THE EFFECTS OF PROGRAMMED KINESIOLOGICAL TREATMENT ON CORRECTION OF KYPHOSIS AND FLAT FEET DEFORMITY IN PUPILS

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Abstract: The aim of this study was to determine the effects of programmed kinesiological treatment on transformation of postural spinal status in the sagittal plane - kyphosis and flat feet - pes planus, in IV to VI grade pupils (second triad of nine-year elementary school). The study was conducted on a 290 pupil sample. Eight (8) variables were applied in the study to evaluate postural spine status - kyphosis and flat feet - pes planus. The research had a longitudinal character. The use of contingent tables shows the frequencies and the corresponding percentages increase the deformity of the spine - kyphosis and flat feet - pes planus. The results of the study indicate the statistical significance of the percentage of deformity of the kyphosis and flat feet - pes planus. Changes in the arch of the feet and spine are mainly in the first stage of deformation, which also enabled the correction of the condition with the application of programmed kinesiological treatment. Therefore, in the global assessment of the quality and justification of the use of programmed kinesiological treatment for one school year, we must state that it contributed to the improvement of the deformity of the kyphosis and the flat feet of the research sample of pupils.

Keywords: pupils, correction, postural status, kyphosis, pes planus.

INTRODUCTION

Modern lifestyles, with all the dangers of morbid trias (insufficient movement, poor nutrition and stress), for children in development, longer lasting session at school and at home, excessive demands in the segment of intellectual workload require intervention in the direction

EFKETI PROGRAMIRANOG KINEZIOLOŠKOG TRETMANA NA KORIGIRANJE DEFORMITETA KIFOZE I RAVNOG STOPALA KOD UČENIKA

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Apstrakt: Cilj ovog istraživanja bio je da se utvrdite efekti primjene programiranog kineziološkog tretmana na transformiranje posturalnog statusa kralježnice u sagitalnoj ravnini - kifoza i stopala – pes planus, kod učenika od IV do VI razreda (druge trijade devetogodišnje osnovne škole). Istraživanje je provedeno na uzorku od 290 učenika. U istraživanju je primjenjeno osam (8) varijabli za procjenu posturalnog statusa kralježnice – kifoza i stopala – pes planus. Istraživanje je imalo longitudinalni karakter. Primjenom kontingencijskih tablica prikazane su frekvencije i pripadajući postotci pojave deformiteta kralježnice – kifoza i stopala.. Dobijeni rezultati istraživanja ukazuju na statistički značajan postotak deformiteta kralježnice – kifoza i stopala – pes planus. Promjene na svodovima stopala i kralježnice su uglavnom u prvom stupnju deformacije, što je i omogućilo značajno korigiranje stanja uz primjenu programiranog kineziološkog tretmana. Dakle, u globalnoj procjeni kvaliteta i opravdanosti primjene programiranog kineziološkog tretmana za jednu školsku godinu, može se konstatirati da je isti doprinio poboljšanju stanja deformiteta kifoze i stopala istraživanog uzorka učenika.

Ključne reči: učenici, korigiranje, posturalni status, kifoza, pes planus.

UVOD

Moderan način života, sa svim opasnostima morbido-trijasa (nedovoljno kretanje, pogrešna ishrana i stres), kod djece u razvoju pojačan još dugotrajnim sjeđenjem u školni, ali i kod kuće, te pretjeranim zahtjevima u segmentu intelektualnog opterećenja, zahtjeva dodat-
of prevention. It is a well-known fact that sports activities can be strong tool against the intellectual overload of students, and today we have pure physical deformity of children and thus the expansive appearance of deviant behavior in and out of school. The only question is, do we make enough use of this segment of activity?

The specificity of physical and health education stems not only from its goals and tasks, content of work, methods of work, methodological and organizational forms of work, but also from the fact that such teaching is basically a polyvalent process. That is why physical and health education teaching on the one hand is expected to influence the transformation of anthropological characteristics of students and on the other hand contributes to their upbringing and education.

Through the development of its species - phylogeny, man gradually evolved and finally reached a two-legged upright posture. This period lasted several millennia. This attainment is still the youngest and is definitely not finished, as indicated by the presence of postural disorders of the spine and feet (Kosinac, 1995).

