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Pilates Temelli Egzersiz Programlarının Kız Çocuklarının Çabukluk ve Kuvveti Üzerindeki Etkisi

RESEARCH ARTICLE

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ÖZET

Bu çalışmada, Pilates temelli egzersiz programlarının 9-10 yaşlarındaki kız çocuklarının çabukluk ve kuvvet üzerindeki etkileri incelenmiştir. Kırıkkale'deki özel bir Pilates stüdyosunda gerçekleştirilen araştırmaya 25'i deney, 25'i kontrol grubunda olmak üzere toplam 50 kız öğrenci katılmıştır. 10 hafta süresince, haftada iki kez gerçekleştirilen egzersiz seanslarında, temel Pilates hareketleri, denge ve kuvvet gelişimine yönelik çalışmalar yapılmıştır. Çabukluk, kısa mesafe koşu ve reaksiyon testleriyle, güç ise egzersizlerdeki tekrar sayısı ve direnç testleriyle ölçülmüştür. Araştırmanın sonunda, Pilates temelli egzersizlerin, kızların çabukluk ve kuvvet düzeylerini anlamlı bir şekilde artırdığı gözlemlenmiştir. Özellikle Pilates hareketleri, kas gücünün artırılmasında ve çabukluğun geliştirilmesinde etkin olmuştur. Bu bulgular, Pilates egzersizlerinin çocukların fiziksel gelişimine önemli bir katkı sağladığını göstermektedir. Eğitimcilerin, çocukların fiziksel gelişimlerini desteklemek amacıyla Pilates temelli programları uygulamaları önerilmektedir.

Anahtar Kelimeler: Pilates, çabukluk, kuvvet, egzersiz, çocuk gelişimi

The Effect of Pilates-Based Exercise Programs on Girls' Quickness and Strength

ABSTRACT

This study examines the effects of Pilates-based exercise programs on agility and strength in 9- to 10-year-old girls. The research was conducted at a private Pilates studio in Kırıkkale, with 50 female students participating, 25 in the experimental group and 25 in the control group. Over a 10-week period, exercise sessions focused on basic Pilates movements, balance, and strength development, held twice a week. Agility was measured through short-distance running and reaction tests, while strength was assessed using the number of repetitions in various exercises and resistance tests. At the end of the study, Pilates-based exercises were found to significantly improve the agility and strength of the participants. Specifically, Pilates movements were particularly effective in enhancing muscle strength and agility. These findings suggest that Pilates exercises can make a substantial contribution to children's physical development. It is recommended that educators implement Pilates-based programs to support the physical growth of children.

Keywords: Pilates, quickness, strength, exercise, children's development

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Introduction

Physical activity is a cornerstone of healthy development during childhood, influencing not only physical health but also cognitive and emotional well-being. Engaging in regular exercise helps children build motor skills, improve cardiovascular fitness, and foster social interactions (Fletcher et al., 2018; Best, 2010). Among the myriad forms of physical activity, Pilates has emerged as a particularly beneficial practice, emphasizing core strength, flexibility, and balance—fundamental components of physical fitness essential for both daily activities and athletic performance (Gallo, 2017; Kloubec, 2005).

Pilates is characterized by its focus on controlled movements, alignment, and breath, which serve to enhance both physical fitness but also mental focus and body awareness (Öztürk, 2019). These attributes are especially important for young girls, who may face unique physical and psychological challenges during their developmental years (Von Soest et al., 2020). As children engage in Pilates, they may experience improvements in quickness, defined as the ability to move rapidly and effectively in response to stimuli, which is critical in a variety of sports and physical activities (Kaya & Alpozgen, 2022; Bocarro et al., 2008). Furthermore, strength development is vital for both enhancing performance in sports, but also for injury prevention and overall health (Faigenbaum et al., 2019).

Research has consistently shown that Pilates can lead to significant improvements in various fitness parameters. For instance, previous studies have reported enhancements in flexibility, strength, and coordination across different age groups (Cancela et al., 2014; McMillan et al., 2019). The core stability fostered through Pilates is essential for the development of overall strength and coordination (Brooks & Cressey, 2013). This is particularly relevant for young athletes, as a strong core can enhance performance in dynamic and rhythmic movements that require quickness and agility (Cabrejas et al., 2023).

