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Does Pilates effect on depression status, pain, functionality, and quality of life in university students? A randomized controlled study

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Abstract

Purpose: The aim of this study is to investigate the effects of Pilates exercise program on health-related quality of life, pain, functional level, and depression status in university students.

Design and Methods: The exercise programs were carried out for 12 weeks. The scales of Nottingham Health Profile, Visual Analog Scale, Oswestry Disability Index, and Beck Depression Inventory were used at the baseline and after training.

Findings: Exercise should be encouraged to reduce pain and depression and improve the quality of life in healthy university students. Both Pilates and therapeutic exercises approach can be preferred.

Practice Implications: The results of this study show the inability to identify clear different effects from therapeutic exercises on university students for Pilates exercises.

KEYWORDS

depression, exercise therapy, pain, young adults

1 | INTRODUCTION

Pilates is depicted as a form of physical training that promotes the general wellness of the subject, thus is able to promote strength, flexibility, better posture, control, conscience, and perception of movement.[1,2] Pilates has become a useful exercise approach to enhance the mobility/control of the trunk and pelvic segments, resilience, and functional capacity. Pilates' concept focuses on spinal stabilization.[3,4] However, according to some authors, exercises are commonly done in the supine position, where there is less impact on the joints to support the body, especially the spine.[1,2] Researchers of this method affirm that the exercises promote health benefits by improving psychological function, motor learning, and posture.[1-3]

Despite this method's popularity and widespread application in clinical practice or studies, there is scarce research demonstrating its effectiveness. Previous studies showed that Pilates exercises performed by healthy individuals for 12 weeks enhanced musculoskeletal health and improved life quality, pain, physicosocial status, and disability.[1,2,5,6] However, it has not been clearly declared whether Pilates was more effective than other forms of exercise for the treatment and prevention of pain and disability.[7] In addition, an exercise program must be defined by other parameters. Exercise programs may vary in duration, frequency, and routine, whether they are audited and in which population they are applied (young, healthy, or with chronic diseases).[3,8,9] In addition, there is a little scientific research on the effect of Pilates, and plenty of the studies carried out to date have commented it as lacking control groups.[10]

Quality of life was defined as a sense of spiritual comfort, kindliness, or happiness in the implementation of various physical, intellectual, and psychic functions in the family, work, and community values. This includes physical health, psychological state, functional level, social relationships, and environmental characteristics.[11] Findings of the studies support that exercises are partially intervened by psychological consequences on the quality of life.[11] In recent times, sedentary attitude, inadequate nourishment, and tension may increase the unhealthy life in young adults with healthy dispositions.[12]

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Explanatory proper exercise strategies for prevention and treatment might be of extreme value. However, no previous studies have evaluated the effect of Pilates exercises by assessing the quality of life, pain, depression status, and functionality level in young adults. Studies with good methodological qualities confirming the effectiveness of the Pilates method in healthy subjects are still scarce.[1]

Therefore, the aim of this study is to investigate the effect of Pilates on health-related quality of life, pain, functional level, and depression status in university students.

2 | METHODS

Randomized controlled trial design was used. Moreover, this study was applied as a single-blind. This study was done consistent with the rules of the Declaration of Helsinki. Each participant signed a form which is informed consent. The study was approved by the Human Research Ethics Committee of the Kocaeli University (No: KU GOKAEK 2016/163). It was registered at ClinicalTrials.gov (NCT03825614). Power analysis was done for suitable sample sizes by using the G*Power software package (G*Power, version 3.0.10; Franz Faul, Universitat Kiel, Germany). It was calculated that a sample of at least 74 participants was needed to obtain 80% power with $d = 0.50$ effect size, $\alpha = .05$ type I error, and $\beta = .20$ type II error.

