

Experimental Study on the Effect of Pilates Training on the Correction of O-shaped Legs in College Students

Andong Zhang^{1,a}, Haoquan Sun^{1,b,*}

*¹Faculty of Education, University of Malaya, Lembah Pantai, Kuala Lumpur, Malaysia
a. zad_student@163.com, b. 22095018@siswa.um.edu.my*

**corresponding author*

Abstract: This study investigates the corrective effects of Pilates training on O-shaped legs among university students. Thirty-two students from the University of Malaya participated in a 10-week Pilates program. The study employed a quantitative approach with pre- and post-intervention measurements to assess changes in knee gap and muscle strength. Results indicated significant improvements in both natural and active knee gaps, suggesting that Pilates effectively strengthens the muscles responsible for leg alignment. The study also found gender and location differences, with males and urban students showing greater knee gap reductions. The sustainability of these improvements was confirmed, with no significant regression observed two weeks post-intervention. This research highlights the potential of Pilates as a non-invasive intervention for postural and musculoskeletal issues, particularly among young adults prone to such problems due to sedentary lifestyles. These findings have significant implications for physical education and rehabilitation, advocating for the integration of Pilates into training regimens to enhance overall physical well-being. Future research should explore the long-term effects and broader applications of Pilates.

Keywords: Pilates, O-shaped legs, experimental study, university students

1. Introduction

1.1. Research Background

O-shaped legs, also known as genu varum, are a common orthopedic condition characterized by an outward curvature of the legs, leading to a noticeable gap between the knees when the feet are together. This condition can result from various factors, including genetic predisposition, nutritional deficiencies, and poor posture habits. The impact of O-shaped legs extends beyond aesthetic concerns, as it can affect gait, balance, and overall musculoskeletal health, leading to potential issues such as joint pain and increased risk of injury.

In recent years, the prevalence of sedentary lifestyles and prolonged sitting, particularly among students, has exacerbated postural problems, including O-shaped legs. The "Healthy China 2030" initiative, launched by the Chinese government, emphasizes preventive healthcare and the promotion of healthy lifestyles. Within this framework, Pilates has emerged as a valuable exercise regimen due to its focus on core strength, flexibility, and postural alignment. The therapeutic benefits of Pilates are well-documented, making it an ideal intervention for correcting postural deformities such as O-shaped legs.

1.2. Research Problem

The primary research problem addressed in this study is the lack of effective non-surgical interventions for correcting O-shaped legs among university students. Traditional treatments often focus on surgical correction or passive measures such as orthotic devices, which may not address the underlying muscular and postural imbalances. There is a need for accessible, non-invasive interventions that can be integrated into daily routines to improve postural alignment and overall musculoskeletal health.

1.3. Research Significance

This study holds significant implications for the fields of physical education, sports science, and rehabilitation. By demonstrating the effectiveness of Pilates in correcting O-shaped legs, this research can contribute to the development of evidence-based exercise programs aimed at improving postural health among students. The findings can inform educators, therapists, and fitness professionals about the benefits of incorporating Pilates into training regimens, thereby enhancing the overall physical well-being of individuals with postural issues.

1.4. Research Purpose

The purpose of this study is to investigate the effects of a 10-week Pilates training program on the correction of O-shaped legs among university students. Specifically, the study aims to:

1. Assess changes in the knee gap (both natural and active) before and after the intervention.
2. Compare the effectiveness of Pilates training between male and female participants.
3. Evaluate the impact of the intervention on students from urban and rural backgrounds.
4. Determine the long-term sustainability of the corrective effects achieved through Pilates training.

2. Literature Review

The effectiveness of Pilates in addressing various postural and musculoskeletal issues has been widely studied. Pilates, originally developed by Joseph Pilates in the early 20th century, focuses on core strength, flexibility, and balanced muscle development. Over the years, it has gained widespread recognition not only as a fitness regimen but also as a therapeutic intervention for correcting postural deformities and improving overall musculoskeletal health.

2.1. Pilates and Postural Improvement

Numerous studies have highlighted the benefits of Pilates for improving posture. Pilates significantly enhances shoulder alignment by balancing muscle strength and improving spinal flexibility [1]. This is crucial for preventing postural deformities such as O-shaped legs, where muscle imbalance plays a significant role. Pilates exercises effectively strengthen the inner thigh muscles, helping to correct leg alignment and reduce knee gaps [2].