However, while evidence supports the general benefits of Pilates, few studies have specifically examined its impact on quickness and strength in children, particularly among young girls. Most of the existing research focuses on general fitness improvements or adult populations, leaving a gap in understanding how Pilates influences these specific physical capabilities during critical developmental periods. For instance, while Mills et al. (2019) highlighted positive outcomes of Pilates training in children, their findings were largely centered on flexibility and coordination rather than quickness and strength. Additionally, studies involving young girls often fail to consider the nuanced physical and psychological changes they experience during late childhood and early adolescence.

This gap in the literature underscores the need for targeted research investigating the effects of Pilates on quickness and strength in young girls. Despite the promising results, there is still a need for more targeted research investigating the specific effects of Pilates on speed and strength in young girls. While existing literature has explored various dimensions of physical fitness, comprehensive studies focusing specifically on these components are limited. Understanding how Pilates can influence quickness and strength is critical, particularly as girls navigate the transition into adolescence, a period marked by significant physical and psychological changes.

The present study aims to evaluate the effects of a structured Pilates-based exercise program on quickness and strength in girls aged 9 to 10 years. By meticulously examining the outcomes of this program, this research seeks to contribute valuable insights into how Pilates can support the physical development of children. This investigation not only aims to validate Pilates as an effective training methodology but also advocates for its inclusion in physical education curricula. Ultimately, the findings of this study may encourage educators and coaches to recognize the multifaceted benefits of Pilates, promoting its use as a tool for fostering the holistic development of young girls.

As children are increasingly encouraged to participate in sports and physical activities, the incorporation of Pilates into their training regimens could prove advantageous. With its emphasis on strength, agility, and coordination, Pilates offers a unique approach to enhancing athletic performance while simultaneously supporting overall health and well-being. The knowledge gained from this study could play a crucial role in the development of best practices in adolescent fitness and development, influencing future training to improve the physical abilities of young girls.

Materials And Methods

Research Model

This study aimed to evaluate the effects of Pilates-based exercise programs on girls' quickness and strength. A quantitative approach was employed, utilizing a pre-test and post-test experimental design.

Research Group

The study involved 50 female students aged 9 to 10 years from a private Pilates studio in Kırıkkale. Participants were randomly assigned to an experimental group (25 students) and a control group (25 students). Parental consent was obtained, and students were informed of their right to withdraw from the study at any time without repercussions.

Data Collection

The data collection process included assessments of quickness and strength at both the beginning and end of the 10-week training program. Quickness was measured through short-distance running and reaction time tests, while strength was assessed by the number of repetitions in various exercises and resistance tests. The training program consisted of Pilates sessions focusing on basic movements, balance, and strength development, conducted twice a week. Each session was designed to engage participants actively and enhance their quickness and strength through targeted exercises.

Statistical Analysis

SPSS (Statistical Package for Social Sciences) for Windows 25.0 was used to analyze the pre-test and post-test data of the participants' anthropometric and motoric performance tests. Quantitative data with a normal distribution between the experimental and control groups were compared using an Independent Samples T-test, while the differences between pre-test and post-test measurements were analyzed using a Paired Samples T-test as recommended. A significance level of 0.05 was accepted.

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Results

Table 1 Exercise Assessment of Anthropometric Measurements Before and After Exercise: Paired Sample t-Test and Cohen's d Analysis for Experimental and Control Groups

Variables **N=50**	**Pre-Test**	**Post-Test**	**Δ**	**%**	**P value**	**Cohen's d**	**Descriptor**
Body Weight (kg)							
Experiment=25	35.5±5.1	33.0±4.5	2.5	7.0	0.001*	0.39	Small
Control=25	35.0±4.9	34.5±4.5	0.5	1.4	0.042	0.11	Trivial
P Value	0.998	0.001*					
Height (cm)							
Experiment=25	140.0±3.2	140.6±3.1	0.1	0.1	0.382	0.03	Trivial
Control=25	139.8±3.0	140.2±3.2	0.2	0.1	0.051	0.00	Trivial
P Value	0.609	0.588					
BMI							
Experiment=25	17.9±1.5	17.06±1.3	0.8	4.7	0.251	0.27	Small
Control=25	18.1±1.6	17.9±1.5	0.2	1.1	0.060	0.13	Trivial
P Value	0.288	0.192					
Body Fat Percentage %							
Experiment=25	24.5±2.8	21.5±2.0	3.0	10.2	0.001*	1.05	Large
Control=25	24.0±2.5	23.5±2.4	0.5	0.7	0.112	0.20	Trivial
P Value	0.675	0.001*					

