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Original Research Article

Comparison of Physical Fitness of Children Training Ju-jitsu with Their Non-Training Peers

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Abstract

Background: Regular physical activity is crucial for the healthy development of children The aim of this study was to compare the physical fitness of children training in ju-jitsu with their non-training peers. **Methods:** The study involved 30 children aged 10-12, divided into two groups: 15 children training in ju-jitsu and 15 non-training children. A modified version of the EUROFIT test was conducted, including tests for hand and foot movement speed, flexibility, explosive strength, static strength, abdominal muscle strength, arm and chest strength, and running endurance. **Results:** The results indicate that children training in ju-jitsu show significantly better performance in most tests, suggesting that ju-jitsu training positively impacts the development of various aspects of physical fitness. An exception was static strength, where no significant differences were observed. **Conclusion:** The study highlights the benefits of regular ju-jitsu training for children, such as improved coordination, flexibility, explosive strength, abdominal muscle strength, arm and chest strength, and endurance. The conclusions can be useful for coaches, parents, and children interested in combat sports**.**

Keywords: Ju-jitsu, EUROFIT test, physical fitness

Introduction

The name "Ju-jitsu" consists of two words: "ju," which means "gentle" or "flexible," and "jitsu," which means "art". This name reflects the principles of this martial art, which involve yielding to a stronger opponent, gentleness, and finesse in techniques, supported by comprehensive physical fitness. Ju-jitsu is not just a collection of techniques but also a practical philosophy of combat that can become a system of behaviours and habits in dangerous situations. It involves adapting appropriate holds, throws, strikes, and kicks to the circumstances of the attack. The goal is to restrain the attacker, even if they are stronger or armed [1,2]. Ju-jitsu is a martial art in which practitioners learn and perfect combat techniques, as well as philosophical and religious principles that influence their lifestyle [3]. It can also be practiced as a sport, where competitors engage in matches according to specific rules. This sporting form requires proper physical preparation, and victory brings recognition and prestige. The principles of Ju-jitsu also demand mental fitness from its practitioners. They must be able to remain calm and focused in stressful situations.

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Additionally, they must be able to make quick decisions and adapt to changing conditions during combat [4]. It is also an excellent way to prepare young people for future social roles they will play in a healthy and safe society [5].

Physical fitness is an important factor for those training in Ju-jitsu. This is because Ju-jitsu is a physically demanding martial art that requires strength, endurance, flexibility, and agility. Ju-jitsu practitioners must be able to endure long periods of combat and perform rapid techniques with appropriate force [6–8]. Therefore, it is crucial for those training in Ju-jitsu to focus on improving their overall physical fitness. Training in sport Ju-jitsu can be an effective method for developing physical fitness due to the comprehensive motor and physiological demands placed on the athlete's body [4,9,10].

Literature analysis indicates that the most important physical fitness traits associated with sports performance in combat sports are hand-eye coordination, maximum anaerobic power, arm strength, endurance, movement speed, and flexibility [11–14]. Therefore, the training of Ju-jitsu athletes should positively impact strength, endurance, flexibility, and movement speed.

The objective of this study is to compare the physical fitness of children training Ju-jitsu with their non-training peers. The analysis includes the assessment of various aspects of physical fitness, such as strength, endurance, flexibility, and movement speed, and examines how regular Ju-jitsu training affects the development of these traits in children. Additionally, the study aims to understand to what extent Ju-jitsu training can contribute to improving overall physical fitness and preparing children for future challenges and social roles.

Material and Methods

Participants

The study participants were a group of 30 children from grades 4, 5, and 6 of primary school. The group was divided into two subgroups:

1. The Ju-jitsu training group consisted of 15 of the best children training Ju-jitsu at the Ju-jitsu RONIN Kraków club. These children had been training Ju-jitsu for at least 2 years and had participated in competitions.
2. The control group consisted of 15 children who did not train Ju-jitsu. These children practiced other sports, such as soccer, basketball, or swimming.

