## Original Research

# The Effect of Pilates Exercise on the Static Balance of Teenage Female Students

Atefeh Jorabian[1], Somayeh Joupari Nejad[2], Fatemeh Jafari[3], Niku Latifi[4], Mehran Shahraki[5]
Nafiseh Hekmatipour[6*]

1. Department of pediatric and neonatal nursing, school of nursing and midwifery, Isfahsn university of Medical Sciences, Isfahsn, Iran.
2. Senior expert in community health nursing, general ICU nurse of Shafa Hospital in Kerman University of Medical Sciences. Iran.
3. Department of Nursing, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran.
4. Master of Geriatric nursing, School of Nursing and Midwifery, Golestan University of Medical Sciences, Gorgan, Iran.
5. Department of Nursing Zahedan Branch, Islamic Azad University, Zahedan, Iran.
6. Department of Nursing, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran.

***Corresponding Author: Nafise Hekmatipour,** Department of Nursing, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran. Email: n-hekmatipour@aliabadiau.ac.ir. Orcid: 0000-0003-0961-6533.

**Abstract:**

**Background:**

Lack of balance is one of the side effects of inactivity during adolescence, which plays an important role in the physical health of people in adolescence and adulthood. Pilates as a new but low-cost exercise by strengthening the body, mind and muscle plays an important role in improving static balance. Therefore, this study was conducted with the aim of investigating the effect of Pilates exercise on the static balance of teenage female students.

**Methods:** This experimental study was conducted on 50 female students in Gorgan city. The students, who had been selected by simple random sampling method, were at the age range of 11-15 years and after selection were divided into two groups of intervention (Pilates) and control. Stork test was used to measure static balance before and after the intervention. In the Pilates group, 8 training sessions (30-45 minutes) were performed once a week for 8 weeks. The data was analyzed by descriptive statistics (table, mean, standard deviation) and inferential statistics (paired t-test, independent t-test and ANCOVA) at the significant level of 0.05.

**Results:** There was no significant difference in the static balance of the right and left legs between the two Pilates and control groups before the intervention. But after the intervention, a significant difference was observed in the static balance of the right and left legs between the two groups. ANCOVA test showed a significant difference by removing the effect of pre-test ($P < 0.01$, Eta=0.42).

**Conclusion**: Pilates exercise increased the static balance of female students. Therefore, community health nurses and instructors can use this modern and new exercise method, which can be implemented in limited facilities and space, to increase physical activity and static balance of female students.

**Keywords:** Pilates, Static Balance, Students, Girl, Teenager

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## Introduction

Adolescence is a transitional-developmental period between childhood and adulthood, and is considered as one of the most important periods of human's growth and development (1, 2).

Statistics show that the largest number of teenagers in the world belongs to the present era. Nearly half of the world's population is under the age of 25, and one fifth of the world's population is 10-19 years old (3). In Iran, there are 16 million 11-19 years old adolescents, which account for 27% of the entire population (1). Due to the changes in lifestyle and advances made in technology, lack of movement and physical activities is a major health concern all around the world, especially among teenagers (4, 5). According to the studies conducted in this area, more than 80% of the world's teenagers are not physically active (6). According to the report of the World Health Organization, the level of physical activity among teenagers is lower than the average standard (7, 8). Meanwhile, physical activities in adolescence improve physical and mental health in adulthood (9, 10). Since adolescence is a critical period for learning and undertaking regular physical activity, the effect of this learning can continue to adulthood (11). On the other hand, muscle weakness is one of the side effects of inactivity that causes movement disorders, skeletal muscle abnormalities and imbalance, especially in teenage girls (12, 13). This decrease in balance and impaired movement function causes back pain in adolescents and adults (14). For this reason, imbalance and movement disorders in the future are one of the common problems of teenage girls (15, 16). Thus, maintaining and strengthening static balance plays an important role in preventing movement disorders in adolescence (17). Maintaining static balance is also the main aim of movement and balance activities (18). Meanwhile, sports activities such as Pilates exercises reduce body fat, increase flexibility and endurance, and help to maintain balance in the body (19). Pilates exercise is one of the most effective traditional and functional exercises that are recommended to improve balance. The Pilates exercises activate and coordinate several muscle groups at the same time, and have a positive effect on the general flexibility and health by strengthening trunk muscles, improving body position and making coordination between breathing and body movements (20, 21). The Pilates exercises also harmonize the mind and body, and maintain balance in the body (13, 22). Since this training method emphasizes on the use of brain in muscle control, its purpose is to strengthen the muscles that help to maintain balance in the body (23). Also, the implementation of this exercise does not require special skills and equipment. This method can also be used for people with normal physical fitness (24, 25). Pilates exercise is a new training method in Iran that does not require a large space and advanced equipment (26). For this reason, the researchers in this study decided to investigate the effect of Pilates exercise on the static balance of teenage girls.