This is further evidence that we have not yet adapted to the new conditions of life. This undoubtedly leads to impaired adaptation and pathological manifestations, especially in developing children.

Proper postural position is taking less and less place in children’s daily activities. Improper seating, standing, inadequate bed and sleeping cushion, various forms of movement activity as well as certain endogenous factors, systematically affect the spine, causing loads that often exceed the soft tissue tolerance zone of the spine, without causing major damage, but by cumulative action through repetitive and prolonged tissue positions and movements experience some deformation in terms of their morphology and function. There is a shortening or weakening of certain muscles, which leads to muscular imbalance, which is the main pattern for the appearance and development of poor posture, i.e. physical deformities (Kosinac, 1995).

The aim of this study is to determine the effects of programmed kinesiological treatment on the correction of spinal deformity - kyphosis and flat feet - pes planus in pupils of the second triad of nine-year elementary school (IV-VI grades).

**METHOD OF WORK**

**Sample of respondents**

The sample of respondents was defined by the population of pupils of IV, V and VI grades of primary school of pupils of the second triad of nine-year elementary school (IV-VI grades).

no interventiranje u pravcu prevencijskog ili, nikad nije kasno, i kurativnog dejstva gore pomenutih čimbenika. Poznata je činjenica, da upravo sportske aktivnosti mogu biti jaka protivteža intelektualnom preopterećenju učenika, pojava danas tako čestih tjelesnih deformiteta djece i takoreći ekspanzivnoj pojavu devijantnog ponašanja u školji i van nje. Pitanje je samo, da li dovoljno koristimo ovaj segment aktivnosti?

Specifičnost nastave tjelesnog i zdravstvenog odgoja proizilazi ne samo iz njenih ciljeva i zadataka, sadržaja rada, metoda rada, metodičko-organizacijskih oblika rada, nego i iz činjenice što ta nastava u osnovi predstavlja polivalentan proces. Zato se od nastave tjelesnog i zdravstvenog odgoja s jedne strane očekuje da utječe na transformaciju antropoloških obilježja učenika, a s druge strane da doprinosi njihovom odgoju i obrazovanju.

Čovjek je kroz filogenezu postupno evoluirao i došao najzad do dvonožnog uspravnog stava. To razdoblje trajalo je nekoliko milenijuma. Ta tekovina je još uvijek najmlađa i definitivno nije završena, na šta ukazuje i prijetnja posturalnih poremećaja na kralješnici i stopalima (Mikić i Bjeković, 2004.).

To je još jedan dokaz da se još uvek nismo adaptirali na novonastale uvjete života. To neosporno dovodi do slabljenja adaptiranja i patoloških pojava naročito kod djece u doba razvoja.

Pravilan posturalni položaj sve manje zauzima svoje mjesto u dječijim svakodnevnim aktivnostima. Nepravilna sjedenja, stajanja, neadekvatan krevet i jastuk za spanje, različiti oblici kretnih aktivnosti kao i određeni endogeni čimbenici, sustavno djeluju na kralješnicu, čime izazivaju opterećenja koja često prelaze zonu tolerantnosti mekih tkiva kralješnice, ne ostvarujući veća oštećenja, ali kumulativnim djelovanjem kroz ponavljajuće i dugotrajne položaje i pokrete tkiva doživljavaju određeno deformiranje u pogledu svoje morfologije i funkcije. Dologi do skraćenja ili slabljenja određene muskulature što samim tim dovodi do mišićnog disbalansa, koji predstavlja glavni uzrok za pojavu i razvoj lošeg držanja tijela, odnosno tjelesnih deformiteta (Kosinac, 1995.).

Cilj ovog istraživanja je utvrđivanje efekata programiranog kineziološkog tretmana na korigiranje deformiteta kralješnice - kifozu i ravnom stopalu- pes planus učenika druge trijade devetogodišnje osnovne škole (IV-VI razreda).
schools in the municipalities of Kalesija, Živinice and Tuzla. The study was conducted on a sample of 290 pupils of the third triad of nine-year primary school. The sample of students is structured from 91 fourth-grade, 98 fifth-grade and 101 sixth-grade pupils.

**Sample variables**
The measurement instrument for this study is composed of 8 variables to assess the postural status of the spine and the flat feet of the pupils.