All the children were healthy and had no contraindications for participation in the study. Before the study began, the parents or guardians of the children signed consent forms for their participation (Table 1).

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Children from grades 4, 5, and 6 of primary school (ages 10-12) Study participants without contraindications to physical activity, confirmed by a doctor Obtaining written consent from parents or guardians for the child's participation in the study Ju-jitsu training group: Children training Ju-jitsu at the Jiu Jitsu RONIN Kraków club for at least 2 years, with competition participation Control group: Children who do not train Ju-jitsu but practice other sports such as soccer, basketball, or swimming	Children with any medical contraindications to participating in the study or physical activity Lack of written consent from parents or guardians for the child's participation in the study Children who cannot participate in the full study period or in key physical fitness tests

Measurement of general Physical Fitness

The study project involved conducting a modified version of the European Physical Fitness Test EUROFIT [15] for individuals aged 10-17, consisting of the following elements:

1. Hand Tapping Test: This test measures the speed and coordination of the child's hands.
2. Foot Tapping Test: This test measures the speed and coordination of the child's feet.
3. Flexibility Test - Sit and Reach: This test measures the flexibility of the child's spine and hamstrings.
4. Explosive Strength Test - Standing Long Jump: This test measures the leg strength and power generation ability of the child.
5. Static Strength Test - Handgrip Measurement Using a Dynamometer: This test measures the child's grip strength.
6. Abdominal Muscle Strength - Sit-ups in 30 seconds: This test measures the endurance of the child's abdominal muscles.
7. Arm and Chest Strength - Push-ups in 60 seconds: This test measures the endurance of the child's arm and chest muscles.
8. Endurance Running Test - Beep Test: This test measures the cardiovascular endurance of the child.

All tests were conducted according to the EUROFIT protocol, with the following modifications.

Modifications Applied in the Study:

1. Removal of the balance test.
2. Substitution of the functional strength test (hanging on a bar) with push-ups.
3. Substitution of the running endurance test (agility) and the multistage shuttle run with the beep test.

Reasons for Modifications.

The modifications were applied to adapt the EUROFIT test to the requirements of combat sports such as Ju-jitsu. The tests that were removed were not considered essential for assessing the physical fitness of children training in Ju-jitsu.

Results

The results in Tables 2 and 3 indicate that training can improve both hand and foot movement speed in children. Children who train achieved significantly better results in both tests compared to children who do not train. These differences were statistically significant ($p < 0.001$).

Table 2. Hand Tapping Test - Comparison of Training and Non-Training Children

Hand Tapping Test (s)	$\bar{x}$	Min.	Max.	SD	t	p
Training	11.53	10.00	14.00	1.30	-6.18	<0.001
Non-Training	15.67	13.00	21.00	2.50		

X- Mean, SD- Standard Deviation, Min- minimum, Max- maximum, p- p-value,

Table 3. Foot Tapping Test - Comparison of Training and Non-Training Children

Foot Tapping Test (s)	$\bar{x}$	Min.	Max.	SD	t	p
Training	13.13	11.00	15.00	1.25	-8.07	<0.001
Non-Training	18.80	16.00	25.00	2.46		

The results in Table 4 present the outcomes of the flexibility test (sit and reach) conducted on the group of training and non-training children. The results indicate that training children have significantly better flexibility compared to non-training children.

This difference is statistically significant ($p < 0.001$), which means it is unlikely to have occurred by chance.

The range of results is greater in the training children group, indicating higher flexibility within this group.

Table 4. Flexibility Test, Sit and Reach: Comparison of Training and Non-Training Children

Flexibility Test (cm)	$\bar{x}$	Min	Max	SD	t	p
Training	16.47	11.00	24,00	3.76	7.78	<0.001
Non-Training	5.47	0,00	15.00	4.67		

Explosive strength is a key element in Ju-jitsu because it allows athletes to perform quick and powerful movements, such as; throwing the opponent to the mat, moving from one position to another, forcing the opponent to submit.

