PILATES EFFECTS ON SPINAL COLUMN POSTURAL STATUS: A SYSTEMATIC REVIEW

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Abstract:

Pilates exercise programs focus on increasing the strength and flexibility of muscles which make up core stability. Since the same muscles take part in maintaining proper posture, the aim of this study was to provide an overview of the existing research in order to determine the effects of a pilates exercise program on the improvement of postural status. When searching electronic databases, the following key words were used: spine, posture, effect, pilates, kyphosis, scoliosis, lordosis. Based on the set criteria, that the research was published after 2010 and that the applied pilates exercise programs focused on correcting postural status, the final analysis included 10 studies. An analysis of the characteristics of the sample of participants indicates that the problem of postural disorders is equally present among individuals of various ages. In terms of gender, in the analyzed studies the female population was almost four times the size of the male population. In most of the studies the exercise program lasted for 8 and 12 weeks, with 2 to 3 training sessions per week, with a duration of 60 min. Eight of the analyzed studies show that pilates exercise programs led to an improvement in the postural status. Based on the extensive analysis, it can be concluded that pilates has positive effects on the correction of postural disorders of the spinal column, such as kyphosis, lordosis and scoliosis among people of different ages.

Key words: corrective exercise, scoliosis, lordosis, kyphosis

Introduction

Proper posture represents the correct positioning of segments of the body (muscles, ligaments and bone tissue) whose role it is to, with the lowest possible expenditure of energy, enable its maintenance (Jovović, 2008). Deviation from proper posture or any disturbances of the postural status require a greater expenditure of energy and lead to the limited movement of the particular segment where the problem is located (Sabo, 2006; Milenković, 2007). The side-effects which emerge as a result of external and internal factors can cause a disturbance of the postural status of the spinal column (Jovović, 2008). The postural disorders of the spinal column occur in the frontal and sagittal plane, and can be noted based on convexity which can be directed towards the inside (lordotic posture) or outwards (kyphotic posture) or can be external that is directed either toward one or the other side of the frontal plane (scoliotic posture) (Živković, 2000; Milenković, 2007). Corrective exercise programs are meant to, with the help of proper dosing of physical exercise, correct any disorders of the postural status of the spinal column (Živković, 2009; Jovović, 2008). One of these programs which could be used is pilates, which was designed by Joseph Pilates in the first half of the twentieth century,

and which represents a combination of various physical exercise programs with the sole goal of establishing muscle balance based on strength of mind (Šiler, 2005; Krejg, 2005; Wells et al., 2012; Cvetković et al., 2008). With the proper selection of exercises with controlled dosing, pilates programs can influence the correction of postural disorders of the spinal column (Nikolov, 2014). Their goal is to establish a balance between the muscle strength of the entire body and to maintain their harmonious synchronicity. Pilates exercise programs focus on increasing the strength and flexibility of muscles which make up core stability. Since the same muscles take part in maintaining proper posture, the *aim* of this study was to provide an overview of the existing research to determine the effects of a pilates exercise programs on the improvement of postural status.

Methodology

In order to analyze the existing studies, we used the following electronic databases: Google Scholar, SCIndeks, MEDLINE, SPORTDiscus, PubMed and Web of Science. When searching the databases we used the following key words: Correct posture of spine, posture of spine, effect pilates exercises, kyphosis, scoliosis, lordosis. The identified titles of the

studies, abstracts and entire texts were analyzed and selected based on the following criteria: whether the studies were published during the period between 2010 and 2016, whether the participants were diagnosed with postural status disorders of the spinal column, and whether the participants were subjected to a pilates exercise program focused on the correction of the postural status of the spinal column.

The studies which met the set criteria were then analyzed and presented based on the following parameters: references (the first letter of the author's name and the year of publication), the sample of

participants (the number of participants, age of the participants, gender of the participants and the number of groups of participants), the experimental treatment, monitored parameters, measuring instruments and the research results

Results

Compiling the research, the analysis of the individual papers and their selection is shown in figure 1. After various levels of selection, it was determined that 11 papers met the set criteria and what ensued was their detailed analysis.