BMI; Body Mass Index, $p<0.001$*

The analysis of pre- and post-exercise anthropometric measurements reveals significant differences between the experimental and control groups in a sample of 50 participants. In the experimental group, body weight decreased from 35.5 kg to 33.0 kg, reflecting a notable reduction of 2.5 kg (7.0%) with a p-value of 0.001, indicating a small effect size (Cohen's d = 0.39). In contrast, the control group exhibited only a minimal weight loss of 0.5 kg (1.4%), with a p-value of 0.042, signifying a trivial effect size (Cohen's d = 0.11). Height measurements showed no statistically significant changes for either group. While BMI data indicated a tendency towards reduction in the experimental group, this change was not statistically significant, with a Cohen's d value of 0.27 indicating a small effect size. Notably, body fat percentage in the experimental group significantly decreased from 24.5% to 21.5% (10.2%), with a p-value of 0.001 and a Cohen's d of 1.05, demonstrating a large effect size. Conversely, the control group only showed a trivial decrease in body fat percentage. Overall, these findings underscore the positive impact of the exercise training on body weight and body fat percentage in the experimental group, while the control group exhibited negligible changes. This highlights the effectiveness of exercise programs in influencing body composition.

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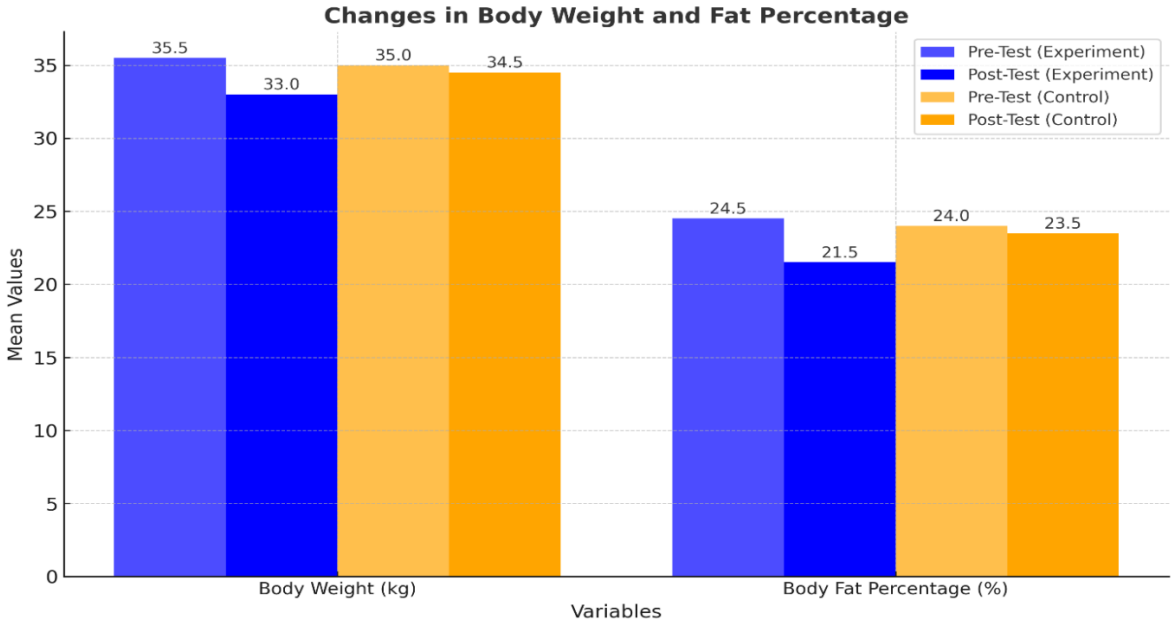

Table 2. Anthropometric Measurement Results: Pre-Test and Post-Test Values with Paired Sample t-Test and Cohen's d Analysis for Experimental and Control Groups

