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PLAYFUL KINESIOTHERAPY VERSUS TRADITIONAL KINESIOTHERAPY: PREVENTING FLAT FEET IN PRESCHOOL CHILDREN

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Abstract

Aim. The aim of the study is to investigate whether playful physical therapy or traditional physical theapy can lead to significant improvements in factors that support the development of plantar arches, such as muscle strength, balance and proprioception, and thereby to investigate whether it is possible to prevent flat feet.

Methods. During the study, a total of 15 preschool aged children participated in an 8-week program in three groups (control group, playful physiotherapy group, traditional physiotherapy group). The members of the control group did not participate in physical therapy sessions, while those participating in traditional physical therapy aimed to improve the functional development of the foot muscles and ankle joints. The playful group did the same, but within a playful, fairy-tale setting. During the examinations, range of motion and functional movements of the ankle joint were observed.

Results. Greater progress was observed in the gaming group than in the traditional group, while the control group showed no change. The range of motion measured at the ankle returned to normal values (Boucher, Onate, & Bolte, 2014), and functional performance improved for all variables.

Conclusions. The intervention successfully improved the variables associated with flat feet. The playful method proved to be more effective than the traditional method.

Keywords: Flat foot, prevention, playful physiotherapy, children.

Introduction

Nowadays, pathological flat feet are becoming increasingly common among 7- to 14-year-olds (Sadeghi-Demneh, Melvin, & Mickle, 2018).

The structure and composition of children's feet differ from those of adults, which clearly affects walking and foot function (Stebbins, & Mifsud, 2023).

Functional abnormalities develop in parallel with the formation of flat feet. In terms of balance changes, it can be said that, in general, children with flat feet have lower balance control than children with normal arches (Markowicz et al., 2023); however, it has been observed that the same is specifically true for the ability to maintain dynamic balance, i.e., it is also lower in cases of flat feet (Rizqillah & Sudaryanto, 2025).

Active inversion is generally affected by that flat feet are characterized by pronated, inward-tilting feet, which restrict movement and thus reduce the range of inversion; however, it has also been observed that in the case of pronated feet, the rear foot moves more strongly into eversion during walking (Molina-García et al., 2024).

Therefore, it is very important to prevent flat feet in preschool age in order to avoid complications in later adulthood.

Strong leg muscles promote the development of proper arches, making it less likely that the child will have permanent flat feet in the future. Exercises that focus on strengthening the legs, balance, and coordination, such as barefoot play, balance exercises, and special leg stretches, can help with this. (Turner, Gardiner, Midgley, & Stefanis, 2020).

With early treatment of flat feet, we can reduce the likelihood of the compensatory movements and promote better posture, reducing the risk of musculoskeletal problems as children grow (Kovács, 2020).

At the same time, Prins J, van der Wilt., van der Veen C., & Hovinga D. (2022) stated that in early childhood, play is a fundamental activity for children, which is intertwined with the learning process. Children want to play, thereby acquiring new information, and play helps them maintain their attention and interest for longer periods of time.

Objectives

The aim of the research is to examine the extent to which playful therapeutic exercises can prevent the problems associated with flat feet presented above, thereby offering a solution to eliminate these disorders and demonstrating that they are more effective than traditional physical therapy, while also achieving significant results in a short period of time.

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Methods

When studying the literature, the most important keywords and terms in the selection process were flat feet, playful physiotherapy, prevention, and preschool age, which I tried to map mainly using the search engines of Google Scholar, ResearchGate, and PubMed.

In terms of testing, the range of motion of the ankle, the AROM (Active Range Of Motion) was measured using a goniometer (White, 2016) (flexion, extension, inversion, eversion), while functional tests examined static balance by modified Flamingo test (Adeloye et al., 2022), dynamic balance by modified Star Excursion Balance Test (SEBT) (Olmsted, Carcia, Hertel, & Shultz, 2002) and changes in leg strength by the Up-on-the-toe test (Zahid, Celik, Godfrey, & Buckley, 2022).

The groups consisted of preschool children (aged 3-6), with a similar average age: control group 4.5 years (±1.5 years), playful experimental group 4.3 years (±1.3 years), and traditional exercise group 4.5 years (±1.5 years), and also with the same gender distribution: there were 3 girls and 2 boys in each group. The results of 5 individuals were processed in both the control group and the two experimental groups.

