

The Influence of Taekwondo Training on Cardiovascular Health and Flexibility: A Functional Strategy for Promoting Healthy Aging in Older Adults

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ABSTRACT

The study explores the influence of Taekwondo training on cardiovascular health and flexibility, focusing on its potential as a functional approach to promoting healthy aging in older adults. With an increasing aging population, the importance of maintaining physical health, particularly cardiovascular function and flexibility, is critical for independence and quality of life. Traditional fitness programs often fail to meet the specific needs of older adults. This research investigates the impact of an 8-week Taekwondo training program on improving cardiovascular health, measured through heart rate, and flexibility, assessed via the Sit-and-Reach test. Results from pre- and post-intervention tests indicate significant improvements, with participants showing reductions in resting heart rate and enhancements in flexibility. These findings suggest that Taekwondo, as a dynamic and holistic physical activity, holds considerable promise for enhancing both cardiovascular health and flexibility in older adults, offering a functional exercise approach to healthy aging. Further research could explore long-term impacts and compare Taekwondo with other fitness regimes.

Keywords: Taekwondo, cardiovascular health, flexibility, healthy aging, older adults.

Introduction

Taekwondo traces its roots to traditional Korean martial arts, particularly Taekkyeon and Hwa Rang Do, which evolved into a more modern form during the 20th century. These martial arts practices were integral to the military culture of ancient Korea. Taekkyeon, in particular, focused on fluid, circular movements, with an emphasis on kicking and footwork, and served as a primary form of martial training in Korean society (Park & Kim, 2019).

Over time, as Korea encountered external influences, especially from neighboring China and Japan, martial techniques began to adapt and incorporate elements from other cultures, notably Karate from Japan, which became prominent in the early 20th century (Rozenfeld, 2020). This amalgamation of traditional Korean martial arts and foreign influences led to the development of a new form of martial art, which would become Taekwondo. In the 1950s, Taekwondo became formalized as a distinct martial art under the leadership of several Korean masters, most notably Choi Hong Hi (Moenig & Kim, 2021).

The core principles of Taekwondo combined elements of Taekkyeon, Karate, and Hwa Rang Do. What set Taekwondo apart was its emphasis on powerful and high kicks, as well as its distinctive forms and self-defense techniques. Initially, Taekwondo was practiced primarily for self-defense, discipline, and physical fitness, with practitioners focusing heavily on footwork and kicks (Fong, 2014). They sought to develop a Korean martial art that preserved cultural traditions while incorporating the best aspects of modern combat sports. After World War II and the Korean War (1950-1953), Korea was left in a state of devastation. Martial artists began meeting and discussing the need to unify Korean martial arts into a single system that could represent Korea internationally (Millett, 2021).

The result was the formalization of Taekwondo. At the same time, Korean martial artists began to incorporate modern combat techniques from Karate, which emphasized powerful hand techniques, and Taekkyeon, which focused on high kicks and fluid movements. These influences blended into what we now recognize as Taekwondo. Choi Hong Hi, in particular, played a crucial role in promoting Taekwondo and spreading it globally. In 1961, the Korea Taekwondo Association

(KTA) was founded, and the martial art was officially recognized as the national sport of Korea (Moenig & Kim, 2021).

Taekwondo continues to grow as a symbol of Korean heritage, with millions of practitioners across the globe. From its ancient origins in Korea's martial traditions to its modern-day role as an Olympic sport, Taekwondo's journey is a testament to its adaptability and resilience. It remains a martial art that transcends borders, bringing together people from diverse backgrounds and cultures in pursuit of excellence. The enduring legacy of Taekwondo serves as a reminder of the martial art's roots in the ancient combat traditions of Korea, while embracing modernity and progress in the martial arts world. The global population ages, there is an increasing need for effective approaches to maintain cardiovascular health and flexibility in older adults. Traditional fitness programs often fail to meet the specific needs of individuals over 50 (Bethancourt et al., 2014). Taekwondo, with its focus on cardiovascular fitness, flexibility, and functional movement, offers potential benefits but remains underexplored for this age group. This study aims to investigate the impact of Taekwondo training on improving cardiovascular health and flexibility in adults over 50, providing a functional approach to healthy aging.

