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THE IMPACT OF MYOFASCIAL RELEASE ON MIDDLE SCHOOL STUDENTS' SIT-AND-REACH PERFORMANCE: A RANDOMIZED CONTROLLED TRIAL

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Abstract

This study explores the relationship between Sit-and-Reach performance among Chinese adolescents and myofascial release, making a significant contribution to the field of sports science. Given the central role of student physical health in school physical education and Sit-and-Reach as a crucial indicator of adolescent flexibility, the results of this study hold broad practical and theoretical implications. 62 students from Xianlin Middle School in Hangzhou participated in a controlled group experiment, meticulously designed to record data across 8 experimental conditions. Utilizing SPSS software, we conducted ANOVA statistical analyses and post-hoc comparisons among IG1, IG2, IG3, IG4, IG5, IG6, CG1, and CG2 to ensure the reliability of our conclusions. Significant differences in student performance were observed under IG1, IG2, and IG3 conditions due to different measurement methods. Notably, the inter-group difference was most significant in Technique 1 ($p < .001$), followed by Technique 3 ($p = .028$), with Technique 2 showing the highest level of significance ($p = .055$). This provides scientific basis for selecting methods in physical assessments, aiding more accurate evaluations of student flexibility. The difference in performance between warm-up and non-warm-up groups was significant ($p = .019$), highlighting the positive impact of warm-up on Sit-and-Reach performance. This finding emphasizes the crucial role of warm-up in enhancing Sit-and-Reach scores, underscoring the importance of warm-up routines. IG4, IG5, and IG6 compared to CG2 all showed highly significant differences ($p < .01$), indicating that different warm-up techniques significantly influence Sit-and-Reach performance. This discovery not only provides new strategies for physical education and training but also supports personalized teaching approaches. The findings of this study are highly innovative and applicable in the field of sports science. By integrating myofascial release techniques, we can effectively enhance Sit-and-Reach performance among students, thereby improving their flexibility. This achievement not only enhances the physical health of

secondary school students but also enhances their performance in sports competitions. Therefore, we recommend that physical education professionals and coaches actively incorporate myofascial release techniques into their teaching and training practices to promote comprehensive development of students' physical fitness.

Key Words: Myofascial release; Flexibility; Middle school students; Sit-and-reach

INTRODUCTION

In 2002, China implemented the "National Student Physical Health Standard" comprehensively, assigning schools the fundamental tasks of promoting student health and enhancing physical fitness. Consequently, the physical health level of students is now a key indicator of the quality of physical education in schools (China, 2022).