**Variables to assess postural spine and flat feet status:**
1. KYPHOSIS - kyphosis (normal posture)
2. KYPHOS1 - kyphosis (first degree of deformity)
3. KYPHOS2 - kyphosis (second degree of deformity)
4. KYPHOS3 - kyphosis (third degree of deformity).
5. PESNOR - Normal foot status
6. PESPLA1 - lowered foot (first degree of deformity)
7. PESPLA2 - lowered foot (second degree of deformity)
8. PESPLA3 - lowered foot (third degree of deformity)

**Measurement description**
To assess the deformity of the spine in the thoracic region, an ultrasound probe was performed, which included the assessment of the following variables: normal posture, kyphosis grade 1, kyphosis grade 2, kyphosis grade 3. The assessment of foot defects was performed using the Footdisc digital computer subgraph, which included the evaluation of the following variables: normal foot status, pes planus I, pes planus II, pes planus III.

**DATA PROCESSING METHODS**
Using the contingency tables, the frequencies and the percentages of the occurrence of spinal deformities and flat feet were shown.

**Applied corrective exercise program**
The corrective exercise program was implemented 3 times a week for two teaching hours, with an interval of one school year, with a recommendation and instruction that students under parental control take an additional two (2) terms at home.

In the introductory part of the lesson, all subjects worked together (heating and stretching) and were subsequently divided into groups depending on the physical deformities present.

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Kalesija, Živinice i Tuzla. Istraživanje je provedeno na uzorku od 290 učenika II trijade devetogodišnje osnovne škole. Uzorak učenika je struktuiran od 91 učenika četvrtih razreda, od 98 učenika petih razreda i 101 učenika šestih razreda.

**Uzorak varijabli**
Mjerni instrument za ovo istraživanje sastavljen je od 8 varijabli za procjenu posturalnog statusa kralježnice i stopala učenika.

**Varijable za procjenu posturalnog statusa kralježnice i stopala**
1. KIFOZNO – kifoza (normalno držanje tijela)
2. KIFOZ1 - kifoza (prvi stupanj deformiteta)
3. KIFOZ2 - kifoza (drugi stupanj deformiteta)
4. KIFOZ3 - kifoza (treći stupanj deformiteta).
5. PESNOR – normalan status stopala
6. PESPLA1 – spušteno stopalo (prvi stupanj deformiteta)
7. PESPLA2 – spušteno stopalo (drugi stupanj deformiteta)
8. PESPLA3 – spušteno stopalo (treći stupanj deformiteta)

**Opis mjerenja**
Za procjenu deformiteta kralježnice u grudnom dijelu izvršena je primjenom ultra zvučne sonde što podrazumijevalo procjenu sljedećih varijabli: normalno držanje tijela, kifoza 1. stupanj, kifoza 2. stupanj, kifoza 3. stupanj. Procjena defomiteta stopala izvršena je primjenom digitalne kompjuterske podografije Footdisc, što podrazumijevalo procjenu sljedećih varijabli: normalan status stopala, pes planus I, pes planus II, pes planus III.

**METODE OBRADE PODATAKA**
Primjenom kontingencijskih tablica prikazane su frekvencije i pripadajući postoci pojave deformiteta kralježnice i stopala ispitanika.

**Primijenjeni program korektivnog vježbanja**
Primijenjeni program korektivnog vježbanja bio je sproveden 3 x sedmično u trajanju od dva nastavna sata, u vremenskom intervalu od jedne školske godine, preporukom i uputstvom da učenici pod kontrolom roditelja kući upražnjavaju još dodatna dva (2) termina.

U uvodnom pripremnom dijelu sata, svi ispitanici su radili zajedno (zagrijavanje i strećanje), a nakon toga su dijeljeni po grupama u zavisnosti od prisutnih tjelesnih deformiteta.
Complexes of applied corrective exercises for particular deformities with volume and intensity of work.

**Flat feet**

Lowered arches and flatness occur most commonly on the feet. The occurrence of these deformities is influenced primarily by the hereditary factor, as well as physical inactivity, obesity, inadequate footwear. The consequences are difficulties in walking and standing, pain in the legs and sometimes in the back. If it is not a matter of already formed deformities that would require orthopedic treatment, the physiatrist will recommend corrective gymnastics, playing sports and correcting bad posture habits.