Introduction to Taekwondo Training and Healthy Aging

Taekwondo, a dynamic Korean martial art known for its powerful kicks, punches, and high-energy techniques, offers a wide range of benefits, particularly for older adults. As we age, maintaining physical and mental health becomes a priority, and healthy aging refers to the ability to stay active, independent, and engaged while managing any health conditions that might arise (Segal et al., 2018). Taekwondo is more than just a physical exercise; it promotes a holistic approach to aging by improving physical fitness, enhancing mental clarity, and fostering emotional well-being. Training in Taekwondo can thus play a significant role in promoting a healthy aging process by addressing key health concerns like mobility, strength, and cognitive function.

Aging is a natural process that affects individuals physically, mentally, and emotionally. As the global population ages, promoting healthy aging becomes increasingly important. Healthy aging is not just about adding years to life, but

ensuring those years are full of vitality, independence, and well-being (Chockalingam et al., 2024). Regular physical activity is crucial to achieving this. Among various forms of exercise, Taekwondo stands out as a martial art that provides a holistic approach to aging by improving mobility, strength, cognitive function, and emotional health.

This sense of autonomy is crucial for maintaining self-esteem and overall well-being in older age. Finally, Taekwondo also contributes to posture and body alignment. As we age, posture can deteriorate, leading to back pain and other musculoskeletal problems (Kim et al., 2022). Taekwondo's focus on stances and proper body alignment can help counteract this issue. Regular practice improves posture, strengthens the core, and enhances spinal alignment, all of which are essential for reducing the risk of back pain and maintaining a healthy, upright posture as we age (Yamak et al., 2018).

Overview of Taekwondo as a Physical Activity

Taekwondo is a dynamic and fast-paced martial art that originated in Korea, renowned for its distinctive techniques, particularly high-flying kicks, swift strikes, and rapid movements. These movements are not only visually impressive but also require a high level of agility, balance, and coordination (Latash, 2018). The sport is built around these dynamic techniques, which involve powerful strikes with the hands, feet, and legs, often targeting various parts of the opponent's body. This makes Taekwondo a highly engaging and physically demanding activity that can help individuals develop strength, endurance, and flexibility (Yilmaz, 2021).

Taekwondo offers a comprehensive workout that engages both the body and the mind. Its focus on high-intensity physical activity, combined with the development of mental strength, makes it an excellent choice for people looking to improve their overall fitness, build self-confidence, and cultivate discipline. Whether practiced as a sport, self-defense skill, or physical fitness regimen, Taekwondo promotes a healthy, active lifestyle while offering numerous benefits for people of all ages (Kim et al., 2022).

The Importance of Physical Activity in Healthy Aging

Physical activity is essential for healthy aging, offering numerous benefits that

support both physical and mental well-being as individuals grow older. As people age, the body experiences natural changes, such as a decline in muscle mass, bone density, and flexibility, as well as a reduction in cardiovascular function. These age-related changes can lead to decreased mobility, increased risk of falls, chronic health conditions, and a general decline in overall health. However, regular physical activity can help mitigate these effects, improving quality of life and promoting independence in later years.

As people age, the risk of heart disease and stroke increases due to factors like hypertension, high cholesterol, and reduced blood circulation (D'Onofrio et al., 2023). Regular exercise, such as walking, swimming, or cycling, helps maintain heart health by improving blood flow, reducing blood pressure, and lowering cholesterol levels. Exercise strengthens the heart and enhances the efficiency of the cardiovascular system, reducing the risk of cardiovascular diseases and enhancing overall vitality. Muscle strength and bone health are another critical aspect of healthy aging that physical activity can address (Tian & Meng, 2019).