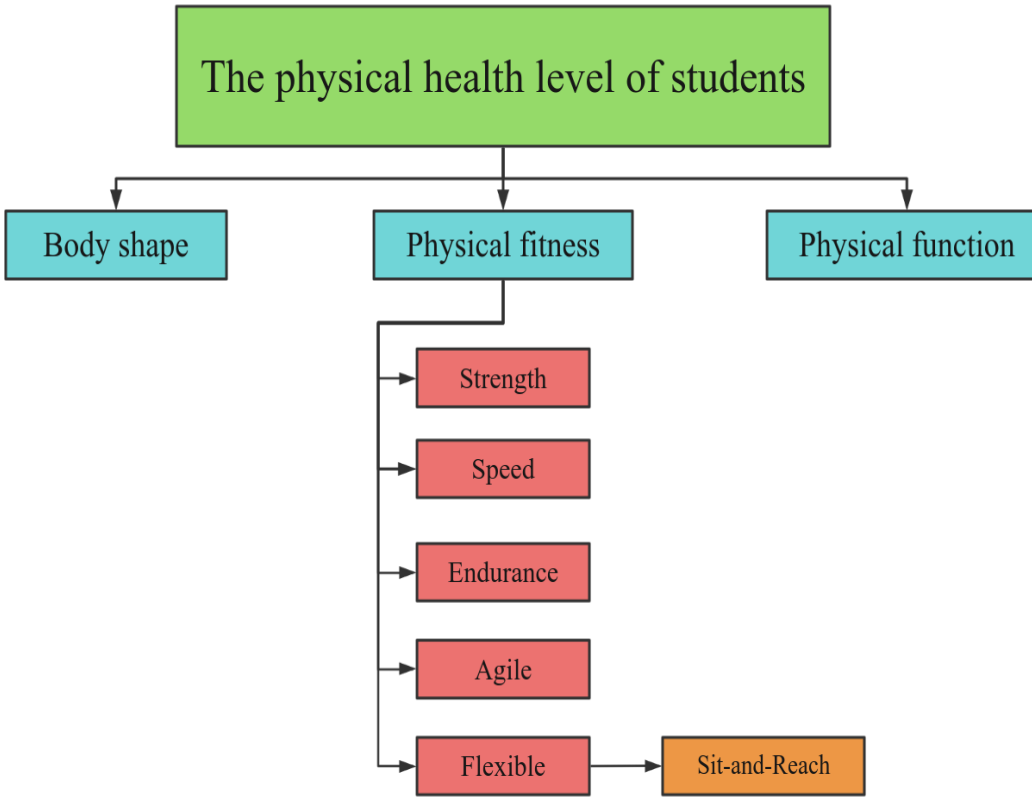

Fig. 1. Brief content of student physical health level

Within the dimension of physical fitness, the development of strength, speed, endurance, flexibility, and agility involves distinct training and assessment methods. Among these, the sit-and-reach test is a primary means of measuring and evaluating middle school students' flexibility and sit-and-reach performance. This test aims to improve joint flexibility and body coordination, thereby promoting physical fitness. (As shown in Fig. 1) Research indicates that there is a negative correlation between lower limb length and sit-and-reach performance, though this correlation is not significantly positive with other variables. This suggests that the negative correlation between lower limb length and sit-and-reach performance has some reference value (Gao & Li, 2021).

Improving students' sit-and-reach performance and developing their body flexibility through targeted exercises is a challenge faced by every physical education teacher. This study aims to bridge the gap in knowledge and practical application regarding myofascial release and flexibility in middle school students. Some scholars believe that functional movement training can enhance sit-and-reach performance, though the experimental period tends to be lengthy (Chan, 2020). Others suggest that diversified stretching exercises can enhance sit-and-reach performance (Yu, 2020). Therefore, this paper aims to explore the impact of myofascial release on enhancing sit-and-reach performance.

Firstly, based on theory. Therapists Rolf and Thomas Myers, in their book "Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists," proposed that muscles do not operate independently but are part of a holistic network of fascia that runs throughout the body. They identified and summarized seven main myofascial meridians and several key points, noting a remarkable correspondence between these meridians and the pathways of traditional Chinese medicine. If a problem occurs in one area, it affects other parts, eliciting corresponding reactions (Myers, Guan, Zhou, & Weng, 2015). This concept drew considerable attention in the fields of physical therapy and medicine (Chen, 2018).

Secondly, based on practice. While more research on myofascial release has been conducted in medicine, its application in sports, particularly in enhancing flexibility, has been relatively limited. In gymnastics, a sport that demands high flexibility, a survey revealed that Chinese rhythmic gymnastics coaches predominantly use stretching methods that combine dynamic, static, and dynamic-static stretching. However, these methods are largely experience-based, with little application to other sports. Globally, mainstream methods for flexibility training include PNF stretching, equipment-assisted stretching, thermal effect training, dynamic range of motion exercises, vibration stimulation, and mental imagery-assisted training, among others (Lv, 2010). Among these, PNF stretching is notably effective, producing significant improvements in flexibility with minimal pain over a short period. Experiments have shown that traditional stretching methods combined with "massage + PNF" stretching produce significant differences in joint flexibility, essentially applying myofascial release techniques (Hou, Shi, Zhang, & Luo, 2019; Ma, 2021; Wang, 2022).

When myofascial tissues are in an abnormal state, they can restrict joint movement and cause varying degrees of movement disorders. Myofascial release techniques, including the use of foam rollers, massagers, and massage balls, can reduce fascial adhesions, expand the range of motion, activate flexibility and joint mobility, and improve flexibility to a certain extent, though not indefinitely. These methods can also alleviate pain, although the effectiveness varies with individual differences. Additionally, myofascial release can improve flexibility and running economy simultaneously (Guo, 2020; Huang, Yu, & Zhao, 2016; Qiu, 2017). This has undoubtedly made a concrete contribution in practice.

In summary, the study concludes the following: First, myofascial release significantly enhances physical fitness. Through research and practice, we found that myofascial release techniques significantly improve flexibility. For instance, using foam rollers, massagers, and massage balls for myofascial release effectively reduces fascial adhesions, expands range of motion, and activates flexibility and joint mobility, thereby significantly improving students' flexibility and athletic performance in a short period. This technique has been applied in some sports, such as gymnastics and athletics, but its popularity remains limited. Currently, most coaches rely on single and experience-based training methods, lacking scientific validation and systematic promotion.

Second, individual differences are closely related to flexibility levels. Variations in physiological characteristics, physical conditions, and exercise foundations determine the differences in flexibility improvement. Although myofascial release can significantly enhance flexibility, its effect has a certain range and upper limit; it cannot be infinitely improved with increased release time. Studies indicate that after a period of myofascial release training, an individual's flexibility reaches a stable level, with the rate of improvement gradually decreasing thereafter. Therefore, training plans need to be adjusted according to each student's specific situation to avoid injuries caused by overtraining.

Third, while myofascial release is effective in improving flexibility, research on its impact on the sit-and-reach test is relatively sparse. Current research mainly focuses on the effects of myofascial release on overall flexibility and joint mobility, but in-depth studies specific to the sit-and-reach test are lacking. The sit-and-reach test is not merely a simple flexibility test; it involves the health of the spine and lower limbs and has higher requirements for students' overall physical fitness. More research is needed to explore the specific mechanisms and effects of myofascial release in improving sit-and-reach performance, providing stronger scientific evidence for physical education.