**Flat foot correction exercises**

We present only part of the flat foot correction program. The complete program consists of 10 exercises where each exercise is performed with 10 repetitions.

Here are the basic exercises for flat feet:

| Red. broj / No. | Opis vježbe-način izvođenja / Exercise Description - Exercise Method | Broj serija / Number of series | Broj ponavljanja / Number of repetitions |
|----------------|---------------------------------------------------------------------------------|--------------------------------|---------------------------------------|
| 1.             | Iz sjedećeg položaj sa opuštenim koljenima i zategnutim stopalima prema licu savijati prste / From sitting with knees stretched and feet stretched towards the face, bend your toes | 10                             | 10                                    |
| 2.             | Savijenim prstima na jednoj nozi dodirivati koljeno druge noge i vraćati u početni položaj / With bent fingers on one leg, touch the knee of the other leg and return to the starting position | 10                             | 10                                    |
| 3.             | Iz početnog položaja sa zategnutim stopalom savijati i opružati prste......10 serija x 10 ponavljanja / From the initial position with the foot tightened and stretch the toes......10 series x 10 reps | 10                             | 10                                    |
| 4.             | Iz početnog položaja savijati i podizati prste / From the starting position, bend and lift your fingers | 10                             | 10                                    |
| 5.             | Hodati na petama sa savijenim prstima / Walk on heels with bent toes | 5 po/30m                       | 5 po/30m                              |
| 6.             | Hodati na prstima ispruženih (ukočenih) nogu u zglobu koljena / To walk on the toes of the extended (rigid) legs in the knee joint | 5 po/30m                       | 5 po/30m                              |
| 7.             | Hodati u polučučnju na unutarnim (konvuktnim) rubovima stopala / To walk in a semi-skimsh in the inner (convex) edges of the feet | 3 po/30m                       | 3 po/30m                              |
| 8.             | Hodati u polučučnju na vanjskim (konveksnim) rubovima stopala / To walk in a semi-skimsh in the outer (concave) edges of the feet | 3 po/30m                       | 3 po/30m                              |
| 9.             | Hodati na prstima sa osloncem ruku na koljenu / Walk in a squat on your toes with your hands resting on your knees | 2 po/30m                       | 2 po/30m                              |
| 10.            | U stojećem stavu prstima obje noge najmješteno (palcem i dopalcem), privlačiti konopac ka sebi iz maksimalnog iskoraka (dužina konopača 3m) / In standing posture, fingers with both feet alternately (thumb and thumb), draw the rope towards you from maximum step (length of rope 3m) | 5                             | 5                                    |

**Kyphosis**

Kyphotic poor posture (hunched back, shoulders bent forward), in preschool, if not corrected, may develop into kyphosis in the next few years. If it is not already formed deformities that would require orthopedic treatment, it is necessary to apply a program of corrective treatment with a targeted complex of exercises of corrective gymnastics, to increase overall physical activity and sports, in order to correct bad posture habits.

**Exercises to correct kyphotic posture**

The following exercises for the correction of kyphotic poor posture were applied within the corrective exercise program:

| No. | Exercise Description - Exercise Method | Number of series | Number of repetitions |
|-----|----------------------------------------|------------------|-----------------------|
| 1.  | To walk on the toes of the extended (rigid) legs in the knee joint | 5 | 5 per 30m |
| 2.  | To walk in a semi-skimsh in the inner (convex) edges of the feet | 3 | 3 per 30m |
| 3.  | To walk in a semi-skimsh in the outer (concave) edges of the feet | 3 | 3 per 30m |
| 4.  | Walk in a squat on your toes with your hands resting on your knees | 2 | 2 per 30m |
| 5.  | In standing posture, fingers with both feet alternately (thumb and thumb), draw the rope towards you from maximum step (length of rope 3m) | 5 | 5 |

**Kifoz**

Kifotično loše držanje (pogrljena leda, ramena povijena naprijed), u predškolskom uzrastu ako se ne koriguje može da preraste u kifozu u narednih nekoliko godina. Ako se ne radi o već formiranim deformitetima koji bi zahtjevali ortopedski tretman, neophodno je primijeniti program korektivnog tretmana sa ciljnim kompleksom vježbi korektivne gimnastike, pojačati uopšteno fizičku aktivnost i bavljenje sportom, kako bi korigovali loše navike u držanju tijela.