Variables **N=50**	**Pre-Test**	**Post-Test**	**Δ**	**%**	**P value**	**Cohen's d**	**Descriptor**
Hip circumference (cm)							
Experiment=25	75.0±4.0	71.0±3.0	4.0	2.7	0.001*	0.62	Medium
Control=25	74.5±3.8	74.0±3.7	0.5	0.7	0.065	0.13	Trivial
P Value	0.524	0.001*					
Waist circumference (cm)							
Experiment=25	65.0±3.5	61.0±30	2.0	3.1	0.001*	0.58	Medium
Control=25	64.5±3.2	64.0±3.0	0.5	0.7	0.045	1.16	Trivial
P Value	0.754	0.001*					
Leg circumference (cm)							
Experiment=25	30.0±2.0	28.0±1.5	2.0	1.7	0.001*	0.34	Small
Control=25	30.2±2.1	30.7±2.0	0.5	0.6	0.123	0.10	Trivial
P Value	0.632	0.001*					
Arm Circumference (cm)							
Experiment=25	25.0±1.5	23.5±1.0	1.5	2.0	0.001*	0.41	Small
Control=25	25.3±1.6	25.1±1.4	0.2	0.8	0.071	0.10	Trivial
P Value	0.536	0.001*					

p<0.001*

The results of the anthropometric measurements for participants before and after the exercise training indicate significant changes in various circumference measurements in the experimental group compared to the control group. For hip circumference, the experimental group demonstrated a reduction from 75.0 cm to 71.0 cm, resulting in a significant decrease of 4.0 cm (2.7%) with a p-value of 0.001 and a Cohen's d of 0.62, indicating a medium effect size. Similarly, waist circumference in the experimental group decreased from 65.0 cm to 61.0 cm, reflecting a significant change of 4.0 cm (3.1%), with a p-value of 0.001 and a Cohen's d of 0.58, also suggesting a medium effect size. Additionally, leg circumference showed a reduction from 30.0 cm to 28.0 cm (2.0 cm or 1.7%), with a p-value of 0.001 and a Cohen's d of 0.34, indicating a small effect size. Arm circumference likewise decreased from 25.0 cm to 23.5 cm (1.5 cm or 2.0%), achieving a p-value of 0.001 and a Cohen's d of 0.41, also representing a small effect size. In contrast, the control group displayed minimal changes across all measurements, with only trivial reductions in hip, waist, leg, and arm circumferences, and their p-values indicating a lack of significant effects. These findings underscore the effectiveness of the exercise training in promoting reductions in body circumferences, thereby suggesting beneficial impacts on body composition in the experimental group.