In China, the sit-and-reach test is part of the physical fitness assessment for middle school students and a mandatory item in the physical education entrance exam. It primarily evaluates flexibility, spinal, and lower limb health, reflecting athletic performance and injury prevention. By measuring students' flexibility and body coordination, the sit-and-reach test provides a clear assessment tool for physical education teachers and students regarding health status and physical development levels. This study explores the impact of myofascial release techniques on improving students' sit-and-reach performance, with profound practical significance.

From the perspective of physical education practice, the introduction of myofascial release techniques provides a scientific and effective supplement to traditional flexibility training methods. This technique not only enhances training effectiveness but also reduces discomfort and injuries during training, creating a safer and more efficient training environment for students.

From the perspective of student health outcomes, the application of myofascial release techniques helps comprehensively improve students' physical fitness levels. Flexibility is a key factor affecting athletic performance and injury prevention. Systematic myofascial release training significantly improves students' flexibility, which not only helps them achieve better results in the sit-and-reach test but also enhances their performance in other sports. More importantly, myofascial release techniques can improve spinal and lower limb health, reducing the likelihood of sports injuries. By releasing fascial tension, students' joint mobility increases, and muscle coordination and stability are enhanced, making them more comfortable and safer during high-intensity or complex movements.

In conclusion, the application of myofascial release techniques in improving students' sit-and-reach performance and flexibility provides new methods and tools for physical education practice and lays a foundation for students' comprehensive health development. The widespread application of this research is expected to promote the scientific and systematic process of physical education, further improving students' physical fitness levels and fostering their overall development in sports and learning.

MATERIAL & METHODS

*Research flow chart (*As shown in Fig. 2)