## Method

This experimental study was conducted in 2022 on 50 teenage girls aged 11-15 years in the city of Gorgan, Iran. The criteria for entering the study were; being a teenage female student, and having no chronic physical or mental illness based on the school health record. Exclusion criteria included not willing to participate or continue with the study by students or parents. The sample size of this study was calculated to be 50 people based on the study of Akhli et al. (2019) with an effect size of 0.70, test power of 80%, and confidence interval of 95% at the significant level of 0.05 (13). The researcher selected 50 samples from students who met the inclusion criteria by simple random method. Then, by random method (coin tossing), 25 students were allocated to the intervention

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(Pilates) group and 25 students to the control group. Stork test was used to measure static balance of the participants. The stork test is a fixed position in which, the subjects stand on a flat surface putting their hands on their hips. Then they place their non-support legs (superior leg) next to the knee of the supporting legs (non-superior leg). The time that the subject can maintain this position is considered as a score. When an error occurs, the timer stops. The errors of this test include; removing the hand from the hip, swinging the non-supporting leg in any direction, separating the non-supporting leg from the knee, and touching the ground with the heel of non-supporting leg (27, 28). In the intervention of group, 8 sessions (30-45 minutes) of Pilates exercise were performed once a week for 8 weeks under the supervision of a sport coach with expertise in Pilates exercises (Table 1). In the control group, routine school exercises were performed. At the end of the study, The Pilates exercise was performed for students in the control group who wished to receive the exercise. The information was collected and entered into SPSS-21 statistical software to be analyzed by descriptive statistics (table, average, standard deviation) and inferential statistics (paired t-test, independent t-test and ANOVA test) at a significance level of 0.05.

**Results**

Independent t-test showed no significant difference between the intervention and control group in terms of the students' age (P=0.49), weight (P=0.32), and height (P=0.49).

Independent t-test before the intervention showed no significant difference between the two groups in terms of the static balance of right leg (P=0.13) and left leg (P=0.26), (Table 1).However after the intervention, this test showed a significant difference between the two groups in terms of the static balance of right leg ($P < 0.01$) and left leg ($P < 0.01$), so that the static balance was higher in the Pilates group compared to the control group (Table 1). Also, the paired t-test showed no significant difference in the static balance of right leg (P=0.56) and left leg (P=0.61) of the control group before and after the intervention. But, it showed a significant difference in the static balance of right leg ($P < 0.01$) and left leg ($P < 0.01$) of the Pilates group before and after the intervention, so that the static balance in the Pilates group improved after the intervention.

ANOVA test by removing the effect of pre-test ($P < 0.01$, Eta=0.42) showed that 42% of static balance changes in the Pilates group could be explained by the Pilates exercise.

**Discussion**

The results of present study showed that Pilates exercise increased the static balance in the right and left legs of students.

Castro (2022) stated that Pilates exercise strengthens back muscles and helps to maintain body posture (24).

Kibar et al. (2018) conducted a study on the effect of Pilates exercise on the static and dynamic balance as well as the flexibility of hamstring and abdominal muscles. They showed that Pilates exercise has a positive effect on improving balance and strengthening abdominal and hamstring muscles (29).

Rahmani (2015) showed that Pilates exercise strengthens physical strength and increases balance (30).

Adıguzel (2022) argued that Pilates exercise strengthens walking and balance (23). Dunyapour (2013) revealed that Pilates exercise improves dynamic balance, and strengthens performance and walking (31).

Alizadeh et al. (2016) showed that after eight weeks of Pilates training, static balance of the participants improved significantly (32).

Tolnai (2016) conducted a study to examine the effect of Pilates exercise on skeletal muscle mass as well as flexibility, balance, and strength of trunk and abdominal muscles

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among healthy young women. This study showed that even one session of Pilates exercise per week can have positive effects on the muscle mass, balance and strength of abdominal and trunk muscles (33).

Khodashenas et al. (2015) showed that performing regular exercise increases dynamic and static balance in children (34). Kazemi (2019) stated that combined resistance exercises cause weight loss, decrease muscle mass and increase balance in the body (35).

Essar (2022) revealed that muscle resistance exercise strengthens the body's central muscles and improves the function of lower limbs by reducing muscle stiffness, which strengthen the balance and stability of the body (36, 37).