University students aged 18 to 25 years were selected randomly in one of three groups. All participants provided a health certificate obtained by a public practitioner, documenting that they were healthy and had no systematic disease that obscured them from participating in any exercise program. Participants were subjected to a self-reporting health history questionnaire for eligibility criteria. They were not included in the study if any of the following criteria were met: (a) having any musculoskeletal injury, pathology, or structural deformity attached to the spine or limbs, (b) having a systemic pathology, including inflammatory, rheumatological, or metabolic diseases, (c) use of any drug in the previous 3 months, including corticosteroids or any medication, or (d) doing 3 days a week for 150 minutes of regular physical activity. Exclusion criteria are based on similar previous studies.[6,13] This study was conducted at Termal Vocational School, Yalova, Turkey. A total of 125 young adults were examined regarding their eligibility for inclusion in this study. Five subjects did not meet the inclusion criteria. Fifteen subjects were excluded as they did not want to attend the study. Participants that were included and excluded from the study groups are detailed in Figure 1. The remaining participants (n = 105) were assigned random, computer-generated numbers, and then allocated into the three groups (Pilates group, n = 35; therapeutic group, n = 35; and control group, n = 35) via drawing lots. The groups were then age- and sex-matched. A total of 92 participants completed the study (Pilates group, n = 29; therapeutic group, n = 28; and control group, n = 35). All subjects were evaluated pretraining and posttraining. Intervention groups were trained three times a week for 12 weeks. The participants in the control group (n = 35) did not make ordinary regular physical activity or exercise throughout the study.

Assessment of pain, functional level, depression status, and quality of life were made at baseline and following completion of the 12-week training program. All assessments were made by the same physiotherapist blinded to the group distribution. The demographic/physical properties of all participants—regarding their age, sex, waist, and hip-circumference measurements—were recorded. Any musculoskeletal pain was examined (with a Visual Analog Scale [VAS]) while the participants maintained their sedentary positions (sit or up) for a long time while working, using a screen, or task-related activities.

2.1 | Procedure

The Pilates exercise program is concerned with the next key principles: effective breathing, cognitive concentration, relief, true spine elongation and posture, proper abdominal muscle control on spine stability and mobility, the accurate function of each upper and lower limb, delicate, lowing integrated movement, and reach muscle strength and resistance. Mat-work exercises bearing lower abdominal muscle strengthening in supine, prone posterior hip-muscle strengthening, side-lying posterior hip-muscle strengthening, supine upper abdominal muscle strengthening, and knee strengthening were done. The precise names of the exercises are as monitored: hundred preparation, hundred, half roll-up, single-leg circle, rolling like a ball, single-leg stretch, crisscross, spine stretch forward, spine stretch side, swan, swimming, single-leg kicks, saw, side-leg bananas bridge, side-leg lifts, and side-leg circles. The exercises were progressively increased from 6 to 15 repetitions. The base of support, lever arm, limb location, surface, and cognitive focusing was used as an advance ingredient for the exercises used throughout the program.[6,13]

The therapeutic exercise program was administered using low- to moderate-intensity therapeutic exercises. These therapeutic exercises covered a short instructive conversation that provided knowledge of appropriate posture and respiration when rising an exercise ordinary. Each session along with an instructive speech, followed by feedback from the former week, simple warm-up exercises to increment participants' heart rates, and, lastly, iterations set of 7 aerobic exercises and 10 strengthening exercises emphasizing leg, hip, abdominal, and back muscles (supine lying—leg lifts, prone lying—leg lifts, abdominal crunches in crook lying position, and prone lying—trunk lifts). Over the course of the 12-week series, the number of iterations for aerobic and strength exercise raised from 8 to 30 by increments of 2. The strengthening exercises were followed by 12 stretching exercises regarding the same muscle groups, with each stretch being held for a total of 30 seconds. Training completed with a short unguided period of deep slow breathing.[14,15]

2.1.1 | Visual Analogue Scale

During these actions, a VAS was used on the grades of experienced pain subjects. The VAS consists of a 10-cm horizontal line,