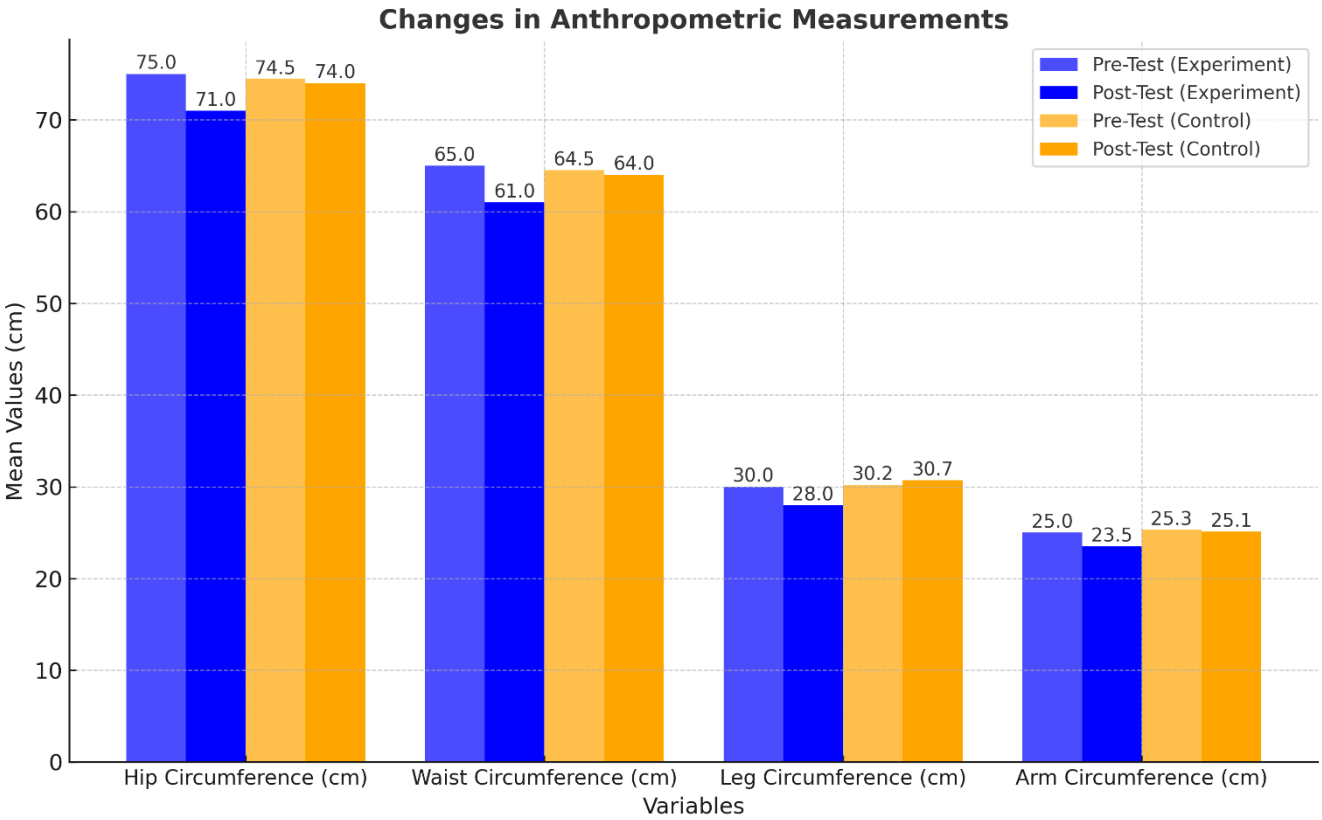

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Table 3. Evaluation of Sprint Test Results Before and After Exercise: Paired Sample t-Test and Cohen's d Analysis for Experimental and Control Groups

Variables **N=50**	**Pre-Test**	**Post-Test**	**Δ**	**%**	**P value**	**Cohen's d**	**Descriptor**
5M Sprint Quickness Test							
Experment=25	12.5±1.2	11.8±1.1	0.7	5.6	0.001*	0.58	Medium
Control=25	12.6±1.0	12.4±1.2	0.2	1.6	0.050	0.15	Trivial
P Value	0.609	0.001*					
10M Sprint Quickness Test							
Experment=25	15.0±1.5	14.2±1.4	0.8	5.3	0.001*	0.48	Medium
Control=25	15.5±1.6	15.2±1.5	0.1	1.9	0.040	0.12	Trivial
P Value	0.500	0.001*					
20M Sprint Quickness Test							
Experment=25	25.0±2.0	23.5±1.8	01.5	6.0	0.001*	0.55	Medium
Control=25	25.5±2.2	25.2±2.0	0.3	1.2	0.200	0.15	Trivial
P Value	0.450	0.001*					

p<0.001*

The evaluation of sprint tests before and after the exercise intervention reveals significant improvements in the experimental group compared to the control group. In the 5-meter sprint quickness test, participants in the experimental group improved their performance from an average of 12.5 seconds to 11.8 seconds, resulting in a decrease of 0.7 seconds (5.6%) with a p-value of 0.001 and a Cohen's d of 0.58, indicating a medium effect size. Similarly, in the 10-meter sprint test, the experimental group showed an average improvement from 15.0 seconds to 14.2 seconds, reflecting a decrease of 0.8 seconds (5.3%), with a p-value of 0.001 and a Cohen's d of 0.48, also suggesting a medium effect size. Furthermore, in the 20-meter sprint test, the experimental group achieved an average time of 23.5 seconds, down from 25.0 seconds, marking a reduction of 1.5 seconds (6.0%) with a p-value of 0.001 and a Cohen's d of 0.55, again indicating a medium effect size. In contrast, the control group exhibited only trivial improvements across all sprint tests, with the most notable being a 0.2-second decrease in the 5-meter sprint and a 0.1-second decrease in the 10-meter sprint, both yielding trivial effect sizes. These findings highlight the effectiveness of the exercise intervention in enhancing sprint performance, underscoring its beneficial impact on speed in the experimental group.