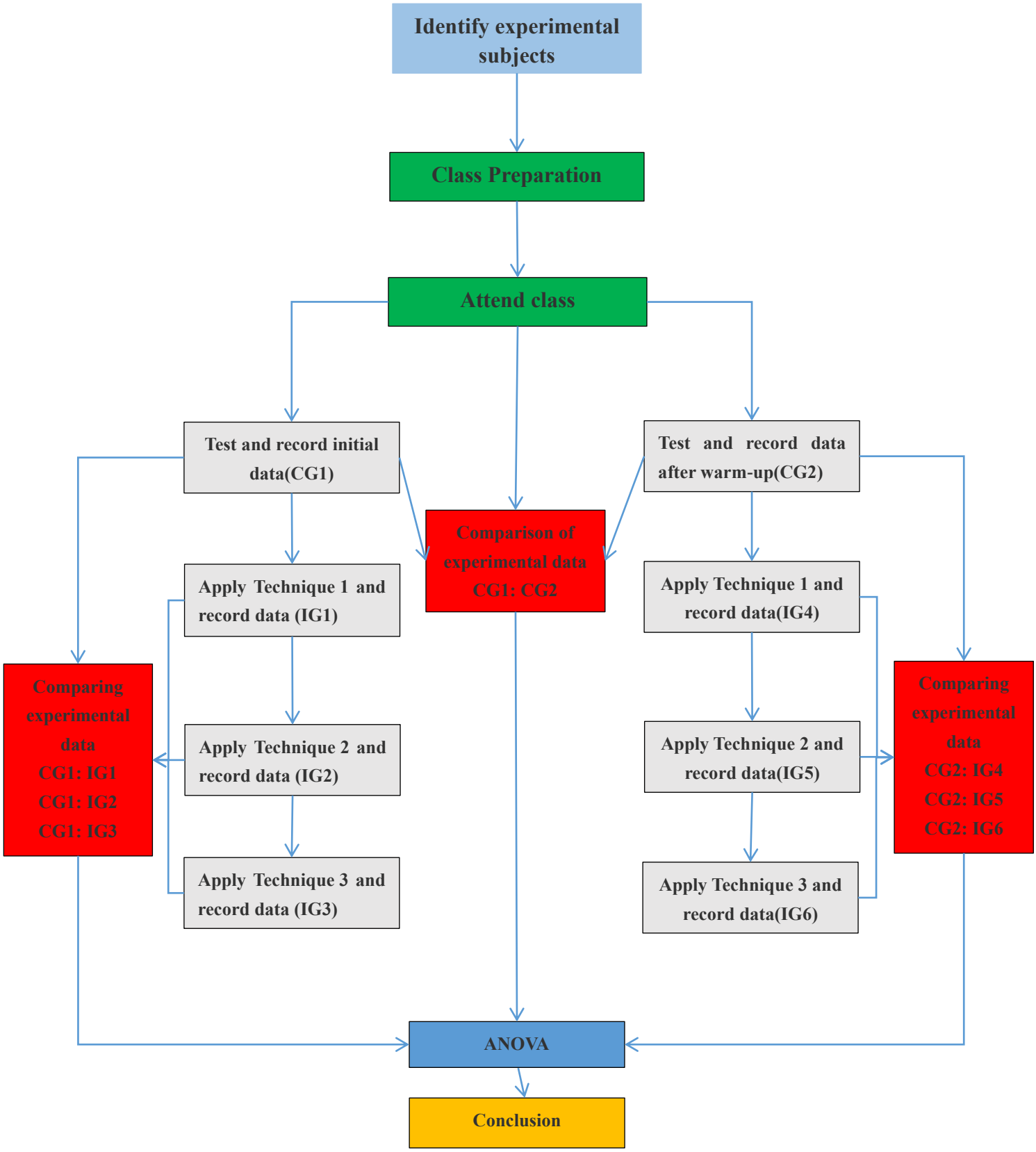

Fig. 2. Research flow chart

Experimental Subjects

Among more than 1,300 junior high school students in 31 classes of Xianlin Middle School, 2 students were randomly selected from each class, totaling 62 healthy students (50% male and 50% female). The sample distribution by age was as follows: 10 students aged 13, 21 students aged 14, 19 students aged 15, and 12 students aged 16. The overall sample consisted of students aged 13 to 16, with an average age of 14.5 years. (As shown in Table 1) To meet the health criteria, all participants were confirmed to be free of major diseases or exercise contraindications before participating in the experiment on myofascial release to improve sit-and-reach performance.

Table 1. Sample size distribution

Age	Number
13	10
14	21
15	19
16	12
TOTAL	**62**

Intervention Process

- The experimental group underwent specific intervention measures, including the application of targeted technical movements, warm-ups, and instruction or correction as needed.
- The control group did not receive any interventions and maintained their initial condition and the status resulting from traditional stretching exercises as a basis for comparison.

Experimental Equipment:

- Sit-and-reach measurement devices. (As shown in Fig. 3)

Technical parameters are as follows: Measurement Range : -20 cm to 35 cm; Scale Interval: 0.1 cm; Error: ±0.1 cm.

- Mats (L 100cm * W 50cm * H 5cm) (As shown in Fig. 4) Main material: Sponge

Fig. 3. Sit-and-reach measurement devices

Fig. 4. Mats

Experimental Preparation:

- The venue equipment includes 3 sit-and-reach measurement devices, 6 mats and a flat, empty indoor venue.
- Arrange 3 recorders and 3 discipline administrators.
- Place the measurement devices on the mats, ensuring that the subjects and the devices are at the same level height.
- Inform the students that each test will be conducted three times, with the best score being recorded. There are a total of eight tests, all conducted strictly according to the teacher's instructions.

Ethical Considerations

- Participant Safety: Ensure that participants do not suffer any harm during the experiment.
- Informed Consent: Ensure that participants fully understand the purpose, process, potential risks, and benefits of the experiment, and that they participate voluntarily.
- Confidentiality: Handle participants' personal information confidentially, ensuring it is not disclosed to unauthorized third parties.

Fig. 5. Demonstration of sit-and-reach

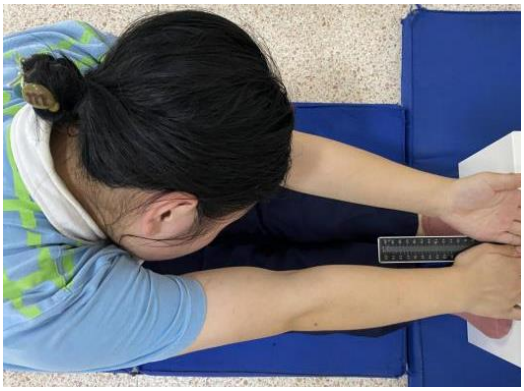

Fig. 6. Techniques 1 Demonstration

Fig. 7. Techniques 2 Demonstration

Experimental Steps

- Control Group 1 (CG1):

Before starting the experiment, all participants undergo a base flexibility test using a sit-and-reach measurement device. The initial sit-and-reach performance is recorded based on the values displayed on the device's scale (as shown in Fig. 5). The specific procedure is as follows:

1. Place the measurement device and the participant on the same level mat.
2. The participant sits with legs extended straight, heels together, toes naturally apart, and soles fully pressed against the flat board of the measurement device.
3. Extend arms and fingers forward with palms facing down.
4. Bend the upper body as much as possible and gently push the cursor on the scale with fingertips until no further forward extension is possible.
5. Hold the position for 3 seconds without making sudden forward thrusts.
6. Observe the scale and record the measurement data.

- Intervention Group 1 (IG1):

Using Technique 1 to measure sit-and-reach performance (as shown in Fig. 6). The testing method is similar to the control group, with the following differences:

1. Place the measurement device and the participant on the same level mat.
2. The participant sits with legs extended straight, heels together, toes naturally apart, and soles fully pressed against the flat board of the measurement device.
3. Extend arms and fingers forward with palms facing down.
4. During the forward motion, gently push the cursor on the scale with fingertips. Simultaneously, rotate the left arm to the left until the palm faces upward, and the neck should lean towards the left shoulder.
5. Extend both hands forward as far as possible and hold the position for 3 seconds.
6. Observe the scale and record the measurement data.