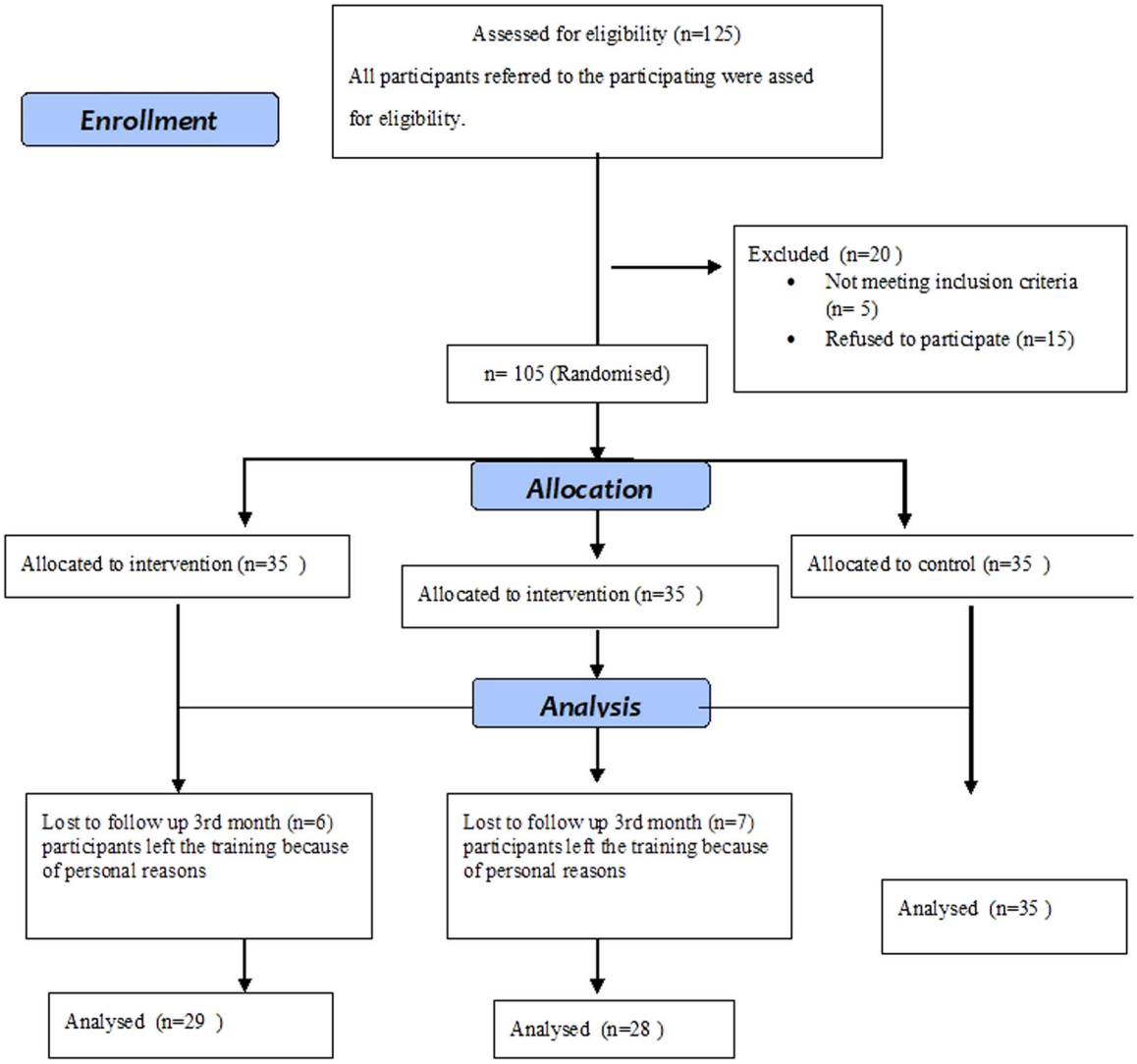


FIGURE 1 Flow diagram of representing participants recruitment and randomization procedure [Color figure can be viewed at wileyonlinelibrary.com]

where 0 states "painless" and 10 indicates "intolerable pain." The participants were asked to sign the potency of the ongoing musculoskeletal pain on the horizontal route. There is a lot of evidence to support the validity of VAS. The cutoff points were used to comment scores: no ache (0-4 mm), mild ache (5-44 mm), moderate ache (45-74 mm), and severe ache (75-100 mm).[16]