**Vježbe za korekciju ryvnih stopala**

Predstavljamo samo dio programa za korekciju ravnih stopala. Potpun program se sastoji iz 10 vježbi gdje se svaka vježba izvodi sa 10 ponavljanja. Ovo je prikaz osnovnih vježbi za ravnu stopalu:

Decembar/December, 2019
RESULTS AND DISCUSSION

Deformity analysis of kyphosis and flat feet of pupils

Spinal deformity analysis (kyphosis) - initial measurement. The results of the analysis of spinal deformity-kyphosis are presented in table 1. 290 pupils were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 1, where the frequencies and the associated percentages of deformity - kyphosis are shown, it is evident that in the entire examined sample of students, 199 students or 69% of the tested sample have a normal spine position. Regarding the percentage of this deformity in the tested sample, we can state that the first degree of deformity is 68 students or 23% of the tested sample, the second degree is 20 pupils or 7% of the tested sample, and the third degree is 68 students or 23% of the tested sample, we can state that the second degree of deformity has 20 pupils or 7% of the tested sample, and the third degree is 68 students or 23% of the tested sample.

Table 1. Contingency table of frequency distribution of spinal deformity (kyphosis) by sub-samples-students initial measurement

| KIFOZA / KYPHOSIS | UZORAK ISPITANIKI - UCENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | IV | V | VI | UKUPNO / TOTAL |
|------------------|------------------------------------------------------------|---------------|----|----|----|----------------|
| KIFOZNO / KYPHOS | %                                                         |               | 65 | 68 | 66 | 199            |
| KIFOZ 1 / KYPHOS | %                                                         |               | 71 | 69 | 65 | 69             |
| KIFOZ 2 / KYPHOS | %                                                         |               | 20 | 22 | 26 | 68             |
| KIFOZ 3 / KYPHOS | %                                                         |               | 22 | 22 | 26 | 23             |
| UKUPNO / TOTAL  | %                                                         |               | 6  | 6  | 8  | 20             |

Tablica 1. Kontingencijska tablica frekvencije distribucije deformiteta kralježnice (kifoza) po subuzorcima-ucenici inicijalno mjerenje

| KIFOZA / KYPHOS | UZORAK ISPITANIKI - UCENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | IV | V | VI | UKUPNO / TOTAL |
|-----------------|-------------------------------------------------------------|---------------|----|----|----|----------------|
| KIFOZNO / KYPHOS| %                                                           |               | 91 | 98 | 101| 290           |
| KIFOZ 1 / KYPHOS| %                                                           |               | 0  | 2  | 1  | 3              |
| UKUPNO / TOTAL  | %                                                           |               | 100| 100| 100| 100            |
Spinal deformity analysis (kyphosis) - final measurement

The results of the analysis of spinal deformity-kyphosis are presented in Table 2. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From Table 2, where the frequencies and the corresponding percentages of deformity-kyphosis are shown, 238 students or 82% of the tested sample have a normal spine position in the entire study sample. With regard to the percentage of this deformity in the tested sample, we can state that the first degree of deformity has 37 students or 13% of the tested sample, the second degree 12 pupils or 4% of the tested sample and the third degree 3 students or 1% of the tested sample.

The results obtained are within the average given previous studies in which 30% to 55% of students of this age have this deformity (Jovović, 1994; Paušić et al., 2006; Bogdanović et al., 2008; Protić-Gava and et al., 2010; Hodžić et al., 2010; Bajrić et al., 2012).

Table 2. Contingency table of frequency of distribution of spinal deformity (kyphosis) by sub-samples - pupils final measurement

| KIFOZA / KYPHOSIS | UZORAK ISPITANIKI – UČENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | UKUPNO / TOTAL |
|-------------------|-------------------------------------------------------------|----------------|---------------|
| F                 | IV                                           | V              | VI            |                |
| KIFOZNO / KYPHOSIS | 79                                          | 80             | 79            | 238           |
| %                 | 87                                          | 82             | 78            | 82            |
| KIFOZ 1 / KYPHOS 1| 9                                           | 12             | 16            | 37            |
| %                 | 10                                          | 12             | 16            | 13            |
| KIFOZ 2 / KYPHOS 2| 3                                           | 4              | 5             | 12            |
| %                 | 3                                           | 4              | 5             | 4             |
| KIFOZ 3 / KYPHOS 3| 0                                           | 2              | 1             | 3             |
| %                 | 0                                           | 2              | 1             | 1             |
| UKUPNO / TOTAL    | F                                           | 91             | 98            | 101           |
| %                 | 100                                         | 100            | 100           | 100           |