Cardiovascular Health and Taekwondo

Cardiovascular health refers to the well-being of the heart and blood vessels, which are essential for maintaining overall physical health and well-being. As people age, maintaining good cardiovascular health becomes increasingly important to reduce the risk of heart disease, stroke, and other related conditions (Campbell et al., 2019). One of the most effective ways to improve cardiovascular health is through regular physical activity, and Taekwondo offers a unique and dynamic approach to achieving this. Taekwondo is an aerobic exercise, which means it increases the heart rate and improves the efficiency of the cardiovascular system. During a typical Taekwondo class, participants engage in a variety of high-intensity activities, such as kicking, punching, footwork drills, and sparring. These movements challenge the heart by requiring it to pump more blood to deliver oxygen to the muscles, which, over time, strengthens the heart muscle and improves overall cardiovascular function (Mathunjwa, 2019). Taekwondo training helps increase stamina, endurance, and cardiovascular efficiency. One of the key benefits of Taekwondo for cardiovascular health is enhanced heart efficiency. The repetitive and rhythmic nature of many

Taekwondo movements improves circulation and boosts heart rate, leading to a more efficient cardiovascular system.

Taekwondo is also beneficial for weight management, which is closely tied to cardiovascular health. Maintaining a healthy weight is important for preventing heart disease, as excess weight can put additional strain on the heart and blood vessels (Samuel et al., 2024). The high-intensity nature of Taekwondo helps burn calories and fat, which can lead to weight loss and help maintain a healthy body composition. Regular exercise like Taekwondo helps regulate metabolic functions, improving insulin sensitivity and reducing the risk of developing conditions like type 2 diabetes, which can negatively affect cardiovascular health. Taekwondo is a powerful and enjoyable way to improve cardiovascular health.

Through its combination of aerobic exercise, strength training, and stress relief, Taekwondo helps increase heart efficiency, lower blood pressure, manage cholesterol levels, and promote overall heart health. It also provides a fun and engaging way to stay fit while reducing the risk of cardiovascular diseases. By incorporating Taekwondo into a regular fitness routine, individuals can experience lasting benefits for their cardiovascular health and overall well-being.

The primary objectives of this study are twofold. First, it aims to evaluate the impact of Taekwondo training on cardiovascular health in adults over 50, specifically focusing on improvements in heart rate and overall cardiovascular function. The hypothesis (H_1) posits that Taekwondo training significantly enhances cardiovascular health in older adults, leading to a reduction in resting heart rate and an improvement in cardiovascular performance. Second, the study seeks to assess the effects of Taekwondo on flexibility in older adults, with the hypothesis (H_2) suggesting that regular Taekwondo training leads to a significant increase in flexibility, resulting in enhanced joint mobility and muscle flexibility. This investigation will explore whether Taekwondo training can effectively contribute to both cardiovascular health and physical flexibility in adults aged 50 and above.

Materials and Methods

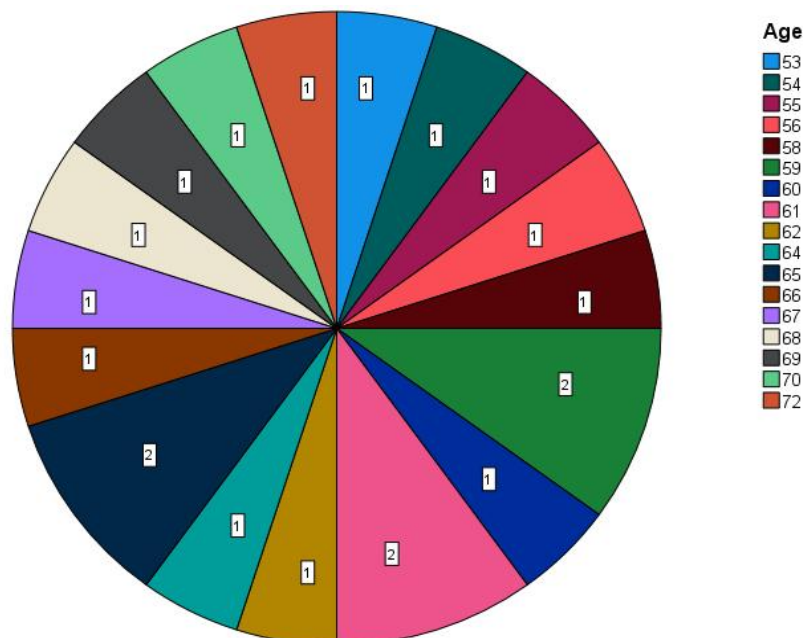
The study was conducted at one primary location: Fit Grid Taekwondo Club. The Taekwondo club had fully equipped fitness facilities, including spaces for physical