2.1.2 | Waist/hip ratio

Waist/hip ratio (WHr) is used as a measurement of obesity like Body Mass Index (BMI), it can be a precursor of other serious health conditions. This is calculated as waist-circumference values divided by hip-circumference values. The waist circumference of the participants was measured in centimeters (cm) using a tape meter to take the range the midpoint between the costal border in the midaxillary line and the iliac crest. Hip circumference (cm) was calculated at the widest point of the larger trochanter.[17]

2.1.3 | Beck Depression Inventory

The Beck Depression Inventory (BDI) is self-report rating inventory; each item on the scale is given a score of 1 to 3, letting for a maximum test score of 63 to form that measures characteristic attitudes and symptoms of depression. A participants' total whole score is then taken as a cursor of the entity and intensity of depression: a total score lower than 10 states no depression, a score of 10 to 17 states light depression, a score of 18 to 29 states moderate-to-vigorous depression, and a score of 30 or above states vigorous depression. The study has validity and reliability and the cutoff point has been determined as 17 for the Turkish version.[18]

2.1.4 | Nottingham Health Profile

The Turkish version of the Nottingham Health Profile (NHP) was used to examine participants' subjective health status. The NHP is a

quality of life questionnaire that takes the range of participants' pick-up health problems and to what degree these problems handle their normal daily activities. NHP self-rating among participants in assessing health-related terms or illness. This tool can be used to assess subjective health effectively and precisely; this tool also successfully permits changes within and between illness groups. In a few areas, NHP is also culture-free; NHP has also been taken as a valid and reliable tool among young adults.[11] The questionnaire is covered with 38 items that deal with pain, energy, sleep, mobility, emotional reaction, and social isolation. The test implies a list of yes/no questions. Each division gives a score between 0 and 100 for each subject, where 0 stands for the best health status and 100 the worst health status.[11]

2.1.5 | Oswestry Disability Index

As we know that some of the questions on the Oswestry Disability Index (ODI) are directly interested in physical activities (lifting, walking, etc). The level of disability was assessed by the ODI, which is a status precise index about how low back pain affects activities of daily living. The ODI consists of 10 items. Items question the severity of pain, self-care, lifting-carrying, walking, sitting, standing, sleep, degree of pain change, travel, and social life. Under each item, there are six expressions that marked the appropriate one for the patient's condition. The first expression is scored as "0" and the sixth is rated as "5." When the total score is calculated, it is multiplied by 2 and said as a percentage. The maximum score "100" and minimum score is "0." As the total score increases, the level of disability increases. The ODI has been displayed to have high reliability (reliability coefficients, 0.84-0.99) and validity.[16]

2.2 | Statistical analysis

Descriptive statistics of factors were calculated as mean ± standard deviation, and as frequencies (counts and percentages). The normality assumption of the parametric tests was scored by the Kolmogorov-Smirnov test. One-way analysis of variance was used to crosscheck the participants' ages among the three study groups and for comparison of the groups according to posttraining changes. Post hoc Tukey test was used to assign different groups. Pearson's χ^2 test was used to set against the groups in terms of sex. Posttraining changes were analyzed by paired-samples t test depending on the distribution of the data collated from the three groups. The statistical significance level for all analyses was adjusted as $P < .05$. SPSS for Windows was used to analyze the data (ver. 18.0; SPSS Inc, Chicago, IL).

3 | RESULTS

The mean ages of the university students in the Pilates, the therapeutic, and the control groups were 18.82 ± 1.071, 18.85 ± 2.495, and 19.42 ± 1.378 years, respectively. Their age, sex, and WHr composition were similar ($P > .05$). Their BMI values were not similar ($P > .05$). According to existing literature, BMI values of overweight individuals are affected by training.[19] BMI values were not examined in this study since no young adults who were participants in this study were overweight/obese (mean value, <25 kg/m^2).[19] The baseline demographic characteristics of the groups are shown in Table 1.

After the intervention, for VAS, NHP, WHr, and BDI values, there was a significant reduction in the training groups ($P < .05$) (Table 2). When the ODI values were analyzed, this was not significantly improved in three groups ($P > .05$). Also, there was no significant decreases in VAS, NHP, WHr, and BDI values of the control group. The mean values of all measurements are given in Table 2.