Postural deformity analysis of the flat foot (pes planus) - initial measurement

The results of postural deformity analysis of the postural flat foot-pes planus are presented in Table 3. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From Table 3, where the frequencies and associated percentages of postural deformity of the flat foot-pes planus are shown, it is evident that in the whole study sample of students, the 178 students or 61% of the test sample has normal foot. With regard to the percentage of this deformity in the tested sample, we can state that...
the first degree of deformity is 86 students or 30% of the tested sample, the second degree is 23 students or 8% of the tested sample and the third degree is 3 students or 1% of the tested sample.

Table 3. Contingency table of frequency of distribution of postural foot status by sub-samples - students initial measurement

| STOPALA PES PLANUS / FOOT PES PLANUS | UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | UKUPNO / TOTAL |
|---------------------------------------|---------------------------------------------------------------|---------------|---------------|
|                                       |                                                               | IV            | V             | VI            |               |
| PESNOR                                |                                                               | 56            | 60            | 62            | 178           |
| %                                     |                                                               | 62            | 61            | 61            | 61            |
| PESPLA 1                              |                                                               | 26            | 28            | 32            | 86            |
| %                                     |                                                               | 29            | 29            | 32            | 30            |
| PESPLA 2                              |                                                               | 7             | 9             | 7             | 23            |
| %                                     |                                                               | 8             | 9             | 7             | 8             |
| PESPLA 3                              |                                                               | 2             | 1             | 0             | 3             |
| %                                     |                                                               | 1             | 1             | 0             | 1             |
| UKUPNO / TOTAL                        |                                                               | 91            | 98            | 101           | 290           |

Analyza deformiteta posturalnog statusa stopala (Pes planus) – finalno mjerenje

U tablici 4, prikazani su rezultati analize deformiteta posturalnog statusa stopala – pes planus. Analizi je podvrgnuto 290 učenika podijeljenih u tri subuzorka, i to IV, V i VI razreda osnovne škole.

Iz tablice 4, gdje su prikazane frekvencije i pripadajući postoci deformiteta posturalnog statusa stopala – pes planus vidljivo je da kod cjelokupnog ispitivanog uzorka učenika normalno stopalo ima 242 učenika ili 83% ispitivanog uzorka. U pogledu postotka zastupljenosti ovog deformiteta na ispitivanom uzorku može se konstatirati da prvi stupanj deformiteta ima 36 učenika ili 13% ispitivanog uzorka, drugi stupanj 10 učenika ili 3% ispitivanog uzorka i treći stupanj 2 učenika ili 1% ispitivanog uzorka.

Table 4. Contingency table of frequency of distribution of postural foot status by sub-samples - final measurement

| STOPALA PES PLANUS / FOOT PES PLANUS | UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | UKUPNO / TOTAL |
|---------------------------------------|---------------------------------------------------------------|---------------|---------------|
|                                       |                                                               | IV            | V             | VI            |               |
| PESNOR                                |                                                               | 77            | 84            | 81            | 242           |
| %                                     |                                                               | 85            | 86            | 80            | 83            |
| PESPLA 1                              |                                                               | 9             | 10            | 17            | 36            |
| %                                     |                                                               | 10            | 10            | 17            | 13            |
| PESPLA 2                              |                                                               | 3             | 4             | 3             | 10            |
| %                                     |                                                               | 3             | 4             | 3             | 3             |
| PESPLA 3                              |                                                               | 2             | 0             | 0             | 2             |
| %                                     |                                                               | 2             | 0             | 0             | 1             |
| UKUPNO / TOTAL                        |                                                               | 91            | 98            | 101           | 290           |

da prvi stupanj deformiteta ima 86 učenika ili 30% ispitivanog uzorka, drugi stupanj 23 učenika ili 8% ispitivanog uzorka i treći stupanj 3 učenika ili 1% ispitivanog uzorka.