The physiotherapy program lasted for 8 weeks, with two sessions per week, each lasting 35-45 minutes, in the two experimental groups. The physical therapy program consisted of several interrelated phases aimed at strengthening the function of the legs, feet, and ankles, improving balance, and supporting neuromuscular integration. The structured design of the exercises ensures gradual loading, activation of proprioception, and development of coordination skills.

The equipment used during the exercises includes rings of various sizes, balance pads, sensory discs, spiky hemispherical balls, hula hoops, small massage balls, stepped elements, colorful pom-poms, and balls.

It is worth knowing that the applied physiotherapy plans contain exactly the same exercises, with the same number of repetitions and the same execution, the difference lies in the execution: in the case of the playful method, the movement itself is a game, part of a story, while in traditional physiotherapy, we perform the same exercises, but here only the manner of execution plays a role.

Microsoft Excel was used to organize the data, and various functions and formulas in the application were used to calculate the statistical data.

Results

Control group

In the control group, there were no significant changes between the initial and final measurements. The minimal difference between the two measurements shows that the changes in the two experimental groups were not random, but rather the result of our intervention (Table 1.)

Table 1. Changes in control group

	Control group (n=5)				
	Initial measurements (in degrees)		Final measurements (in degrees)		I.M.- F.M. (in degrees)
	Average	Standard deviation	Average	Standard deviation	
Plantarflexion	69,8	7,26	68,6	10,33	-1,2
Dorsiflexion	28,4	6,23	28	4,80	-0,4
Inversion	29	5,66	28,6	5,77	-0,4
Eversion	11	2,65	11,2	3,70	+0,2
Static balance	5,8	2,77	5,8	3,56	0,0
Dynamic balance	3,6	1,14	3,8	0,84	+0,2
Foot muscle strength	8,2	2,77	8	2,74	-0,2

I.M., Initial measurements; F.M., Final measurements;

Traditional group

The results achieved in the traditional group are significant after 8 weeks, so it can be said that the group working with traditional physiotherapy methods also succeeded in promoting the prevention of flat feet. It can be observed that the active range of motion is closer to the normal range observed in childhood at the final assessment (Boucher, Onate, & Bolte, 2014), and functional performance has improved in all cases (Table 2.).

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Table 2. Changes in traditional group

	Traditional physiotherapy group (n=5)				
	Initial measurements (in degrees)		Final measurements (in degrees)		I.M.- F.M. (in degrees)
	Average	Standard deviation	Average	Standard deviation	
Plantarflexion	72,6	6,47	62,4	11,78	-10,2
Dorsiflexion	27,2	8,56	24	2,74	-3,2
Inversion	28,8	3,11	26,4	3,29	-2,4
Eversion	10,4	2,30	15,6	4,51	+5,2
Static balance	5,2	4,09	8,6	3,85	+3,4
Dynamic balance	3,4	1,95	5,8	1,92	+2,4
Foot muscle strength	8	1,87	11	2,35	+3

I.M., Initial measurements; F.M., Final measurements;

Playful group

We also achieved outstanding results with the children in the play group, as in the traditional group, their range of motion normalized (Boucher, Onate, & Bolte, 2014), and their functional abilities improved significantly after the 8-week intervention. It is particularly noteworthy that, in contrast to the traditional group, the standard deviations in the final results are quite low, meaning that the groups achieved uniformly effective results without any significant lag, thus proving that the group exercising with playful methods was more effective in this aspect as well (Table 3.)

Table 3. Changes in playful group

	Playful physiotherapy group (n=5)				
	Initial measurements (in degrees)		Final measurements (in degrees)		| I.M.- F.M. | (in degrees)
	Average	Standard deviation	Average	Standard deviation	
Plantarflexion	71,4	4,67	56,6	5,27	-14,8
Dorsiflexion	28,4	4,39	23,8	1,48	-4,6
Inversion	27,8	5,40	26,2	4,49	-1,6
Eversion	10,75	2,70	17	2,55	+6,2
Static balance	5,6	2,97	10	2,35	+4,4
Dynamic balance	3,4	1,14	6,4	1,14	+3,0
Foot muscle strength	8,6	1,52	12	1,58	+3,4

I.M., Initial measurements; F.M., Final measurements;

Comparison of the effectiveness of traditional and playful groups

After reviewing the results, it is clear that the children participating in physical therapy showed greater improvement after the 8-week intervention. To present more accurate results, effect size calculations (Cohen's d value) (Sullivan & Feinn, 2012) were used, as the small sample size could have negatively affected the significance test results (Table 4.).