activity, cardiovascular testing equipment, and flexibility assessment tools. The research design was quasi-experimental, involving a comparison between pre- and post-intervention measurements. The training program was structured as follows: the duration was 08 weeks, with 4 sessions per week, and each session lasted 40 minutes. The target participants were adults aged 50 and above, with no prior experience in Taekwondo training. The focus was on improving cardiovascular health and flexibility through structured Taekwondo training. In the baseline testing, the objective was to assess initial cardiovascular health and flexibility levels. Cardiovascular health was measured using a 3-minute step test, and flexibility was assessed using the Sit-and-Reach Test, which is a standard test for lower back and hamstring flexibility. The Taekwondo training program had a core structure focusing on flexibility, cardiovascular endurance, and overall physical fitness, using a functional Taekwondo approach. The session breakdown was as follows: during the warm-up (10 minutes), dynamic stretching focused on major muscle groups (e.g., leg swings, hip circles) along with light aerobic activity (e.g., jogging, jumping jacks) to increase heart rate and warm up muscles. The main workout (20 minutes) consisted of core Taekwondo techniques, including basic movements such as kicks, punches, and stances to improve cardiovascular endurance and overall fitness. Flexibility exercises included Taekwondo-specific drills to enhance the range of motion, especially in the hips, hamstrings, and shoulders. Conditioning involved dynamic movements such as jump kicks, spinning techniques, and lateral movements to improve agility and cardiovascular function. In the cool-down (10 minutes), static stretching focused on the muscles used during the session, and breathing exercises were used for muscle recovery and relaxation. Post-intervention testing was conducted at the end of the 08-week Taekwondo training program to measure progress and changes in cardiovascular health and flexibility. Data was collected through pre- and post-intervention testing. Baseline tests were conducted before the start of the intervention, followed by the 08-week Taekwondo training program, and post-intervention tests were conducted at the end of the 08-week period. The total sample size was 20 participants, based on previous studies and power analysis for detecting significant differences. Purposive sampling was used to select participants

based on inclusion criteria. Participants were recruited from local community centers, sports clubs, and healthcare facilities. Inclusion criteria for the study were as follows: adults aged 50 and above, no prior experience in Taekwondo training, physically capable of engaging in moderate-intensity physical activity, and consent to participate in the study for the entire 08-week duration. Exclusion criteria included individuals with medical conditions that limit physical activity, such as uncontrolled cardiovascular diseases or orthopedic problems, and participants with current injuries affecting flexibility or cardiovascular performance. For statistical analysis, descriptive statistics, including mean, standard deviation, and percentage changes for cardiovascular health and flexibility measures, were used. The normality of data was checked, and data was normal, paired sample t-tests were used to compare pre- and post-intervention data. A significance level of $p < 0.05$ was set for the analysis.

Results

Figure 1



Note. This figure shows the age distribution of the participants.

Table 1: *Tests of Normality*

	Shapiro-Wilk		
	Statistic	df	Sig.
Pre-Intervention Cardiovascular Heart Rate	.981	20	.944
Post-Intervention Cardiovascular Heart Rate	.961	20	.557
Pre-Intervention Flexibility Sit& Reach Test in cm	.953	20	.420
Post-Intervention Flexibility Sit& Reach Test in cm	.935	20	.191

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. The Shapiro-Wilk test for normality showed no significant deviation from normality for all variables. Pre- and post-intervention cardiovascular heart rate, as well as flexibility Sit & Reach test data, had p-values above .05, indicating normal distribution.