Tablelica 3. Kontingencijska tablica frekvencije distribucije posturalnog statusa stopala po subuzorcima – učenici inicijalno mjerenje

Postural deformity analysis of the flat foot (Pes planus) - final measurement

The results of postural deformity analysis of the postural flat foot-pes planus are presented in table 4. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 4, where the frequencies and associated percentages of postural deformity of the foot - pes planus are shown, it is evident that, in the entire study sample, the 242 students or 83% of the test sample has normal foot. Regarding the percentage of this deformity in the tested sample, we can state that the first degree of deformity is 36 students or 13% of the tested sample, the second degree is 10 students or 3% of the tested sample and the third degree is 2 pupils or 1% of the tested sample.

Table 4. Contingency table of frequency of distribution of postural foot status by sub-samples - final measurement

| STOPALA PES PLANUS / FOOT PES PLANUS | UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS | RAZRED / CLASS | UKUPNO / TOTAL |
|---------------------------------------|---------------------------------------------------------------|---------------|---------------|
|                                       |                                                               | IV            | V             | VI            |               |
| PESNOR                                |                                                               | 77            | 84            | 81            | 242           |
| %                                     |                                                               | 85            | 86            | 80            | 83            |
| PESPLA 1                              |                                                               | 9             | 10            | 17            | 36            |
| %                                     |                                                               | 10            | 10            | 17            | 13            |
| PESPLA 2                              |                                                               | 3             | 4             | 3             | 10            |
| %                                     |                                                               | 3             | 4             | 3             | 3             |
| PESPLA 3                              |                                                               | 2             | 0             | 0             | 2             |
| %                                     |                                                               | 2             | 0             | 0             | 1             |
| UKUPNO / TOTAL                        |                                                               | 91            | 98            | 101           | 290           |
This research has found that there is a statistically significant percentage of deformity of the feet of students in grades IV through VI of primary school, which is in line with the research (Kosinac, 1995; Restović et al., 2008; Hodžić et al., 2008; Stević et al. Pelemiš, 2008; Bogdanović et al., 2010; Mikić et al., 2010; Mihajlović et al., 2010).

It is evident that the percentage of foot deformity increases with the age of the children, which is certainly associated with different loads (length of sitting, standing, overweight, improper footwear). What is encouraging is that the highest number of deformities is at the first-level level, which provides the opportunity for successful correction.

Changes in postural status of the spine and foot in students initial - final measurement

Table 5. Contingency table of the frequency of distribution of spinal deformity (kyphosis) in students initial - final measurement

| KIFOZA / KYPHOSIS | UZORAK ISPITANIKA / SAMPLE OF RESPONDENTS |
|-------------------|----------------------------------------|
| F                 | %                                      |
| KIFOZNO / KYPHOS 1| 199 238                                 |
| %                 | 69 82                                  |
| KIFOZ 1 / KYPHOS 1| 68 37                                  |
| %                 | 23 14                                  |
| KIFOZ 2 / KYPHOS 2| 20 12                                  |
| %                 | 7 4                                    |
| KIFOZ 3 / KYPHOS 3| 3 3                                    |
| %                 | 1 1                                    |
| UKUPNO / TOTAL    | 290 290                                |
| %                 | 100 100                                |

Table 6. Contingency table of frequency of foot deformity distribution in students - initial - final measurement

| PES PLANUS | UZORAK ISPITANIKA / SAMPLE OF RESPONDENTS |
|------------|----------------------------------------|
| F          | %                                      |
| PESNOR     | 178 242                                |
| %          | 61 83                                  |
| PESPLA 1   | 86 36                                  |
| %          | 30 13                                  |
| PESPLA 2   | 23 10                                  |
| %          | 8 3                                    |
| PESPLA 3   | 3 2                                    |
| %          | 1 1                                    |

Based on the insights in table 5, we can conclude that the kinesiological treatment performed produced statistically significant differences between the initial and final spinal deformity (kyphosis) at the level of 12%.

Na osnovu uvida u tablici 5, može se konstatirati da je provedeni kineziološki tretman proizveo statistički značajne razlike između inicijalnog i finalnog stanja deformiteta kralješnice (kifoza) na razini od 12%.
Based on the insights in table 6, we can conclude that the performed kinesiological treatment produced statistically significant differences between the initial and final condition of the foot deformity - pes planus at the level of 22%. It is evident that the results of the presence of spinal and foot deformity after the kinesiological treatment (tables 5 and 6) were significantly better and that the kinesiological treatment significantly contributed to the correction of the postural spine (kyphosis) and flat foot (pes planus), especially in the first and the second degree of deformity. Apparently, the kinesiologic treatment produced more significant effects on the correction of foot deformity - pes planus (22%), compared to spinal deformity (kyphosis) (12%).