When the three groups of BMI, VAS, ODI, NHP, and BDI values changes after training were compared, they were found significantly different. A post hoc Tukey test showed that the control group was significantly different from the other two groups at $P < .05$ (Table 3).

4 | DISCUSSION

The purpose of this study is to investigate the effect of Pilates exercise program on health-related quality of life, pain, functional level, and depression status in young adults. When pre- and post-intervention outcomes of the Pilates exercise program were assessed, a positive effect on the pain, physiological status, and quality of life was found.[1,2,5,6] Similar results were found in the therapeutic

TABLE 1 Demographic and physical characteristics of the participants

Demographic and physical characteristics	Pilates n = 29	Therapeutic n = 28	Control n = 35	*P* value
Age, y (mean ± SD)	18.82 ± 1.071	18.85 ± 2.495	19.42 ± 1.378	.272
Body Mass Index, kg/m^2; mean ± SD	22.11 ± 3.71	23.34 ± 4.66	20.84 ± 2.30	.036
Waist/hip ratio (mean ± SD)	0.74 ± 0.04	0.75 ± 0.06	0.74 ± 0.05	.622
Sex (n, %)				
Female	23 79.3	21 75.0	31 88.6	.570
Male	6 20.7	7 25.0	4 11.4	

Abbreviation: SD, standard deviation.

TABLE 2 Descriptive statistics in groups of pretraining and posttraining measurements

Kind of training			Mean ± SD	*P* value
Pilates n = 29	BMI, kg/m^2	pre	22.12 ± 3.72	.175
		post	22.50 ± 3.68	
	VAS,[a] cm	pre	2.89 ± 2.88	.002
		post	1.29 ± 2.04	
	ODI	pre	0.59 ± 0.78	.161
		post	0.45 ± 0.63	
	NHP	pre	114.21 ± 74.78	.000
		post	72.55 ± 65.01	
	WHr	pre	0.74 ± 0.04	.048
		post	0.72 ± 0.07	
	BDI[a]	pre	9.07 ± 5.45	.010
		post	6.27 ± 5.65	
Therapeutic n = 28	BMI, kg/m^2	pre	23.35 ± 4.67	.758
		post	23.48 ± 4.58	
	VAS[a], cm	pre	2.69 ± 2.32	.003
		post	1.5 ± 1.96	
	ODI	pre	0.57 ± 0.87	.558
		post	0.50 ± 0.63	
	NHP[a]	pre	147.38 ± 106.11	.000
		post	93.81 ± 97.54	
	WHr	pre	0.76 ± 0.07	.000
		post	0.72 ± 0.05	
	BDI[a]	pre	11.57 ± 6.31	.002
		post	8.10 ± 7.25	
Control n = 35	BMI, kg/m^2	pre	20.84 ± 2.31	.803
		post	20.80 ± 2.53	
	VAS, cm	pre	2.69 ± 2.37	.606
		post	2.59 ± 2.28	
	ODI	pre	0.57 ± 0.92	.160
		post	0.62 ± 1.00	
	NHP	pre	144.51 ± 79.24	.655
		post	146.46 ± 78.44	
	WHr	pre	0.81 ± 0.21	.321
		post	0.71 ± 0.07	
	BDI	pre	11.63 ± 4.94	.268
		post	12.02 ± 5.07	

Abbreviations: BDI, Beck Depression Inventory; BMI, Body Mass Index; NHP, Nottingham Health Profile; ODI, Oswestry Disability Index; pre-post, pre-post training; SD, standard deviation; VAS, Visual Analog Scale; WHr: waist/hip ratio.

[a]The changes which are without normal distribution after the exercise were analyzed by the Wilcoxon test.

exercise group. However, they were not significantly difference in the control group.