- Intervention Group 2 (IG2):

Using Technique 2 to measure sit-and-reach performance (as shown in Fig. 7). The technical requirements are as follows:

1.Participants apply slight pressure to rub the brow ridge for at least 30 seconds. This is done once and aims to relax the fascial chains, enhancing overall body flexibility.

2.Follow the same testing procedure as the initial base test.

- Intervention Group 3 (IG3):

Use technique 3 to measure the sit-and-reach test. Technical requirements: Use technique 2 plus technique 1, once, test the sit-and-reach test, observe the scale and record the data.

- Control Group 2 (CG2):

Participants in this group undergo traditional stretching warm-up exercises before immediately testing their initial sit-and-reach values. The exercise methods, time, and frequency are as specified in

Table 2. The purpose is to observe and record experimental data related to their initial sit-and-reach performance after traditional stretching warm-up.

Table 2. Traditional stretching and warm-up methods

Body posture	Sequence	Practice method	Practice time/second	Frequency
Standing posture	1	Stand-and-reach	30	1
	2	Lunge leg press	30	1
	3	Side Leg Stretch	30	1
	4	Front Kick	30	1
	5	Side Kick	30	1
Sitting position	1	Side Split Stretch	50	1
	2	Step-over Stretch	40	1
	3	Horizontal Split	30	1
	4	Vertical Split	60	1
	5	Sit-and-reach	30	1

- Intervention Group 4 (IG4):

Participants in this group will first engage in a traditional stretching warm-up. Following the warm-up, they will perform the Sit-and-Reach test using Technique 1. The performance outcomes of the test will be carefully observed and systematically recorded.

- Intervention Group 5 (IG5):

Participants in this group will first engage in a traditional stretching warm-up. Following the warm-up, they will perform the Sit-and-Reach test using Technique 2. The performance outcomes of the test will be carefully observed and systematically recorded.

- Intervention Group 6 (IG6):

Participants in this group will first engage in a traditional stretching warm-up. Following the warm-up, they will perform the Sit-and-Reach test using Technique 3. The performance outcomes of the test will be carefully observed and systematically recorded.

- Post-Evaluation:

First, to ensure the accuracy and reliability of the data, we will employ repeated measurements along with objective recordings by designated recorders.

Second, we will use SPSS 18.0 statistical software to organize and analyze the data collected from the 62 participants before and after the intervention. The analysis will include calculating the p-value to determine statistical significance.

Finally, we will conduct a detailed comparative analysis of the pre- and post-intervention data to draw conclusions about the effectiveness of the intervention.

- Data Analysis Method

During the experiment, we employed a statistical method known as difference analysis to conduct an in-depth comparison of the collected data. This approach aids in understanding the differences between various groups, leading to more meaningful conclusions.

To compare data across multiple control and intervention groups, we utilized Analysis of Variance (ANOVA). ANOVA is particularly useful in examining whether there are significant differences among the means of multiple independent samples without the need for multiple individual t-tests. When ANOVA detects significant differences, it indicates that at least one group mean is different from the others.

To pinpoint which specific groups exhibit substantial differences in their means, we applied Bonferroni correction for multiple comparisons. This method helps accurately identify significant mean differences between groups, thereby ensuring the reliability of our conclusions.

RESULTS

This experiment was conducted with a human-centered approach, adhering to the educational philosophy of "Health First." The Sit-and-Reach test was designed and implemented based on the Level Four basic requirements outlined in the "National Student Physical Health Standard." Emphasizing innovation and focusing on student development, the primary objective was to improve Sit-and-Reach performance, leveraging the available school facilities.

A total of 62 middle school students participated in this experiment. In accordance with the experimental requirements, they underwent 1,488 tests, allowing us to obtain objective, accurate, and reliable data on their myofascial release before and after the intervention (see Fig. 8 and Fig. 9).