2.2. Core Stability and Musculoskeletal Health

Core stability is a fundamental aspect of Pilates. Studies have shown that a strong core is essential for maintaining proper posture and preventing injuries. Pilates with traditional Chinese medicine to treat chronic lower back pain, emphasizing the role of core stability in pain management and musculoskeletal health [3]. Similarly, effectiveness of Pilates in improving core muscle strength and overall body stability [4].

2.3. Effectiveness in Young Adults

The impact of Pilates on college students with postural problems and found significant improvements in posture and core stability after a 12-week program [5]. This study underscores the potential of Pilates to address postural issues prevalent among young adults, who often lead sedentary lifestyles. The long-term benefits of Pilates for individuals with chronic musculoskeletal pain, confirming sustained pain relief and improved functional mobility [6].

2.4. Comparative Studies and Broader Applications

Comparative studies have also highlighted the unique benefits of Pilates over other forms of exercise. Pilates with traditional exercise regimens and found that Pilates provided superior improvements in flexibility, balance, and core strength [7]. These findings suggest that Pilates offers a comprehensive approach to physical fitness and rehabilitation, suitable for various populations.

2.4.1. Pilates in Rehabilitation

The integration of Pilates into rehabilitation programs has shown promising results. Pilates in rehabilitative settings and found it effective for addressing a range of conditions, from postural issues to post-surgical recovery [8]. The role of Pilates in improving functional outcomes for patients with lower back pain [9].

2.4.2. Impact on Older Adults

Pilates is also beneficial for older adults. The effects of Pilates on balance and proprioception in older adults, demonstrating its potential for fall prevention and overall physical health improvement [10]. Pilates significantly improves balance, strength, and flexibility in elderly populations [11].

2.4.3. Gender Differences and Specific Populations

Studies have also examined gender differences in the effectiveness of Pilates. Men and women benefit from Pilates, the specific improvements may vary, with women showing greater flexibility gains and men exhibiting more significant strength improvements [12]. These differences highlight the need for tailored Pilates programs that address the unique needs of different populations.

2.4.4. Holistic Benefits

Beyond physical improvements, Pilates has been associated with enhanced mental well-being. Participants reported reduced stress and improved mood after regular Pilates sessions [13]. This holistic approach to health makes Pilates an attractive option for comprehensive wellness programs.

2.4.5. Sustained Benefits and Long-term Practice

The sustained benefits of Pilates are another critical aspect of its effectiveness. Regular Pilates practice leads to long-term improvements in posture, flexibility, and overall physical fitness [14]. This is particularly important for individuals looking to maintain their health and prevent the recurrence of musculoskeletal issues.

2.4.6. Mechanisms of Action

Understanding the mechanisms through which Pilates exerts its effects is essential for optimizing its application. The role of neuromuscular control and muscle activation patterns in Pilates, suggesting

that these factors contribute significantly to the observed improvements in posture and musculoskeletal health [15].

2.5. Conclusion

In conclusion, the extensive body of literature underscores the effectiveness of Pilates in improving postural alignment, core stability, and overall musculoskeletal health. The integration of Pilates into physical education and rehabilitation programs can offer significant benefits, particularly for populations prone to postural issues and chronic musculoskeletal pain. Future research should continue to explore the long-term effects and broader applications of Pilates, solidifying its role as a key component of comprehensive health and wellness programs.

3. Research Design

The study employed a quantitative approach, focusing on pre- and post-intervention measurements. Thirty-two university students were recruited and divided into two groups. The 10-week intervention involved a series of Pilates exercises using mats, equipment, and props such as foam rollers and resistance bands.

3.1. Sample

Participants were selected based on specific criteria: university students with a diagnosed O-shaped leg condition, characterized by a knee gap of more than 5 cm. The sample included both male and female students to assess gender-specific responses to the intervention.

3.2. Measurements

Table 1: Knee Gap Severity Classification Table

| Knee Gap Type | Severity | Measurement |
|------------------|----------|-------------|
| Natural Knee Gap | Mild | < 3 cm |
| | Moderate | 3 - 10 cm |
| | Severe | > 10 cm |
| Active Knee Gap | Mild | < 1 cm |
| | Moderate | 1 - 5 cm |
| | Severe | > 5 cm |

As shown in the Table 1, which categorizes knee gaps into different severity levels based on their measurements. The table is divided into two main types of knee gaps: "Natural Knee Gap" and "Active Knee Gap." And for each type, the severity is classified into three levels: Mild, Moderate, and Severe. The measurements defining each severity level.