Table 4. The results of the effect size analysis

	Cohen's d at traditional physiotherapy group	Cohen's d at playful physiotherapy group	Interpretation of the results of the playful group
Plantarflexion	-1,70*	-2,81*	Very large
Dorsiflexion	-0,47*	-0,86*	Large
Inversion	-1,16*	-0,30*	Medium
Eversie	1,49	4,35	Very large

Static balance	2,98	3,86	Very large
Dynamic balance	4,38	4,24	Very large
Foot muscle strength	1,73	6,21	Very large

Since the goal was to normalize the range of motion, the decrease should also be considered a positive result. We can also look at the results of the significance test (t-test) (Table 5).

Table 5. Effectiveness of the intervention in terms of significance

	Effectiveness of the intervention in terms of significance traditional group		Effectiveness of the intervention in terms of significance playful group	
	t	p	t	
Plantarflexion	t=3.79	p=0.019*	t=6.29	p=0.003*
Dorsiflexion	t=1.05	p=0.354	t=1.92	p=0.128
Inversion	t=2.59	p=0.061	t=0.67	p=0.541
Eversion	t=-3.33	p=0.029*	t=-9.73	p=0.001*
Static balance	t=-6.67	p=0.003*	t=-8.63	p=0.001*
Dynamic balance	t=-9.80	p=0.001*	t=-9.49	p=0.001*
Foot muscle strength	t=-3.87	p=0.018*	t=-13.88	p=0.000*

*Significant change

If we look at the results of the significance test (t-test), it is evident that we used the same programme, as we achieved significant changes in the two groups with the same variables. However, it can be observed that the values are much lower in the player group, so the player method proved to be more effective.

At the same time, it can be said that significant results can be achieved with either method with an 8-week intervention.

Discussions

In general, it can be said that our results are consistent with previous research, so the possibility of our success was well-founded from the outset. At the same time, it is important to note that prevention and the use of playful methods are not areas that have been extensively researched, so these studies do not fully correspond to our topic, but rather intersect with it at certain points.

In terms of balance changes, it can be said that, in general, children with flat feet have lower balance control than children with normal arches (Markowicz et al., 2023); however, it has been observed that the same is specifically true for the ability to maintain dynamic balance, it is also lower in cases of flat feet (Rizqillah & Sudaryanto, 2025). In line with the results of the research, we effectively improved the static and dynamic balance of children by developing their feet and ankles.

Sativani, & Pahlawi (2020) obtained significant results in their research, proving that targeted physiotherapy is an effective method for treating certain types of arch collapse. Looking at the details, their results showed that foot strengthening exercises significantly improved posture balance and functional abilities in children with flat feet. The exercises targeted the inner muscles of the foot, which are key to maintaining the arch and providing proper support for the foot. The study concluded that incorporating the exercises into a regular routine could help prevent foot deformities and improve posture stability in children with flat feet. In our case, the program involving the development of the inner muscles of the foot improved all functional abilities tested.

In addition, Stoychew, Popova, & Filipova (2020) found that children aged 6-10 respond positively to targeted physical therapy aimed at strengthening the muscles of the feet, making it a viable long-term treatment option. They emphasize the importance of early intervention in the treatment and prevention of flat feet in children, noting that the development of the arch of the foot begins in early childhood and lasts until around the age of 8-9, with the most dynamic development occurring between the ages of 4 and 7, making this the most effective period for intervention. Our research shows that even with younger children (of preschool age), a preventive program can be implemented with significant results in a short period of time.

In his study, Kolooli (2014) examined the effect of an 8-week corrective training program on the height of the navicular bone in 12- to 16-year-old teenagers with flat feet. He demonstrated that the 8-week intervention caused a significant difference in the height of the navicular bone in the experimental group, suggesting that similar programs can effectively improve flat feet. The research proves that significant results can be achieved in a short period of time, and in our case, since we cannot talk about flat feet in preschool children, these changes are not pathological, so their development is easier and faster.

Turner, Gardiner, Midgley, & Stefanis (2020) state in their guidelines that it is important from a physiotherapy perspective to provide an exercise program aimed at increasing the strength of the muscles that stabilize the arch. This can include walking on tiptoes, walking on heels, activities that improve dynamic arches, walking barefoot on different surfaces, bending and gripping the toes, rolling a ball under the arch of the foot, climbing, and other gross motor activities. Our program, which included similar exercises, also proved to be effective in prevention.

Conclusions

The intervention successfully improved the variables associated with flat feet, the 8-week prevention program attempt proved successful. The playful method proved to be more effective than the traditional method.

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