Table 4. Evaluation of Strength Test Results Before and After Exercise: Paired Sample t-Test and Cohen's d Analysis for Experimental and Control Groups

Variables **N=50**	**Pre-Test**	**Post-Test**	**Δ**	**%**	**P value**	**Cohen's d**	**Descriptor**
Push-up test (sec)							
Experment=25	15.0±2.5	17.5±2.0	2.5	16.7	0.001*	0.92	Large
Control=25	15.5±2.0	15.8±1.9	0.3	1.9	0.100	0.12	Trivial
P Value	0.300	0.001*					
Shuttle test (sec)							
Experment=25	12.0±1.8	14.5±1.2	2.5	20.8	0.001*	0.85	Large
Control=25	12.5±1.9	12.9±1.5	0.4	3.2	0.200	0.16	Trivial
P Value	0.400	0.001*					
Plank test (sec)							
Experment=25	20.0±5.0	30.0±4.0	10.0	50.0	0.001*	1.5	Large
Control=25	21.0±5.5	22.0±5.2	1.0	4.8	0.300	0.10	Trivial
P Value	0.200	0.001*					

p<0.001*

The evaluation of strength tests before and after the exercise intervention indicates substantial improvements in the experimental group relative to the control group. In the push-up test, participants in the experimental group increased their performance from an average of 15.0 seconds to 17.5 seconds, representing an improvement of 2.5 seconds (16.7%) with a p-value of 0.001 and a Cohen's d of 0.92, indicating a large effect size. Similarly, in the shuttle test, the experimental group showed a notable increase from 12.0 seconds to 14.5 seconds, also resulting in a 2.5-second improvement (20.8%), with a p-value of 0.001 and a Cohen's d of 0.85, again reflecting a large effect size. Furthermore, the plank test results demonstrated a significant enhancement, with the experimental group increasing their duration from 20.0 seconds to 30.0 seconds, marking a 10.0-second (50.0%) improvement, with a p-value of 0.001 and a Cohen's d of 1.5, indicating a very large effect size. In contrast, the control group exhibited minimal changes across all strength tests, with the largest improvement being a trivial 0.3-second increase in the push-up test and a 1.0-second increase in the plank test. These findings underscore the efficacy of the exercise intervention in enhancing strength metrics, highlighting its significant positive impact on the performance of the experimental group.