Figure 1. The analysis procedure of the selected papers

The results of the analyzed studies are shown in table 1. Starting from 2010, most of the papers on the topic of the effects of pilates exercise programs on postural status was published in 2016, while from 2011 to 2015 no papers of this type were published. In terms of the number of participants, the smallest number of participants were found in the work of Emery et al. (2010) while the largest number of

participants (n=50) were included in the work of Kloubec et al. (2010). In eight papers the samples of participants were divided into an experimental group and a control group, while in one paper the participants were divided into two experimental groups (Kim et al., 2016), and in yet another there was only one experimental group (Krawczyk et al., 2016).

Table 1. An overview of the compiled and analyzed studies

F I R S T A U T H O R A N D Y E A R	S A M P L E O F P A R T I C I P A N T S			E X P E R I M E N T A L T R E A T M E N T				R E S U L T S
	Number	G e n - d e r	Year	Program	Duration	Measuring instru- ment	Outcomes	
Emery, 2010.	n=19; 1E(n=10), 1K (n=9)	M/F	E ($\pm$ 33.1 8.6), K ($\pm$ 28.6 3.7)	Pilates (exercises for strengthening abdominal musculature)	UT'=12 weeks; NU=2; TT=60 minutes.	Vicon 512 Motion Analysis System,	The angle of kyphosis measured in a seated position	1E: sig. decrease in kyphosis measures at rest in a seated position
Kloubec 2010.	n=50; 1E(n=25), 1K (n=25)	M/F	E (58–26); K (30–59)	Pilates (exercises for muscle endurance and flexibility of the abdomen)	UT=12 weeks; NU=2; TT=60 minutes	A coordinate network for the postural analysis.	Postural status	No significant differences were determined between groups in terms of postural status.
De Araújo, 2012.	n=31; 1E(n=20), 1K (n=11)	F	18–25	Pilates (exercises for muscle endurance and flexibility with the help of props)	UT=36 weeks; NU=2; TT=60 minutes.	Adam's test, a radio- graphic method and Cobb's angle	Angle of the dorsal lumbar scoliosis.	1E: sig. angle of scoliosis
Junges, 2012.	n=41; 1E(n=22), 1K(n=19)	F	Mean 59 $\pm$ 9	Pilates (basic deep breathing exercises and strength and stretching exercises)	UT= 30 weeks; NU= 2; TT= 60 minutes.	Cobb's angle, Fisimet- rix program	The angle of ky- phosis, postural status	1E: sig. angle of kyphosis; sig.* postural status
Rezaei, 2014.	n=30; 1E(n=15), 1K(n=15)	F	E ($\pm$ 28.86 4.75); K ($\pm$ 28.2 4.68)	Pilates (strength and flexibility exercises)	UT= 8 weeks; NU= 3; TT= 60 minutes	A flexible ruler	Lumbar lor- dosis	1E: sig. angle of lordosis
Sinzato, 2013.	n=33; 1E(n=14), 1K(n=19)	F	18–30	Pilates (strength and flexibility exercises)	UT=10 weeks, NU=2; TT= 60 minutes	Postural Assessment software	Postural status	No significant differences were determined between groups in terms of postural status.
Schroeder, 2014.	n=24; 1E (n=10), 1K(n=14)	F	33–53	Pilates (strength and muscle flexibil- ity exercises)	UT= 12 weeks; NU= 1; TT= 60 minutes	An analysis of the spinal shapes (stereg- ographic algorithm)	The angle of ky- phosis, angle of lordosis, pelvic incline, length of the spinal column	1E: sig. angle of kyphosis, sig. length of the spinal column; no other differences.
Kim, 2016.	n=24; 1E(n=12), 2E (n=12)	F	1E (Mean $\pm$ SD = 15.6 $\pm$ 1.1); 2E (Mean= 15.3 $\pm$ 0.8)	1E - Schroth exercises 2E - pilates (cor- rective exercises, exercises of strength and bal	UT= 12 weeks; NU= 3; TT= 60 minutes	Radiography (Cobb's angle)	The angle of scoliosis	For both groups a sig. decrease in the angle of scoliosis was noted, where the improvement was greater for the 1E.
Krawczyk, 2016.	1E(n=13)	M/F	18–59	Pilates (exercises of flexibility and strength)	UT= 8 weeks; NU=2; TT= 60 minutes	SAPO software	The angle of ky- phosis, lordosis, the horizontal position of the head, pelvis)	1E: sig. a decrease in the angle of ky- phosis and lordosis
Navega, 2016.	n=31; 1E(n=14), 1K(n=17)	F	60–75	Pilates (exercises for stretching muscles and hips, and torso stabilization)	UT= 8 weeks; NU= 2. TT= 60 minutes	biophotogrammetry	The angle of kyphosis	1E: sig. decrease in the angle of kyphosis