As a simple, low-cost and effective exercise method, Pilates exercise improves dynamic balance and flexibility, and also increases bone density and quality of life (26). Pilates, as a regular exercise method, regulates neurotransmitter neurons, stimulates and releases calcium and accelerates the production of dopamine and acetylcholine. It also plays an important role in increasing balance and promoting mental health (26).

Based on studies conducted in this area, it can be said that exercise plays an important role in improving health and quality of life (5). Exercise is a safe, low-cost and complication-free method to improve mental health (38, 39). One of the limitations of this research was its concurrency with the Covid-19 pandemic that caused many problems in implementing group exercises. We overcame this problem by holding the training sessions in groups of 3 to 4 people and complying with the recommended health protocols.

## Conclusion

The results of present study showed that Pilates exercise increased static balance in teenage female students. Pilates exercise strengthens body muscles and helps to maintain balance by coordinating body and mind. The use of this exercise method is recommended as it requires a limited space and equipment. We also recommend this low-cost and effective method to be implemented as a physical activity at schools.

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## Conflict of interest

There was no conflict of interest in this study.

## Reference

1.ehsanian e, hojjati h. The relationship between religious orientation and self-actualization in ۱۲-۱۸-year-old. jpenir. ۲۰۱۷;۴(۱):.۳۰-۵

2.Sadeghloo A, Shamsaee P, Hesari E, Akhondzadeh G, Hojjati H. The effect of positive thinking training on the quality of life of parents of adolescent with thalassemia. Int J Adolesc Med Health. ۲۰۱۹;.(۳)۳۴

3.SHahhosayni ZS, M; Ramezankhani,A. Social Needs of Social Girls: Explaining the Role and Importance of the Family. Monitoring Journal. ۱۳۹۱;۱۱(۳):.۳۵۱-۹

4.Moradi G, Mostafavi F, Piroozi B, Zareie B, Mahboobi M, Rasouli MA. The prevalence of physical inactivity in Iranian adolescents and the impact of economic and social inequalities on it: results of a National Study in ۲۰۱۸. BMC Public Health. ۲۰۲۰;۲۰(۱):.۱۴۹۹

5.Hekmati pour N, Hojjati H, Farhadi S, Sharifnia SH, Manouchehr B, Kouchaki G, et al. Effect of a regular exercise program on self-consistency and life satisfaction among

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elderly in Gorgan and Gonbad (۲۰۱۱). ilam-ijgn. ۲۰۱۴;۱(۱):.۷۳-۸۲

6.Soleiman Ahari Z, Asadpour M, Mazar L, Nasirzadeh M. Evaluation of Physical Activity and its Effective Factors in Junior High School Female Students in Rafsanjan City: Application of Social-cognitive Theory, ۲۰۱۷-۱۸. muq-journal. ۲۰۲۱;۱۵(۳):.۱۸۸-۹۷

7.Alasqah I, Mahmud I, East L, Alqarawi N, Usher K. Physical inactivity and its predictors among adolescents in Saudi Arabia: A cross-sectional comparison between cities with and without a Healthy Cities Program. Saudi Med J. ۲۰۲۱;۴۲(۸):.۸۸۶-۹۴

8.Parker K, Timperio A, Salmon J, Villanueva K, Brown H, Esteban-Cornejo I, et al. Activity-related typologies and longitudinal change in physical activity and sedentary time in children and adolescents: The UP&DOWN Study. Journal of sport and health science. ۲۰۲۱;۱۰(۴):.۴۴۷-۵۳

9.Akbarpour Beni M, Aghajani Z. Comparison of the effect of TRX and traditional resistance training on serum levels of some liver enzymes in inactive women. Journal of Sport and Exercise Physiology. ۲۰۲۲;۱۵(۲):.۲۰-۸

10.Codella R, Terruzzi I, Luzi L. Sugars, exercise and health. J Affect Disord. ۲۰۱۷;.۲۲۴:۷۶-۸۶

11.Haible S, Volk C, Demetriou Y, Höner O, Thiel A, Sudeck G. Physical activity-related health competence, physical activity, and physical fitness: analysis of control competence for the self-directed exercise of adolescents. International journal of environmental research and public health. ۲۰۲۰;۱۷(۱):.۳۹

12.Karimizadeh Ardakani M, Mansori MH, Hamzeh shalamzari MH. Investigating the Relationship between Core Muscle Endurance with Movement Function and Postural Control in Blind People. The Scientific Journal of Rehabilitation Medicine. ۲۰۲۰;۹(۲):.۱۴۸-۵۷