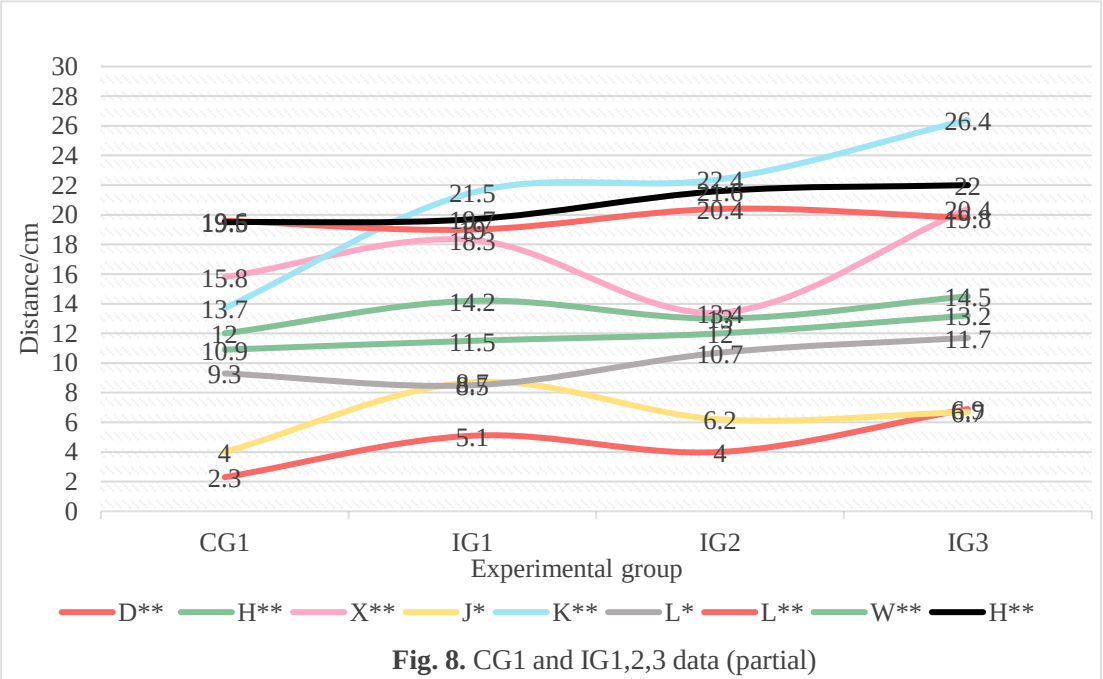

Fig. 8. CG1 and IG1,2,3 data (partial)

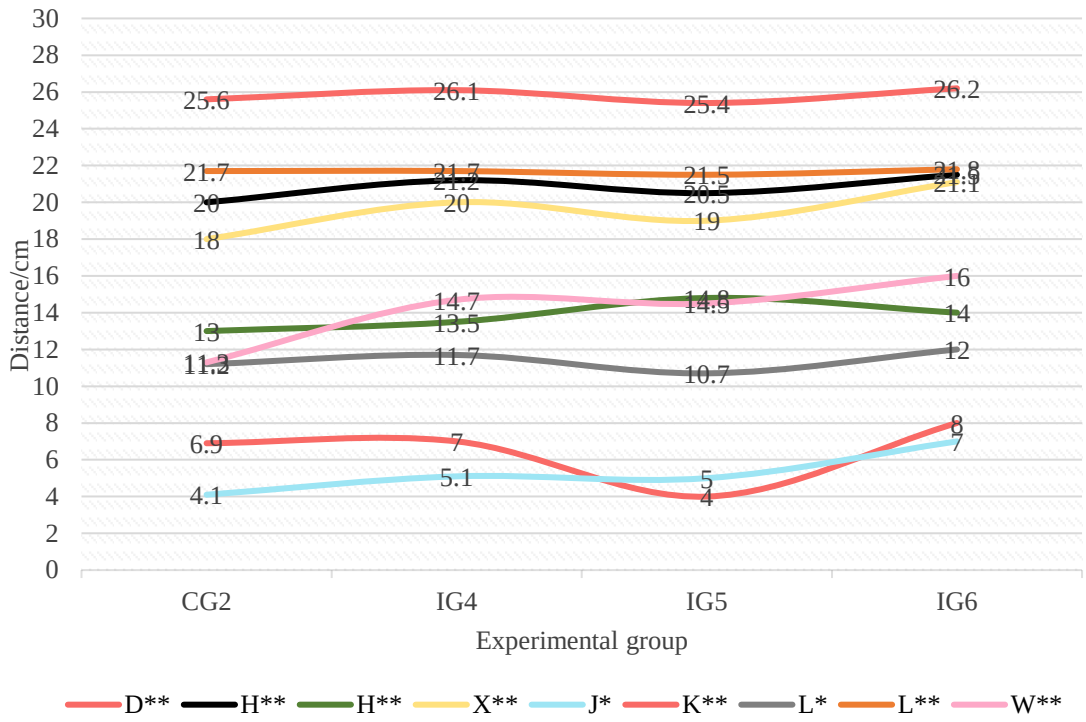

Fig. 9. CG2 and G4,5,6 data (partial)

Relationship Between IG1,2,3 and CG1

Table 3. IG1,2,3 and CG1 ANOVA

		Sum of squares	df	Mean square	F	Probability value
Technique 1	Between groups	1933.687	51	37.915	19.867	.000
	Within groups	19.085	10	1.909		
	Total	1952.772	61			
Technique 2	Between groups	1774.680	51	34.798	2.556	.055
	Within groups	136.145	10	13.614		
	Total	1910.825	61			
Technique 3	Between groups	2098.509	51	41.147	3.116	.028
	Within groups	132.045	10	13.205		

	Total	2230.554	61

As shown in Table 3, the study found that:

Under Technique 1, the between-group variance in students' Sit-and-Reach performance was substantial (Sum of Squares = 1933.687), and this difference was statistically highly significant ($p < .001$). The within-group variance (Sum of Squares = 19.085) was relatively small. The F-value (19.867) indicates that the between-group variance is much greater than the within-group variance.