Table 2: *Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error
Pair 1	Pre-Intervention Cardiovascular Health Heart Rate	87.10	20	4.844	1.083
	Post-Intervention Cardiovascular Health Heart Rate	83.75	20	4.633	1.036
Pair 2	Pre Intervention Flexibility Sit & Reach Test in cm	85.40	20	4.639	1.037
	Post Intervention Flexibility Sit & Reach Test in cm	92.65	20	3.774	.844

Note. The paired samples statistics show the results of two tests conducted before and after an intervention. For cardiovascular health (measured by heart rate), the average pre-intervention heart rate was 87.10 beats per minute with a standard deviation of 4.844, while the post-intervention heart rate decreased to an average of 83.75 beats per minute, with a standard deviation of 4.633. This suggests a reduction

in heart rate after the intervention. For flexibility (measured by the Sit & Reach Test), participants had an average pre-intervention score of 85.40 cm with a standard deviation of 4.639, and the average post-intervention score increased to 92.65 cm with a standard deviation of 3.774, indicating an improvement in flexibility following the intervention. The standard errors show the accuracy of the sample mean estimates, indicating the results are relatively consistent.

Table 3: *Paired Samples Correlations*

		N	Correlation	Sig.
Pair 1	Pre-Intervention Cardiovascular Health Heart Rate &20	.982		.000
	Post-Intervention Cardiovascular Health Heart Rate			
Pair 2	Pre Intervention Flexibility Sit & Reach Test in cm &20	.793		.000
	Post Intervention Flexibility Sit & Reach Test in cm			

Note. The paired samples correlations show the relationship between pre- and post-intervention measurements. For cardiovascular health (heart rate), there is a very strong positive correlation of 0.982 between the pre- and post-intervention heart rates, with a significance level of 0.000, meaning the reduction in heart rate after the intervention is highly significant and closely linked to the pre-intervention heart rate. For flexibility (Sit & Reach Test), there is a moderate positive correlation of 0.793 between the pre- and post-intervention scores, also with a significance level of 0.000, indicating a significant improvement in flexibility that is moderately related to the pre-intervention flexibility scores. Both correlations are statistically significant, meaning the changes observed are unlikely to be due to chance.

Table 4: *Paired Samples Test*

Paired Differences									
95%									
		Std.	Std.	Confidence				Sig.	
	Mean	Deviation	Error	Interval of the				(2-	
			Mean	Difference	t	df		tailed)	
Lower Upper									
Pair	Pre-Intervention	3.350	.933	.209	2.913	3.787	16.052	19	.000

2	Cardiovascular Health Heart	Hedges' 2.883	-2.514	-3.408	-1.605
	Rate & Post-Intervention	correction			
	Cardiovascular Health Heart				
	Rate				

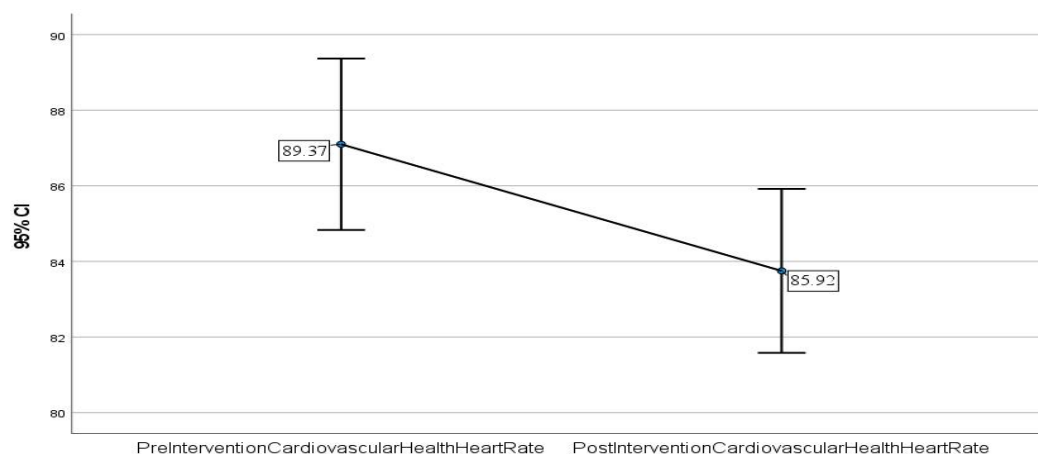
a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation of the mean difference.

Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Note. The effect sizes demonstrate substantial changes from the intervention. For cardiovascular health (heart rate), Cohen's d is 0.933 (confidence interval: 2.369 to 4.796), indicating a large effect, with Hedges' correction giving a slightly higher value of 0.952 (confidence interval: 2.322 to 4.701). For flexibility (Sit & Reach), Cohen's d is 2.826 (confidence interval: -3.478 to -1.637), signifying a very large effect, with Hedges' correction yielding 2.883 (confidence interval: -3.408 to -1.605). Both measures show significant, large effects, highlighting the meaningful impact of the intervention.

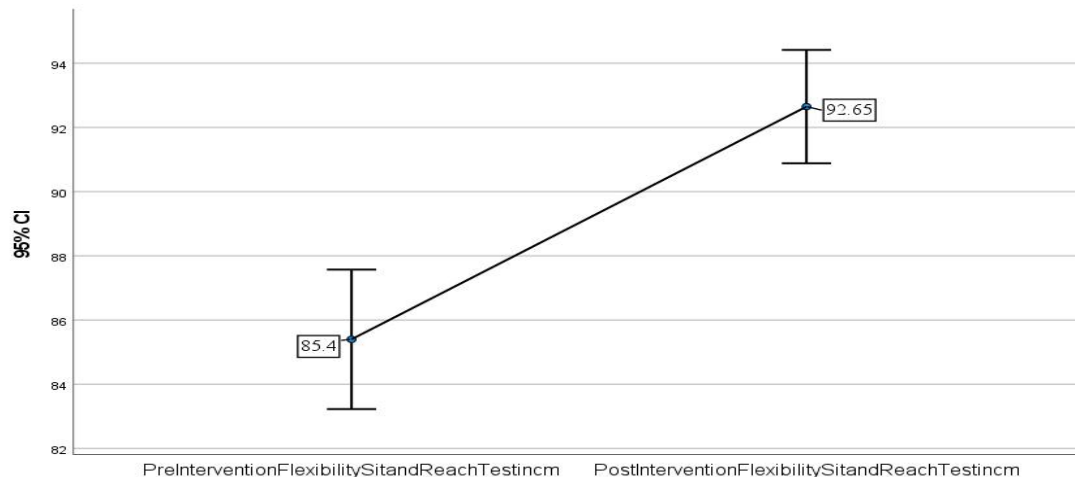
Figure 2



Note. This graph presents a comparison of cardiovascular health, as measured by heart rate, before and after an intervention. The plot shows the mean heart rate values at two time points: Pre-Intervention (89.37) and post-intervention (85.92). The error bars represent the 95% confidence intervals, indicating the range within which the true mean heart rate is likely to fall. The heart rate decreased from pre-

intervention to post-intervention, suggesting a positive effect of the intervention on cardiovascular health, as evidenced by the lower post-intervention heart rate and overlapping confidence intervals indicating statistical reliability.

Figure 3



Note. This graph illustrates a change in flexibility, as measured by the Sit and Reach Test, before and after an intervention. The mean values for flexibility are shown at two points: Pre-Intervention (85.4 cm) and post-intervention (92.65 cm). The error bars represent the 95% confidence intervals, showing the range where the true mean flexibility values are likely to fall. The increase in flexibility from pre- to post-intervention indicates a positive effect of the intervention, with the post-intervention score being significantly higher and supported by the confidence intervals.