13.Okhli H, Hojjati H, Akhoundzadeh G. Comparing the Effect of the Corrective Exercises of America's National Academy of Sports Medicine and Pilates on the Correction of Lordosis among Female High School Students in Golestan Province in ۲۰۱۸. International Journal of School Health. ۲۰۱۹;۶(۴):.۱-۶

14.dehghani e, ghasemi g. Effects of eight week of Dynamic Neuromuscular Stabilization exercises on posture, strength and trunk endurance in educable mentally retarded students. Studies in Sport Medicine. ۲۰۲۱;۱۳(۲۹):.۲۲۹-۵۲

15.Oyibo I, Oyibo PG, Osie-Efetie B. Prevalence and Predictors of Hypocalcaemia among Adolescent Girls in Rural Public Secondary Schools in South-South Nigeria. Ethiop J Health Sci. ۲۰۲۱;۳۱(۶):.۱۱۸۵-۹۲

16.Brodsky JR, Lipson S, Bhattacharyya N. Prevalence of Pediatric Dizziness and Imbalance in the United States. Otolaryngol Head Neck Surg. ۲۰۲۰;۱۶۲(۲):.۲۴۱-۷

17.Gribble PA, Hertel J, Denegar CR, Buckley WE. The effects of fatigue and chronic ankle instability on dynamic postural control. Journal of athletic training. ۲۰۰۴;۳۹(۴):.۳۲۱

18.Shadkanlu Ostad M, Norasteh AA, Babagoltabar Samakoush H. Comparison of Static and Dynamic Balance of Athletes of Different Sports in Conditions With and Without Posture Disturbances. iauh-biomech. ۲۰۱۹;۴(۴):.۱۶-۲۷

19.Ebrahimi Z. Effects of Pilates exercise on body image, body composition and body fat percentage in sedentary women. Sports Psychology. ۲۰۱۸;۳(۲):.۱۵-۲۸

20.Atashin Panjeh L, Bagherpour T, MohammadEbrahim B, editors. Comparison of eight weeks of Pilates and power exercises on dynamic balance in

[ Downloaded from intjmi.com on 2026-11-17 ]

elderly women of Dezful city. ۱st International Conference on Sportd Science; .۲۰۱۵

21.Hatami F, Hojjati H, Mirbehbahani N. The Effect of ROY Compatibility Model on Care Resiliency in Mothers of Children Treated with Chemotherapy. ijpn. ۲۰۱۸;۶(۵):.۶۴-۷۰

22.Zuo C, Li Q, Zhang L, Bo S. Effects of ۶-Week Traditional and Functional Resistance Training on Arterial Stiffness and Muscular Strength in Healthy Young Men. Front Physiol. ۲۰۲۲;.۱۳:۸۵۹۴۰۲

23.Adıguzel H, Elbasan B. Effects of modified pilates on trunk, postural control, gait and balance in children with cerebral palsy: a single-blinded randomized controlled study. Acta Neurol Belg. .۲۰۲۲

24.Castro JB, Lima VP, Mello DB, Lopes GC, Peixoto JC, Santos AOD, et al. Effects of Pilates with and without elastic resistance on health variables in postmenopausal women with low back pain. Pain Manag. .۵۰۹-۲۰:(۴)۱۲;۲۰۲۲

25.Khalili M, Golpaygani M, Shahrjerdi S. The effect of eight weeks Pilates training on pain and quality of life in men with Rheumatoid arthitis. Journal for Research in Sport Rehabilitation. ۲۰۱۵;۲(۴):.۴۱-۵۲

26.Kamali A, Mahdavi nezhad R, Norouzi K. The Effect of Selected Pilates Exercises on Thigh Muscle Strength and Depression in Elderly Women. Journal of Paramedical Sciences & Rehabilitation. ۲۰۱۶;۵(۲):۶۷-.۷۵

27.Sedaghati P, Saki F, Sarlak P. The Impact of Specific Core Stability Training on the Sports Performance of Teenage Competitive Swimmers. RUMS_ JOURNAL. ۲۰۱۸;۱۷(۴):.۳۰۵-۱۸

28.Aradmehr M, Sagheeslami A, Ilbeigi S. The effect of balance training and pilates on static and functional balance of elderly men. FEYZ. ۲۰۱۵;۱۸(۶):.۵۷۱-۷