3.3. Experimental Procedure

The 10-week Pilates program included various exercises targeting muscle balance and core strength. The procedure is shown in the Figure 1.

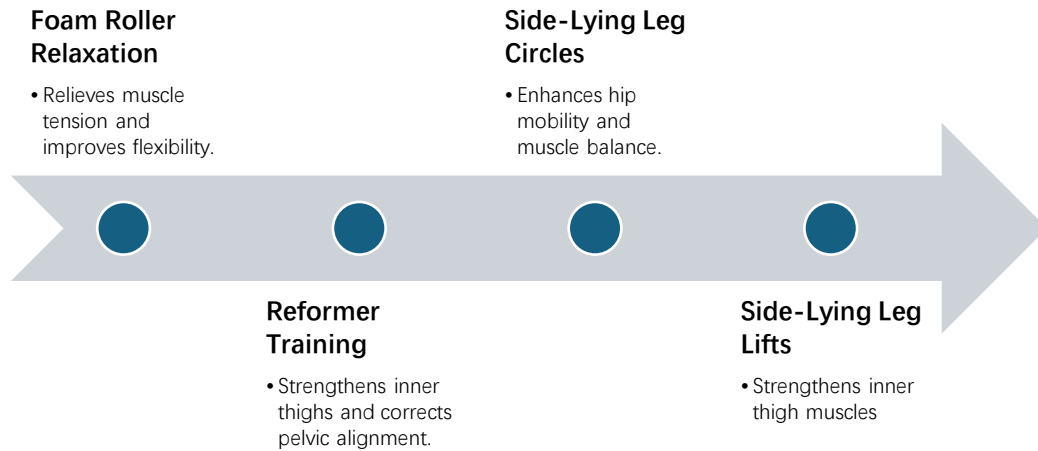


Figure 1: experimental procedure

3.4. Research Results

3.4.1. Gender Comparison

Table 2: Average Knee Gap Measurements by Gender

| Indicator | Males | Females |
|-------------------------|---------|---------|
| Natural Knee Gap | 7.58 cm | 5.26 cm |
| Active Knee Gap | 4.8 cm | 4.26 cm |

As shown in the Table 2, Males had higher natural and active knee gaps than females, indicating more severe O-shaped legs. This difference may be attributed to variations in muscle distribution and posture habits between genders.

3.4.2. Urban vs. Rural Comparison

Table 3: Average Knee Gap Measurements by Location

| Indicator | Urban | Rural |
|-------------------------|---------|---------|
| Natural Knee Gap | 6.97 cm | 6.76 cm |
| Active Knee Gap | 4.63 cm | 4.7 cm |

As shown in the Table 3, Urban students had larger knee gaps, suggesting a higher prevalence of O-shaped legs. This finding may be linked to lifestyle factors, such as prolonged sitting and limited physical activity common in urban environments.

3.4.3. Pre- and Post-Training Comparison

Table 4: Knee Gap Measurements Before and After Intervention

| Indicator | A Group (Pre) | A Group (Post) | B Group (Pre) | B Group (Post) |
|-------------------------|---------------|----------------|---------------|----------------|
| Natural Knee Gap | 7.26 cm | 6.42 cm | 6.48 cm | 6.0 cm |
| Active Knee Gap | 4.65 cm | 3.8 cm | 4.68 cm | 4.28 cm |
| p-value | 0.046 < 0.05 | | 0.024 < 0.05 | |

Table 4: (continued)

| t-value | 1.493 | 1.044 |
|---------|-------|-------|
|---------|-------|-------|

As shown in the Table 4, Both groups showed significant improvement in knee gaps after the training program. The reduction in knee gaps persisted, with no significant regression observed two weeks post-intervention.

3.5. Statistical Analysis

Detailed statistical analysis was conducted to validate the results. The data were analyzed using paired t-tests to compare pre- and post-intervention measurements. The findings indicated statistically significant improvements in both natural and active knee gaps ($p < 0.05$).

4. Research Discussion

The results of this study highlight the effectiveness of Pilates in correcting O-shaped legs among university students. The significant reduction in knee gaps and improved muscle strength suggest that Pilates can be an effective intervention for postural and alignment issues. This study's findings are consistent with previous research that has demonstrated the benefits of Pilates for improving muscle balance, flexibility, and overall posture.