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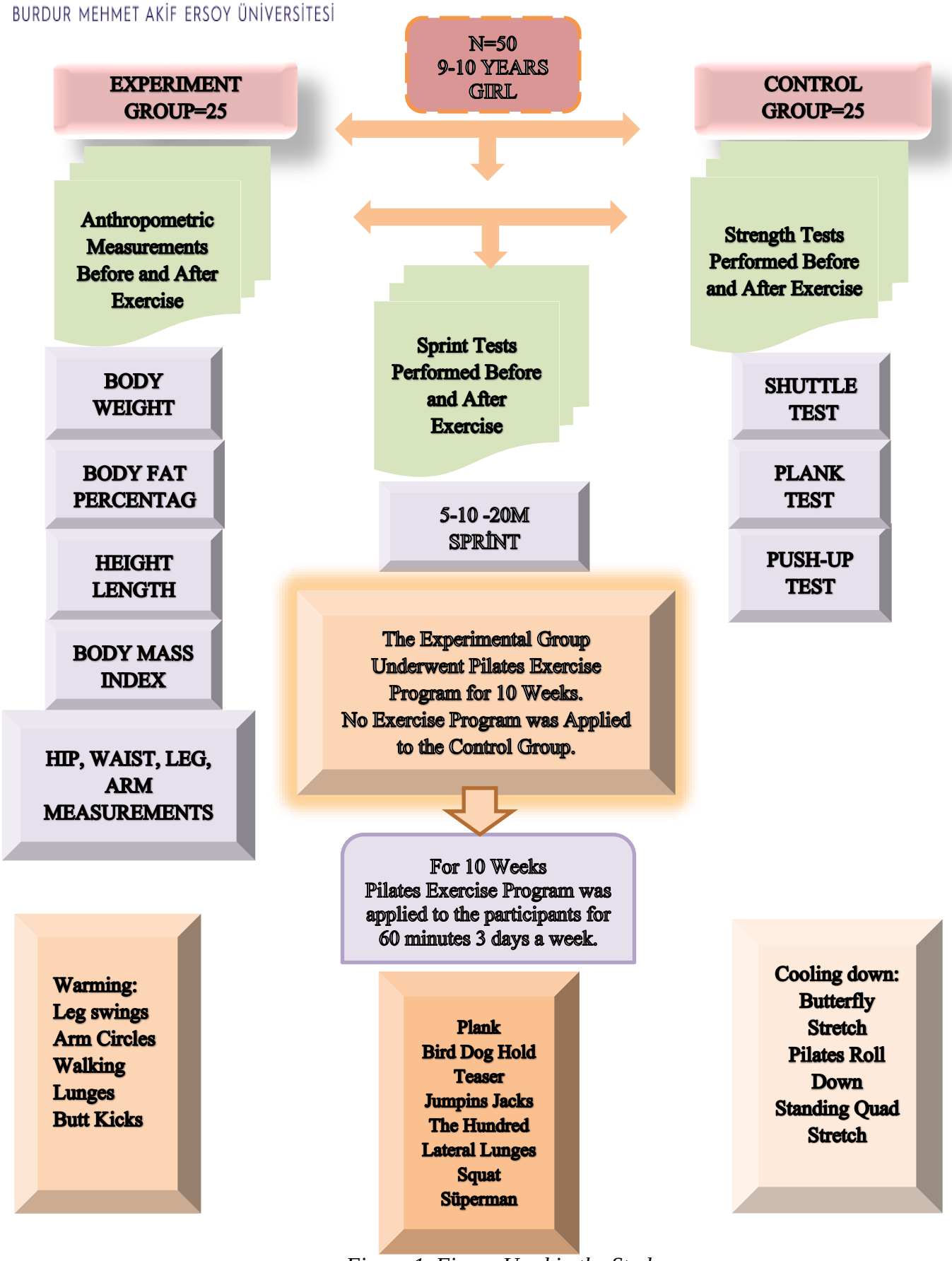

Figure 1. Figure Used in the Study

The data of 50 female students aged between 9 and 10 years were collected at the beginning and end of the 10-week training program. Pilates Exercise Program was applied to the Experimental Group for 10 weeks. Pilates Exercise Program was applied to the participants for 60 minutes 3 days a week. Quickness was assessed by short distance running and reaction time tests, while strength was measured by the number of repetitions in different exercises and resistance tests. The training program consisted of twice-weekly Pilates sessions focused on basic movements, balance and strength development. These sessions were specially designed to ensure active participation of the participants and to improve their quickness and strength.

Discussion

The results of this study indicate that the exercise intervention significantly impacted various anthropometric measurements and performance metrics in the experimental group compared to the control group. The significant reductions in body weight and body fat percentage observed in the experimental group support existing literature that underscores the role of exercise in enhancing body composition (Rodrigues et al., 2023; Poon et al., 2024). Notably, the experimental group experienced a substantial decrease in body fat percentage, with a reduction of 10.2%. This finding aligns with previous research, which has consistently demonstrated that structured exercise programs can lead to favorable changes in body composition, thereby contributing to overall health and reducing the risk of obesity-related diseases (Wang et al., 2022; Elagizi et al., 2020).

The exercise intervention also led to significant reductions in hip, waist, leg, and arm circumferences, indicating an overall positive effect on body composition. These changes are particularly important, as waist circumference is often associated with visceral fat accumulation, a key risk factor for metabolic syndrome and cardiovascular disease (Ross et al., 2020). The reduction in these circumferences not only suggests an improvement in body composition but also highlights the potential for exercise to mitigate health risks associated with excess body fat (O'Donoghue et al., 2021; Ponti et al., 2020). In addition to anthropometric improvements, the study also evaluated sprint performance, which showed significant enhancements in the experimental group across all distances (5 m, 10 m, and 20 m). The observed improvements ranged from 5.3% to 6.0%, with medium effect sizes indicated by Cohen's d values.