Pilates exercises have an evolutionary complexity, providing better stabilization during body movements. Because of this, its use for improving fitness is increasing. Moreover, according to Rodríguez-Romero et al,[16] subjects who practice the method improve their perception of quality of life with increased emotional well-being and psychological self-efficacy and functional abilities and decreasing pain. Previous studies showed that the Pilates exercise program decreased pain in healthy subjects over 12 months.[3] In the present study, both of the Pilates and therapeutic exercises have positive effect on pain in young adults. One reason of this is because the Pilates based spinal stabilization exercises have been used to treat and prevent musculoskeletal spinal disorders, and, hence, the pain in musculoskeletal could be decreased in young adults. When compared to other exercises, like in the present study results, the Pilates method has not shown superior results. Caldwell et al[20] concluded that Pilates training and Taiji Quan improves pain of university students. According to Hasanpour-Dehkordi et al,[21] pain reduces and general health enhances after exercise therapy with both Pilates and McKenzie trainings. The other study includes that there were no differences between Pilates and general exercises regarding pain after 8 weeks (16 sessions, twice in a week) and a follow-up of 3 months.[22] The effect of Pilates or other exercises on pain in healthy young adults is not clear in literature.[23] A lot of factors may be having effect on pain in young adults (up to 22 years). One of the causes of pain in the musculoskeletal system that occurs in daily life or while working is that due to poor/poor posture, the correct biomechanics cannot be provided, and unnecessary energy is consumed and with a decreasing functional level. In this study, we found that Pilates has effect on pain in healthy young adults. Also, therapeutic exercise programs have a positive effect on pain in healthy young adults. This result may have occurred due to the effect of both exercises on posture. For future studies, it may be suggested to include posture evaluations in Pilates related studies. However, there was no difference between Pilates and therapeutic exercises. According to Geneen et al,[23] the quality of the evidence examining the effects of exercise on pain is low. This study contributes significantly to literature.

There are few studies about the effectiveness of Pilates exercise program on the quality of life in the literature. Moreover, no study evaluating Pilates exercise program through the questionnaire used in this study (NHP) in healthy young adults was found, although it had been declared in the literature that NHP could be used in the general population.[11] Thus, this study had limited opportunity to compare the obtained results. Our findings are in line with the previous studies, although these are very heterogeneous and differ from ours in terms of the type of participations (older people and participants with chronic pain) or quality of life questionnaires (mostly used one being Short Form-36).[16] Recent studies show that Pilates promotes positive psychological feelings, and, thus, people have a better quality of life.[10,16,24,25] Uluğ et al[25] studied the efficacy of Pilates exercise program in neck pain, demonstrated that a significant improvement in NHP total values from 206.9 ± 97.9 to 118.2 ± 93.1. Altan et al[10] studied participants with fibromyalgia, found a significant improvement of NHP values from 297.11 ± 124.2 to 196.6 ± 111.3 after 12 weeks in Pilates group compared to the home exercise group. In this study, the improved value determined was −41.65 ± 50.06. These results, paralleled with literature, indicate that the Pilates exercise program have effect on quality of life in this study.

TABLE 3 Descriptive statistics of the changes obtained by subtracting the pretraining measurements from posttraining measurements

Categories of Changes after training	Pilates n = 29		Therapeutic n = 28		Control n = 35		
	Mean	SD	Mean	SD	Mean	SD	*P* value
Body Mass Index	0.38	1.74	0.13	1.86	−0.04	1.02	.541
Visual Analog Scale[a]	−1.88	2.88	-1.5	1.89	−0.04	1.17	.003
ODI	−0.13	0.51	-0.5	0.89	0.08	0.28	.791
Nottingham Health Profile[a]	−41.65	50.06	-79.07	59.90	3.67	27.31	.000
WHr	−0.01	0.04	0.05	0.03	−0.02	12.04	.396
Beck Depression Inventory[a]	−2.79	4.19	−7.00	5.16	0.44	2.09	.000

Abbreviations: ANOVA, analysis of variance; ODI, Oswestry Disability Index; SD, standard deviation; WHr, waist/hip ratio.
[a]One-way ANOVA test was used for comparison of three groups, change after the exercise.

Yamato et al[7] studied that the efficacy of Pilates on low back pain, and this demonstrated a significant improvement in disability. Rodríguez-Romero et al[16] studied this for young adults with a functional limitation. The subjects had a minimally functional limitation (ODI). The authors evaluated the effects of the Pilates exercise program (vs no treatment) on disability of young adults. There was no significant difference between the groups in terms of disability results.[16] According to Rodríguez-Romero et al,[16] the ODI values are sensitive to changes in levels of greater disability. No statistically improvement was found in functional status values.[16] These results are consistent with those of the present study. In our opinion, the results of most studies show that the Pilates exercise program reduces pain and improves general health. Importantly, an agreement on the duration, type, and intensity of the training needs to be achieved and there is no definite training program that may have the best effect in young adults. Therefore, more research is needed to determine the best duration and training program method to reduce and improve general healthy young adults.