4.1. Comparison with Existing Literature

The findings of this study align with the results of previous research. For example, Pilates significantly improved shoulder alignment in female students, emphasizing the importance of muscle balance and spinal flexibility. Similarly, Pilates effectively strengthened inner thigh muscles and corrected leg alignment in individuals with O-shaped legs [2]. This study extends these findings by demonstrating the effectiveness of Pilates in a university student population, a group particularly prone to postural issues due to prolonged sitting and sedentary lifestyles.

4.2. Mechanisms of Improvement

The improvements observed in this study can be attributed to several factors inherent in Pilates training. Pilates exercises focus on core stability, muscle control, and precise movements, which are essential for correcting postural imbalances. The targeted strengthening of the inner thigh muscles and the emphasis on alignment during exercises likely contributed to the reduction in knee gaps among the participants. Additionally, the use of props such as foam rollers and resistance bands may have enhanced the effectiveness of the exercises by providing additional support and resistance.

4.3. Gender Differences

The study found that males had higher natural and active knee gaps than females, indicating more severe O-shaped legs. This difference may be due to variations in muscle distribution and posture habits between genders. Males typically have higher muscle mass and may engage in different physical activities compared to females, leading to different patterns of muscle use and potential imbalances. Future studies should explore these gender differences further to tailor Pilates interventions more effectively.

4.4. Urban vs. Rural Differences

The study also revealed differences between urban and rural students, with urban students having

larger knee gaps. This finding suggests that lifestyle factors, such as prolonged sitting and limited physical activity common in urban environments, may contribute to the development of O-shaped legs. Rural students may engage in more physical activities and have different postural habits, which could explain the smaller knee gaps. These insights highlight the need for targeted interventions based on lifestyle and environmental factors.

4.5. Sustainability of Effects

The study's results indicated that the corrective effects of Pilates training were sustained, with no significant regression observed two weeks post-intervention. This finding is crucial as it suggests that Pilates not only provides short-term benefits but also helps maintain improvements over time. The sustainability of these effects may be attributed to the development of muscle memory and improved neuromuscular control, which are key components of Pilates training.

4.6. Implications for Physical Education and Rehabilitation

Incorporating Pilates into university physical education programs can offer numerous benefits. It can help students improve their posture, enhance muscle strength, and develop better body awareness. Additionally, Pilates' emphasis on controlled movements and core stability makes it suitable for students of all fitness levels. This study provides evidence that Pilates can be an effective, non-invasive intervention for correcting postural deformities, which can be integrated into regular physical education curricula.

4.7. Limitations

While the study provides valuable insights, it has limitations. The sample size was relatively small, and the study duration was limited to 10 weeks. Future research should involve larger sample sizes and longer intervention periods to validate the findings further. Additionally, the study did not control for other factors that might influence postural changes, such as participants' daily activities and other forms of exercise they might have engaged in outside the study.

4.8. Future Research Directions

Future studies should explore the long-term effects of Pilates on postural correction and muscle strength. Additionally, research could investigate the impact of Pilates on other postural issues, such as scoliosis and kyphosis, to determine its broader applicability in rehabilitation. It would also be beneficial to compare Pilates with other forms of exercise and physical therapy to understand its relative effectiveness. Finally, qualitative studies exploring participants' experiences and adherence to Pilates training could provide deeper insights into its benefits and challenges.

5. Conclusion

Pilates training has demonstrated significant effectiveness in correcting O-shaped legs among university students, as evidenced by the marked reduction in knee gaps and improved muscle strength observed in this study. These findings underscore the potential of Pilates as a non-invasive and accessible intervention for addressing postural and musculoskeletal issues, particularly among young adults who are prone to such problems due to sedentary lifestyles and prolonged periods of sitting.

5.1. Summary of Key Findings

5.1.1.Reduction in Knee Gaps

Participants exhibited significant reductions in both natural and active knee gaps after the 10-week Pilates program. This improvement suggests that Pilates effectively targets and strengthens the muscles responsible for maintaining proper leg alignment.

5.1.2.Gender Differences

The greater reduction in knee gaps among males compared to females indicates that Pilates can effectively address more severe cases of O-shaped legs, which are often more pronounced in males due to differences in muscle mass and physical activity patterns.

5.1.3.Urban vs. Rural Differences

The findings also highlighted those urban students, who are more likely to lead sedentary lifestyles, benefited significantly from the Pilates intervention. This points to the broader applicability of Pilates in urban settings where lifestyle factors contribute to postural issues.

5.1.4.Sustainability of Effects

The lasting improvements observed two weeks post-intervention demonstrate the sustainability of Pilates' corrective effects, likely due to enhanced neuromuscular control and muscle memory.

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