M – male participant; F – female participant; 1E – first experimental group; 2E – second experimental group; 1K – control group; sig. $\uparrow$ – statistically significant increase in the results; sig. $\downarrow$ – statistically significant reduction in the results; UT – overall duration of the program; NU – weekly frequency; TT – duration of each individual training session.

In three of the ten studies, the sample of participants consisted of individuals of both genders (Emery et al., 2010; Kloubec et al., 2010; Krawczyk et al., 2016) while in the remaining papers the samples of participants were made up of women. The youngest population (average age = 15) included in a study was found in the work done by (Kim et al., 2016), while the oldest (60-75) was found in the work of Navega et al. (2016). In nine of the ten papers the experimental treatment that was used was only a pilates program, while in the work of Kim et al. (2016), in addition to a pilates program, the Schroth method was also used. The pilates exercise programs consisted of exercises performed without props and apparatuses, except in the work of De Araújo et al. (2012) which relied on theraband resistance bands, pilates balls and steppers. The exercises which were implemented had as a goal to increase flexibility and strength of the muscles. The duration of the exercise program lasted from at least 8 weeks in the studies (Rezei et al., 2014; Krawczyk et al., 2016, Navega et al., 2016) up to 36 weeks in the work of De Araújo et al. (2012). In most of the studies the exercise programs lasted from 8 to 12 weeks. The weekly frequency was twice a week in seven studies, in two of the studies it was three times a week, while a frequency of only once a week was noted in the study of Schroeder et al. (2014). In all the studies the duration of an individual training session was 60 minutes. The studies monitored various parameters which refer to the postural status, as well as parameters which refer to postural disorders on the spinal column. That was why the angles of kyphosis, lordosis and scoliosis were measured, along with the horizontal positions of the head, the horizontal position of the pelvis, the angle of the hips, and the vertical position of the body. In eight of the ten studies the implemented programs of pilates exercises led to an improvement in the results, in the sense that there was a decrease in the angles of lordosis, kyphosis, scoliosis as well as positive changes in other measured parameters. Only in the works of Kloubec et al., (2010) and Sinzato et al. (2013) were no improvements noted in the measured parameters of postural status.

Discussion

Based on the year of publication of the analyzed papers, we can note that the research into the effects of the implementation of pilates programs on postural status is very current, since it is precisely in 2016 that most of the papers were published. In

the case of the gender of the participants involved in the pilates programs for the correction of postural disorders, there were almost four times as many women as men. This gives us room to study the effects of the pilates program on the correction of postural disorders among male participants, considering the gender differences in the motor skills. When it comes to the age of the participants, we can note that the problem of postural disorders is equally present among participants, irrespective of age, from adolescence to old age, where most of the analyzed cases involved a population with an average age of 20 to 65. Compared to postural disorders, we can say that most of the participants showed signs of the changes in postural status located on the frontal plane (scoliosis) and on the sagittal plane (kyphosis and lordosis). Based on the analysis of the overall program duration, and the weekly frequency of duration of individual training sessions, we can conclude that the pilates programs which lasted from 8 to 12 weeks with a weekly frequency of two or three times a week, and sixty-minute training sessions, have positive effects on the correction of postural disorders of the spinal column. This kind of information is significant because it indicates that postural disorders can be corrected by implementing pilates exercise programs over a relatively short period of time of 2 to 3 months, which can certainly have a positive effect on people with this condition, influencing them to opt for this corrective exercise program.

Conclusion

Based on the extensive analysis, it can be concluded that pilates programs which last from 8 to 12 weeks, with a weekly frequency of 2 to 3 times a week, with a minimum duration of individual training sessions of 60 min have positive effects on the correction of postural disorders of the spinal column, such as kyphosis, lordosis and scoliosis among people of different ages.

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