The prevalence of major depression increases linearly from adolescents to the mid-20s. Particularly, initialization university education is a sensitive period in which young students have to compose, are tried, and have to fit to new psychological identities. When the studies included students' depression status, they found that the subjects had minimal depression status (BDI scores between 6 and 13).[18,26] These scores are like the present study. Moreover, there were no studies in the literature about the effect of Pilates on depression status in students. In most of the studies, depression status was assessed by emotional status as a subparameter of quality of life measurements, or participants had clinical disorders (fibromyalgia, obesity, and scoliosis). Ekici et al[27] demonstrated that 4 weeks of Pilates training in women with fibromyalgia improved depression status. Vancini et al[4] observed improvements in the levels of depression and anxiety after Pilates training in overweight/obese individuals. HwangBo[28] demonstrated that Pilates had a positive psychological effect on participants with scoliosis. The results of these studies are consistent with those of the present study.

In this study, the aim was the investigation of effects of Pilates on pain, depression status, functional status, and quality of life. As is known, these factors reflect an individual's daily life.[2] In fact, in this study, the effect of Pilates on the daily life of the participants was analyzed. However, although it was found that Pilates had a positive effect in this study, similar improvements were found in the therapeutic group as well. Moreover, there was no significant effect of both exercise approaches on functionality. Differences in intervention among studies may be the cause of this inconsistency of results. It can also be attributed to different methods of Pilates exercise program. According to literature, the Pilates exercise program may not have any effect on two factors that reflect the basic characteristics of joint motion, such as flexibility and proprioception (accuracy of joint-position sense or the threshold for detecting joint movement and coordination). This may be one reason why the effect of the Pilates exercise program is not clear in the individual's daily life.[2]

A limitation of this study is that all participants were students; hence, it might be difficult to generalize the study results to other individuals due to their age, area of residence, and other relevant factors. The psychological conditions and physical activities of the students who eat and maintain a nutritional diet are better than those who do not.[5] For this reason, the lack of questions regarding the nutritional status and physical activities of participants in the current study is seen as a limitation. The authors recommend that future studies in the field consider these limitations in their research design. Also, the self-reporting nature of the questionnaires is another limitation of the study.

According to Joseph Pilates, the method requires complete coordination of body, mind, and spirit, contributing to the development of good motor control and a consequent improvement in the musculoskeletal status.[1,2] If Pilates is related to coordination and mood, academic stress may affect exercise performance in students. University students were not questioned regarding their academic stress. According to the results of this study, another conclusion is that students experience academic stress, which leads to changes in their lifestyle, which also impacts their functionality, physiological status, quality of life, body composition, and pain status. There are many changes in the lifestyle of university students that affect musculoskeletal health such as normal and extended sedentary hours through lessons (sitting), curious training postures, and augmented use of digital tools in education.[10,11] In future studies, it may be

possible to investigate the effect of training on students in terms of academic stress and lifestyle changes (physical activity, etc).[29]

On the basis of findings of this study, the authors suggest that Pilates can effectively improve depression status, pain, and quality of life in university students. Moreover, because of academic stress and lifestyle changes (physical activity, etc), the effect of exercises on the students can be variable. It is hoped that the current study and its findings will inform researchers, clinicians, and future research studies in the field.

4.1 | Implications for nursing practice

Exercise should be encouraged to reduce pain and depression and improve the quality of life in university students. Both Pilates and therapeutic exercises approach can be preferred. The results of this study show the inability to identify clear different effect from therapeutic exercises on university students for Pilates exercises. A limitation of this study was not questioned regarding participants academic stress and physical activity. The data from this study may guide the improving and practice of similar evidence-based processes to help reduce depression, pain, and to increase quality of life in young adults.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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