Discussion

The aging global population faces challenges in maintaining cardiovascular health and flexibility, as traditional fitness programs often fail to meet the unique needs of individuals over 50. Taekwondo, with its dynamic movements, offers a holistic solution by combining cardiovascular conditioning, strength training, and flexibility exercises, essential for healthy aging (Chockalingam et al., 2024; Demir, 2022). Research has shown that regular exercise, including flexibility training, is vital to prevent declines in muscle mass, cardiovascular health, and joint mobility (Bethancourt et al., 2014; Nelson & Kokkonen, 2021). Taekwondo improves cardiovascular efficiency, flexibility, and joint health, especially in the hips, hamstrings, and lower back, crucial areas affected by aging (Mathunjwa, 2019;

Yılmaz, 2021). Additionally, its functional movements support independence in daily tasks and reduce fall risk, while mental benefits, such as stress reduction and cognitive enhancement, improve overall well-being (Izquierdo et al., 2021; Weiss & Miller, 2019). This study aims to evaluate the impact of Taekwondo on cardiovascular health and flexibility in adults aged 50 and above, offering empirical evidence of its benefits for promoting healthy aging.

Conclusion

Taekwondo training is shown to be a highly beneficial activity for older adults, significantly improving cardiovascular health and flexibility. The reduction in resting heart rate and the improvement in flexibility scores indicate that Taekwondo can effectively enhance cardiovascular function and joint mobility. This study highlights the importance of including dynamic and holistic exercise programs like Taekwondo in fitness routines for seniors. The combination of strength, endurance, flexibility, and mental focus makes Taekwondo an excellent choice for promoting functional aging and improving quality of life in older adults.

Limitations of the Study

The limitations of this study include a small sample size, which may limit the generalizability of the results to a broader population of adults over 50. The study's duration may not capture long-term effects of Taekwondo training on cardiovascular health and flexibility. Participant compliance could vary, potentially impacting the consistency of the results. Additionally, other factors such as diet, pre-existing health conditions, and medications may influence the outcomes, making it difficult to isolate the effects of Taekwondo alone. Variability in measurement tools for assessing cardiovascular health and flexibility may also affect the accuracy of the results. Some participants with significant pre-existing conditions might find it challenging to fully engage in Taekwondo training, which could limit their ability to benefit from the program. The absence of a control group makes it difficult to compare the effects of Taekwondo with those of other fitness programs. Finally, participant selection bias may occur, as those who choose to join the study are likely to be more health-conscious or active, which may skew the findings toward more positive outcomes.

Recommendations

Integration of Taekwondo into Senior Fitness Programs: Based on the results of this study, it is recommended that Taekwondo be incorporated into fitness programs specifically designed for older adults. Its benefits for cardiovascular health, flexibility, and overall physical fitness can play a significant role in promoting healthy aging.

Further Research: Future studies should investigate the long-term effects of Taekwondo on older adults, including its impact on mental health and cognitive function. Additionally, exploring the effects of different Taekwondo training frequencies or intensities could provide deeper insights into optimal training regimens for seniors.

Tailoring Programs for Diverse Health Conditions: Fitness programs for seniors should be tailored to accommodate varying levels of health and fitness. It is recommended to offer beginner-level classes that gradually build cardiovascular endurance and flexibility to ensure that older adults with different fitness levels can participate and benefit.

Policy Implications

Policy on Senior Fitness: Governments and health organizations should consider including Taekwondo as part of their recommended physical activity programs for older adults. Taekwondo's cardiovascular and flexibility benefits align well with public health initiatives aimed at promoting active aging and preventing chronic diseases associated with aging.

Health and Fitness Policies for Aging Populations: Healthcare policies should incorporate guidelines that encourage physical activity for older adults, emphasizing martial arts and functional fitness as effective ways to enhance physical health. By promoting evidence-based fitness programs like Taekwondo, policymakers can support the well-being of aging populations and reduce healthcare costs associated with age-related diseases.

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