Under Technique 2, the between-group variance (Sum of Squares = 1774.680) was also relatively large, but the significance level was higher ($p = .055$), which is at the borderline of statistical significance. The within-group variance (Sum of Squares = 136.145) was larger than that observed under Technique 1. The F-value (3.116) suggests that while the between-group variance is greater than the within-group variance, it is not as pronounced as with Technique 1.

Under Technique 3, the between-group variance (Sum of Squares = 2098.509) was the highest, and this difference was statistically significant ($p = .028$). The within-group variance (Sum of Squares = 132.045) was similar to that observed under Technique 2. The F-value (3.116) again shows that the between-group variance exceeds the within-group variance, but it is not as significant as with Technique 1.

Overall, across all three measurement techniques, the between-group variance in students' Sit-and-Reach performance was greater than the within-group variance, indicating that different measurement techniques significantly impact students' performance. Technique 1 showed the most significant between-group variance, followed by Technique 3, with Technique 2 having the highest significance level.

Relationship Between CG2 and CG1

Table 4. CG2 and CG1 ANOVA

		Sum of squares	df	Mean square	F	Probability value
warm up	Between groups	1950.571	51	38.246	3.484	.019
	Within groups	109.793	10	10.979		
	Total	2060.363	61			

This time, the comparison is between control group 1 and control group 2. But now, control group 2 has become the intervention group. The various stretching exercises in the intervention group have improved the flexibility and agility of the students' bodies (Li & Chen, 2009; O'Sullivan, Murray, & Sainsbury, 2009). Some have increased by 0.1cm, while others have increased by 11.9cm.

The table 4 also reveals that the between-group variance in students' Sit-and-Reach performance (Sum of Squares = 1950.571) is significant, with a statistical significance level of p

= .019. The within-group variance (Sum of Squares = 109.793) is relatively small, indicating that the scores within the warmed-up group or the non-warmed-up group are relatively consistent. The F-value (3.484) further shows that the between-group variance is greater than the within-group variance, highlighting the noticeable difference in performance between the warmed-up and non-warmed-up groups.

This result suggests that warm-up exercises have a significant positive impact on students' Sit-and-Reach performance, with students who warmed up achieving better scores on this test.

Relationship Between IG4,5,6 and CG2

Table 5. IG4,5,6 and CG2 ANOVA

		Sum of squares	df	Mean square	F	Probability value
G4	Between groups	1941.525	41	47.354	31.627	.000
	Within groups	29.945	20	1.497		
	Total	1971.470	61			
G5	Between groups	2259.977	41	55.121	26.747	.000
	Within groups	41.217	20	2.061		
	Total	2301.194	61			
G6	Between groups	2055.494	41	50.134	11.011	.000
	Within groups	91.059	20	4.553		
	Total	2146.554	61			

From the analysis of Table 5, it was found that the significance levels for the three intervention groups compared to Control Group 2 were all .000. This indicates that the between-group differences are statistically highly significant, far exceeding the commonly accepted significance level (e.g., 0.05). Therefore, we can conclude that different warm-up techniques combined with specific methods have a significant impact on students' Sit-and-Reach performance.

In summary, the distribution of students' Sit-and-Reach performance indicates that there are significant between-group differences under different warm-up and technique conditions, while the within-group differences are relatively small. However, the within-group variance for the warm-up plus Technique 3 condition is relatively larger. This suggests that when selecting warm-up and technique combinations, their impact on student performance should be carefully considered.

DISSUTION

In exploring methods to enhance Sit-and-Reach performance, we designed a controlled experiment to compare the effects of different stretching techniques. The experiment strictly adhered to scientific research standards, ensuring the accuracy and reliability of the data.

Through rigorous data analysis, we were delighted to discover that both myofascial release techniques and traditional stretching methods improved Sit-and-Reach scores to some extent. However, upon closer comparison of their effects, myofascial release techniques demonstrated remarkable superiority, significantly enhancing Sit-and-Reach performance. This finding not only validates our research hypothesis but also reveals the immense potential of myofascial release techniques in sports training and rehabilitation.

Placing this achievement within the broader context of existing literature, our study provides strong support for the application of myofascial release techniques in sports rehabilitation and physical training. Notably, myofascial release techniques have been shown to enhance flexibility more effectively than traditional flexibility training methods, yielding significant results in a shorter period (T. Chen, 2018). Additionally, PNF stretching demonstrates unique advantages, as evidenced in Taekwondo where it improves flexibility without compromising athletic performance (Yılmaz, 2021). This is primarily attributed to the ability of myofascial release techniques to stimulate and massage the fascia, thereby improving its elasticity and flexibility. Relaxation and stretching of the fascia alleviate muscle tension and pain, thereby enhancing athletes' flexibility.