29.Kibar S, Yardimci FO, Evcik D, Ay S, Alhan A, Manco M, et al. Can a pilates exercise program be effective on balance, flexibility and muscle endurance? A randomized controlled trial. The Journal of sports medicine and physical fitness. ۲۰۱۶;۵۶( ۱۱۳۹-۴۶:(۱۰PMID: ۲۶۴۷۳۴۴۳

30.Rahmani M, Heirani A, Yazdanbakhsh K. The effect of Pilates training on improving the reaction time and balance of sedentary elderly men. mrj. ۲۰۱۵;۹(۳):.۴۴-۵۳

31.Donyapour H, Mohammadzade H, Abedini M, Rezaye S, Safari H. The impacts of Pilates trainings on improvements of dynamic balance and gait performance in elderly men with falling background. The Scientific Journal of Rehabilitation Medicine. ۲۰۱۳;۲(۳):.۱۱-۸

32.Alizadeh SI, KH. Taheri,M. The effect of ۸-weeks Pilates training on static and dynamic balance of athletes with chronic back injuries. Journal for Research in Sport Rehabilitation. ۲۰۱۶;۴(۸):۷۵-۸۳. https://DIO.org/۱۰/۲۲۰۸۴/rsr.۲۰۱۷/۹۱۵۸/۱ .۱۹۵

33.Tolnai N, Szabo Z, Koteles F, Szabo A. Physical and psychological benefits of once-a-week Pilates exercises in young sedentary women: A ۱۰-week longitudinal study. Physiology & behavior. ۲۰۱۶; ۱۶۳:۲۱۱-۸ http://doi/۱۰/۱۰۱۶/j.physbeh. ۲۰۱۶/۰۵/۰۲۵ PMID: .۲۷۱۹۵۴۵۶

34.Khodashenas E, Moradi H, Asadi Ghaleni M, Heydari E, Shams A, Enayati A, et al. The effect of selective training program on the static and dynamic balance of Deaf Children. medical journal of mashhad university of medical sciences. ۲۰۱۷;۶۰(۱):.۳۸۳-۹۱

35. Kazemi A, Mahalati S. Effects of ۱۰-Week Concurrent Training on Insulin Resistance and the Serum Levels of Vaspin and Visfatin in Overweight Females. QHMS. ۲۰۱۹;۲۵(۳):.۱۴۶-۵۷

36. Assar S, Gandomi F, Mozafari M, Sohaili F. The effect of Total resistance exercise vs. aquatic training on self-reported

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knee instability, pain, and stiffness in women with knee osteoarthritis: a randomized controlled trial. BMC Sports Sci Med Rehabil. ۲۰۲۰;.۱۲:۲۷

37. Jafari F, sarkoohi Z, Ebrahimpour Roodposhti M, Firoozi F, seifi z, Hekmatipour N. The Effect of Muscular Resistance Exercise on The Dynamic Balance of Female Students Aged ۱۲-۱۵ Years NeuroQuantology ۲۰۲۲;۲۰(۶):۷۰۹۹-.۱۰۵
38. Hekmati Pour N, Hojjati H. Effects of Exercise on Mental Health of Elderly. gums-hnmj. ۲۰۱۶;۲۶(۴):.۳۶-۴۲
39. Mohammad Gholinejad P, Hojjati H, Ghorbani S. The Effect of Aerobic Exercise on Body Composition and Muscle Strength of Female Students at Elementary Schools of Ali Abad Katoul in ۲۰۱۸. International Journal of School Health. ۲۰۱۹;۶(۴):.۲۷-۳۳
40. Mehrangiz Ghabimi, Fatemeh Mahdavipour, Maryam Zarei, Raziye Mazroei, Maryam Kamali, Aminreza Askarpour, & Hamid hojjati. (2022). The Effect of Implementing Pain Control Guidelines on the Pain of Patients Admitted to the Intensive Care Unit. *Journal of Pharmaceutical Negative Results*, 344–348. Retrieved from https://www.pnrjournal.com/index.php/home/article/view/1840

**Table**

**Table 1: Comparison of the static balance of the samples in the Pilates and control groups before and after the intervention**

| Time / Variable | Before the intervention | | After the intervention | |
|---|---|---|---|---|
| | **Right leg** | **Left leg** | **Right leg** | **Left leg** |
| Control | 13.04 ± 3.18 | 12.72 ± 2.15 | 12.36 ± 2.46 | 13.01 ± 1.93 |
| Pilates | 14.56 ± 3.37 | 13.41 ± 2.1 | 16.12 ± 2.89 | 16.66 ± 2.41 |
| P-value | P=0.13 | P=0.26 | P<0.01 | P<0.01 |

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