**CONCLUSION**

The aim of this study is to determine the effects of programmed kinesiological treatment on the correction of postural spine status - kyphosis and flat feet - pes planus, in grades IV to VI pupils (second triad of nine-year elementary school). By looking at the results of detection of the presence of postural deformities before the beginning of the application of programmed kinesiological treatment, we can conclude that the presence of all three degrees of deformity in the treated segments of postural status were recorded. Using the contingency tables, the frequencies and associated percentages of spinal deformity - kyphosis and flat feet - pes planus are shown. Looking at the results of detection of postural disorders after the completion of programmed kinesiological treatment, we can conclude that there was a significant improvement in the postural status of the subjects, since the observed deformities decreased significantly compared to the initial assessment of the postural status of the spine - kyphosis and flat foot - pes planus. Apparently, the kinesiologic treatment produced more significant effects on the correction of foot deformity - pes planus (22%), compared to spinal deformity (kyphosis) (12%). The obtained results indicate a statistically significant percentage of spinal deformity (kyphosis) and longitudinal and transverse arch of the flat foot - pes planus. Changes in the spine and arches of the feet are mainly in the first stage of deformation, which enabled the correction of the condition with the application of programmed kinesiological treatment in children of this age. It has also been

Na osnovu uvida u tablici 6, može se konstatirati da je provedeni kineziološki tretman proizveo statistički značajne razlike između inicijalnog i finalnog stanja deformiteta stopala – pes planus na razini od 22%. Evidentno je da su dobiveni rezultati stanja prisutnosti deformiteta kralješnice i stopala nakon provedenog kineziološkog tretmana (tablici 5 i 6), značajno bolji i da je provedeni kineziološki tretman značajno doprinio korigiranju posturalnog statusa kralješnice (kifoza) i ravnog stopala (pes planus) posebno u prvom i drugom stupnju deformiteta. Očigledno je da je primjenjeni kineziološki tretman proizveo značajnije efekte na korigiranje deformiteta stopala – pes planus (22%), u odnosu na deformitet kralješnice (kifoza) (12%).

**ZAKLJUČAK**

Cilj ovog istraživanja je utvrđivanje efekata primjene programiranog kineziološkog tretmana na korigiranje posturalnog statusa kralješnice - kifoza i stopala – pes planus, učenika i učenica od IV do VI razreda (druge trijade devetogodišnje osnovne škole).

Uvidom u rezultate detekcije stanja prisutnosti posturalnih deformiteta prije početka same primjene programiranog kineziološkog tretmana, može se konstatirati da je evidentirano prisustvo sva tri stupnja deformiteta u tretiranim segmentima posturalnog statusa.

Primjenom kontigencijskih tablica prikazane su frekvencije i pripadajući postoci pojave deformiteta kralježnice - kifoza i stopala – pes planus učenika.

Uvidom u rezultate detekcije stanja prisutnosti posturalnih poremećaja nakon završetka primjene programiranog kineziološkog tretmana, može se konstatirati da je evidentirano znatno poboljšanje posturalnog statusa ispitanika, jer su se praćeni deformiteti znatno smanjili u odnosu na početnu ocjenu posturalnog statusa kralješnice - kifoza i ravnog stopala – pes planus.

Očigledno je da je primjenjeni kineziološki tretman proizveo značajnije efekte na korigiranje deformiteta stopala – pes planus (22%), u odnosu na deformitet kralježnice (kifoza) (12%).

Dobiveni rezultati istraživanja ukazuju na značajan procenat korigiranih deformiteta kralješnice (kifoza) i uzdužnog i poprečnog svoda stopala – pes planus. Primjene na kralješnici i svodovima stopala su uglavnom u prvom stupnju deformacije, što je omogućilo korekciju
proven that through the proper cooperation of teachers, parents and medical staff, it can be very effective in reducing the incidence of these deformities as well as in the growth and development of children of this age.

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