Furthermore, experiments by Guo Xin-yuan on myofascial release using foam rollers on shoulder joints, hip joints, and plantar fascia similarly show effective improvement in Sit-and-Reach performance (Guo, 2020). This finding further validates the effectiveness of myofascial release techniques in enhancing flexibility.

While previous studies indicate that myofascial release techniques have some effect on increasing flexibility and reducing muscle tension, their specific impact on the Sit-and-Reach test has been underexplored with limited research findings. Our study not only fills this gap but also provides new insights and directions for research in this field.

In summarizing our experimental results, we also noted some interesting observations. Research suggests a significant interaction between stretching techniques and duration (Davis, Ashby, McCale, McQuain, & Wine, 2005). Implying that different stretching techniques require varying durations to achieve optimal results. Therefore, in practical applications, it is essential to select appropriate stretching techniques and durations based on specific circumstances.

Compared to other studies, our approach offers significant advantages. Firstly, it does not rely on specific equipment or facilities, making it convenient and accessible. Secondly, it demonstrates rapid efficacy, significantly improving Sit-and-Reach performance in a short time frame. These advantages enhance the practical applicability of our findings.

CONCLUSIONS

In conclusion, through this controlled experiment, we thoroughly examined the effects of different stretching techniques on Sit-and-Reach performance. The results demonstrate that both myofascial release techniques and traditional stretching methods improve flexibility and Sit-and-Reach scores. However, myofascial release techniques significantly enhance Sit-and-Reach performance and can also reduce discomfort commonly associated with stretching.

In practical applications, we recommend physical education professionals and coaches consider integrating myofascial release techniques into sports teaching and training. By combining these techniques with traditional stretching methods, students' flexibility and athletic performance can be effectively enhanced. Moreover, for professional athletes, myofascial release can serve as an effective recovery method, aiding in faster muscle recovery and reducing the risk of sports injuries.

For future research, we suggest further exploring the combined effects of myofascial release techniques with other training methods, as well as evaluating their application across different sports and age groups. Comprehensive research will provide a deeper understanding of the mechanisms and application value of myofascial release techniques, thereby making significant contributions to sports rehabilitation and physical training.

In summary, this experiment provides valuable insights and guidance. It underscores the need for ongoing innovation and development in sports teaching and training methods to cultivate students with excellent physical fitness.

LIMITATION

Sample Selection Bias

When conducting randomized controlled trials among junior high school students, sample selection may face biases. For instance, recruiting students from only one school may not fully represent the entire junior high school population. In this study, due to school scheduling and other reasons, the school authorities provided only two class periods, totaling 90 minutes, for student participation in the experiment. While this time frame barely allowed completion of the basic experiment procedures, it clearly could not ensure the depth and breadth of the experiment. Within the limited time, researchers might not have been able to conduct comprehensive testing and evaluation for each student, nor could they observe and record every experimental phase in detail.

Despite the participation of only 62 students in the experiment, this sample size still provides some valuable information to a certain extent. However, compared to larger sample sizes, the sample of 62 students is relatively small, potentially limiting the representativeness and generalizability of the results. A larger sample size means more data and information, which can more accurately reflect the characteristics and patterns of the entire junior high school population, thereby making the experimental results more persuasive and reliable.

Therefore, in future research, efforts should be made to expand the range of sample selection to ensure diversity and representativeness. This can be achieved by recruiting students from multiple schools and considering students from different geographical and cultural backgrounds to enhance the representativeness of the sample. At the same time, efforts should also be made to secure more experimental time to ensure the depth and breadth of the experiment, thereby obtaining more accurate and reliable results.

Consistency of Intervention

The myofascial release technique may exhibit variability among practitioners. Different trainers might employ varying techniques or intensities during interventions, potentially affecting the consistency of research outcomes. During the experiment, it was noted that some students exhibited improper movements and could not endure the pain caused by stretching the ligaments for an extended period, which may lead to discrepancies in data. To address these issues, a series of measures will be implemented in subsequent experiments to ensure consistency and accuracy. We will provide trained professionals to offer guidance, who will be responsible for training and supervising trainers to ensure they adhere to standardized procedures when implementing the myofascial release technique.

Student Characteristics

In this study, our primary focus was on examining the impact of myofascial release interventions on individual Sit-and-Reach performance, without delving deeply into individual differences. However, this does not imply that these factors are unimportant or negligible. On the contrary, for a more comprehensive understanding of factors influencing Sit-and-Reach performance and to offer more personalized training recommendations for students with different characteristics, future research could rigorously classify and explore these factors.

Specifically, future studies could design more refined experimental protocols by grouping participants based on characteristics such as height, gender, and others. Subsequently, the effects of myofascial release on Sit-and-Reach performance could be assessed within each group. This approach would allow us to better understand the effects of myofascial release across different student demographics and provide more precise training guidance accordingly.

FUNDING

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CONFLICTS OF INTEREST

There are no potential conflicts of interest related to the study, and publication of this article.

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