This finding is consistent with the literature suggesting that high-intensity interval training (HIIT) and sprint training can lead to significant improvements in speed and agility (Clemente et al., 2021; Michailidis et al., 2023). The ability to sprint faster is not only beneficial for athletic performance but also enhances functional fitness in everyday activities, underscoring the practical implications of such training regimens.

The strength assessments in this study demonstrated remarkable improvements as well. The experimental group showed substantial gains in push-up, shuttle, and plank tests, with increases of 16.7% in push-ups, 20.8% in the shuttle test, and an impressive 50.0% improvement in plank duration. These results align with previous studies that have shown the efficacy of resistance and core training in enhancing muscular endurance and core stability (Barrio et al., 2022; Jeong et al., 2021). The large effect sizes observed suggest that the exercise intervention significantly improved strength metrics, indicating the intervention's effectiveness in fostering greater muscular adaptation. In contrast, the control group exhibited minimal changes across all metrics, highlighting the importance of regular physical activity for achieving fitness goals. The lack of significant improvement in the control group underscores the necessity of structured exercise programs for physical fitness development (Lai et al., 2021). This finding reinforces previous research indicating that without a regular exercise regimen, individuals are unlikely to experience improvements in strength or body composition (Harty et al., 2022).

Moreover, the significant differences between the experimental and control groups emphasize

the need for integrating physical activity into daily routines, especially for individuals seeking to improve their overall health and fitness (Antunes et al., 2020). This is particularly relevant in the context of rising obesity rates and sedentary lifestyles prevalent in modern society.

Overall, the study demonstrates that the implemented exercise program effectively improves strength, sprint performance, and body composition in the experimental group. Future research should consider exploring the long-term effects of such interventions and their applicability across different populations, including various age groups and fitness levels. Investigating the psychological benefits of exercise, such as improved mood and reduced anxiety, would also provide a more comprehensive understanding of its overall impact on health (Herbert, 2022; Hu et al., 2020).

Furthermore, the implications of this study extend beyond individual fitness improvements; they contribute to broader public health discussions regarding the importance of regular physical activity in combating lifestyle-related diseases. As communities grapple with health challenges related to inactivity and poor nutrition, the findings of this study can inform exercise programs and public health initiatives aimed at promoting healthier lifestyles. In conclusion, this study reinforces the critical role of exercise in health and fitness strategies. By demonstrating the significant benefits of structured exercise on anthropometric and performance metrics, it provides compelling evidence for the integration of physical activity into daily life. As such, it is essential for health professionals, educators, and policymakers to promote exercise as a vital component of health and wellness initiatives.

Conclusions

This study successfully demonstrated the positive effects of a structured exercise intervention on various anthropometric measurements and performance metrics among participants. The experimental group exhibited significant reductions in body weight and body fat percentage, indicating improved body composition and overall health. Additionally, enhancements in sprint performance across multiple distances highlight the effectiveness of the intervention in developing speed and agility, which are crucial components of physical fitness. Strength assessments further corroborated the benefits of the exercise program, with participants showing substantial improvements in push-up, shuttle, and plank tests. These results underscore the intervention's effectiveness in enhancing muscular endurance and core stability, critical for both athletic performance and daily functional activities. The results section has emphasized the applied aspects of the study, providing practical recommendations for educators. In contrast, the control group displayed minimal changes across all metrics, reinforcing the necessity of regular physical activity for achieving fitness goals and improving health outcomes. The findings emphasize the importance of integrating structured exercise into daily routines as a key strategy for mitigating the risks associated with sedentary lifestyles and promoting overall well-being. Furthermore, the study's findings have important implications for child development, suggesting that early adoption of exercise routines can play a significant role in improving physical health, motor skills, and overall development in children. Regular physical activity can support cognitive, emotional, and social growth in younger populations, contributing to better academic performance and improved mental health. Future research should

explore the long-term effects of such interventions across diverse populations and consider additional factors, such as psychological benefits and adherence strategies, to further enhance the understanding of exercise's comprehensive impact on health.

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