers in group K. The tested pupils from groups E1 and E2 had more correct bodily posture (less number of scoliotic bad postural and flat foot), at the time of a control measuring. Another variable that discriminates these groups is a longitudinal dimensionality of the skeleton.

It is believed that the credit for an improvement of the obtained values can be assigned to the impact of the kinesics exercises for specialised attendees of the tennis school, as well as a specific programme of corrective gymnastics exercises.

The programme of corrective gymnastics contributes significantly to the improvement of the flat foot, which does not apply to the scoliotic bad posture. The reasons for a partial success can be looked for in the following hypotheses:

– scoliosis is a heavy and complex postural disturbance and body deformity,
– programme of corrective gymnastics planned and carried out in a year long timeframe obviously is not sufficient for better quality changes in statistics and dynamics of a spinal cord in frontal plane.

Due to this reason, we propose to prolong the programme of corrective gymnastics to 24 months believing that better quality changes in the spinal cord state can be expected in that timeframe.

It is believed that a programme content of kinesics learning organised and carried out in regular PE classes has far less effect on the transformation of some abilities when compared to a joint effect of corrective gymnastics, tennis school, and regular PE classes.

6. CONCLUSION

On the basis of the obtained results at the first (initial) measuring as well at the second (final) measuring carried out after twelve months, the following conclusion can be drawn:

After the three groups (E1, E2, and K) had been formed and the canonical discriminative analysis done, at the initial measuring, statistically significant differences between the groups were determined. The first obtained discriminative function accounts for the differences between the groups with 63.5% variability. Having an insight into the coefficients that determine the first discriminative function, it can be concluded that group E1 discriminates in relation to the other two groups.

The second obtained function accounts for the differences between the groups of 36.5% variability. This function discriminate group E2 from the other two groups.

After one-year long experimental period had been over and the final measuring carried out, the following results were obtained:

– Two discriminative functions, out of which one discriminative function accounts for the differences between the groups with 66.7% variability, whereas the second discriminative function accounts for the difference with 33.3%.

Herewith, we can fully ascertain postulate P1.

Considering the coefficients that determine the first discriminative function, at the first (initial) measuring as well at the second (final) measuring, the following remarks and hypotheses can be presented:

– At the beginning and the end of the experiment, the group E1 discriminated in relation to the other two groups. The variables that contributed the most to the discrimination at the first (initial) measuring are LIAF, DHB30, BSP, TFRB, BFFS, and UAFFS.

It can be stated that improved coordination values (L3TB), the flat foot state (LIAF), loss (decrease) of subcutaneous fat back tissue (BFFS) and of the upper arm, as well as decreased flexibility (TRSA).

The second discriminative function at the first (initial) measuring discriminates group E2 in relation to the other two groups, and the coefficients of the following variables SOUAS, UAFFS and AL have the greatest contribution in it.

At the second (final) measuring, the second discriminative function discriminates group K in relation to the other two groups, and the coefficients of the following variables L3TB, TRSA, BFFS, DHB30, BW, RCAS and SOUAS have the greatest contribution in it.

On the basis of the obtained values of the coefficients of the discriminative values, the following can be presented:

– the tested subjects from group K were not included in the experimental programme of corrective gymnastics and tennis school programme, that consequently influenced a decrease of speed abilities (DHB30), coordination abilities (L3TB), flexibility (TRSA), and increase in body mass (BW), which confirms postulate P2.

Finally, it can be concluded that there are differences between the groups which are statistically significant at the first (initial) as well at the second (final) measuring.

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UTVRĐIVANJE RAZLIKA U POSTURALNOM, ATROPOMETRIJSKOM I MOTORIČKOM PROSTORU KOD UČENIKA III RAZREDA NA POČETKU I KRAJU ŠKOLSKE GODINE

Saša Milenković

Uzorak ispitaika u ovom radu su činili učenici i učenice III razreda osmogodišnje škole. Narušen telesni status (posturalni poremećaji), je prisutan kod velikog broja učenika i učenica, što je potvrđeno brojnim istraživanjima kako naših tako i inostranih autora. Predmet ovog istraživanja se odnosi na utvrđivanje razlika u posturalnom, antropometrijskom i motoričkom prostoru kod učenika III razreda osmogodišnje škole "D.J. Stanko", na početku i kraju školske godine. U posturalnom prostoru su praćene promene na kičmenom stubu u frontalnoj ravni (skolioza) i uzdužnom svodu stopala (ravno stopalo). Problem istraživanja se ogledao u mogućnosti organizovanja sekcija korektivne gimnastike i teniske škole u školskim uslovima (sala za fizičko vaspitanje). Osnovni cilj ovog istraživanja podrazumeva utvrđivanje i ocenjivanje telesnog statusa (skolioza, ravno stopalo), antropometrijskih vrednosti i motoričkih sposobnosti, na početku i kraju školske godine. Suštinski cilj istraživanja se odnosi na utvrđivanje efikasnosti delovanja-uticaja programiranog vežbanja korektivne gimnastike i vežbanja tenisa na transformaciju posturalnih, antropometrijskih karakteristika i motoričkih sposobnosti. Nakon dobijenih rezultata na inicijalnom i finalnom merenju izvršenom nakon dvanaest meseci mogu se izneti sledeća zapažanja.

Kanoničkom diskriminativnom analizom utvrđena je statistički značajna razlika između grupa ispitanika. Ocenjeni telesni status učenika III razreda osnovne škole "D.J. Stanko", ukazao je na visok procenat učenika sa skoliotično lošim držanjem tela i ravnim stopalom. Dobijene vrednosti na finalnom merenju posebno kod učenika eksperimentalnih grupa, ukazale su da su programski sadržaji sekcije korektivne gimnastike i teniske škole imali uticaj na transformaciju određenih manifestnih varijabli. To je evidentno u prostoru bazične motorike i antropometrijskom prostoru, a posebno u prostoru posturalnih poremećaja. Pokazalo se da je opravdano organizovanje i funkcionisanje sekcija korektivne gimnastike i teniske škole.

Ključne reči: *posturalni prostor, antropometrijski prostor, motorički prostor, sekcija korektivne gimnastike, teniska škola*