The results presented in Table 5 suggest that children training in Ju-jitsu have significantly greater explosive strength than non-training children.

In addition to the benefits in the context of Ju-jitsu, better explosive strength can also benefit the overall physical fitness of children, improving their ability to perform other activities requiring speed and power, such as running, jumping, and throwing.

Table 5. Explosive Strength Test, Standing Long Jump: Comparison of Training and Non-Training Children

Explosive Strength (cm)	$\bar{x}$	Min	Max	SD	t	p
Training	180.47	156.00	212.00	18.33	5.75	<0.001
Non-Training	137.13	98.00	175.00	21.89		

Static strength refers to the ability to maintain force over a prolonged period of time. In Ju-jitsu, static strength is important for: holding the opponent in a specific position, controlling the opponent by applying pressure to prevent them from escaping or attacking, applying joint locks, which involve holding the opponent's limb in a position that causes pain or discomfort, forcing them to submit.

The results presented in Table 6 suggest that there is no significant difference in static strength between children training in Ju-jitsu and non-training children. This may indicate that ju-jitsu training does not have a significant impact on static strength in children.

Table 6. Static strength test, measurement of hand strength using a dynamometer: comparison of children who train and do not train

Static strength (kg)	$\bar{x}$	Min	Max	SD	t	p
Training	22.36	15.60	35.10	4.93	0.65	0.53
Non-Training	21.09	13.80	34.9	6.05		

Abdominal muscle strength is important in Ju-jitsu, for example, for defense against takedowns (strong abdominal muscles help maintain an upright position and stabilize the body).

The results presented in Table 7 suggest that children training in Ju-jitsu have significantly stronger abdominal muscles than non-training children. This is likely due to the fact that Ju-jitsu training includes many exercises that strengthen the abdominal muscles.

Table 7. Abdominal Muscle Strength, Sit-Ups in 30 Seconds: A Comparison of Children Who Train and Do Not Train

Sit-Ups (number of repetitions)	$\bar{x}$	Min	Max	SD	t	p
Training	26.07	20.00	40.00	5.06	6.38	<0.001
Non-Training	18.07	10.00	26.00	4.06		

Arm and chest strength is important in Ju-jitsu because it allows for controlling the opponent, holding them in specific positions, and preventing their escape, as well as supporting defensive actions during a fight.

The results presented in Table 8 suggest that children training in Ju-jitsu have significantly stronger arms and chest compared to non-training children. This is likely due to the fact that Ju-jitsu training includes many exercises that strengthen the arms and chest.

Table 8. Arm and chest strength, push-up hold for 60 seconds: a comparison of children who train and those who do not

Push-up (number of repetitions)	$\bar{x}$	Min	Max	SD	t	p
Training	26.20	18.00	40.00	6.05	6.54	<0.001
Non-Training	10.20	4.00	20.00	4.99		

Endurance (Table 9) is important in Ju-jitsu for athletes to maintain a high level of intensity throughout the duration of the fight. The test results indicate statistically significant differences between the two groups ($t = 6.56$, $p < 0.001$). Children training in Ju-jitsu show significantly higher running endurance compared to non-training children.

Table 9. Running endurance test, beep test: comparison of children who train and those who do not

Beep test (level)	$\bar{x}$	Min	Max	SD	t	p
Training	6.98	5.40	9.30	1.56	6.56	<0.001
Non-Training	4.63	2.80	7.90	1.29		

Discussion

The conducted studies have shown that regular Ju-jitsu training has a significant impact on the development of physical fitness in children. Analyzing the results of the individual tests, one can observe significant differences between training and non-training children, indicating the benefits of practicing this martial art. The research also provides important information on the benefits of engaging in this form of physical activity.

The results of the hand and foot movement speed tests indicate significant differences between training and non-training children. Children training in Ju-jitsu achieved significantly better results in both tests, suggesting that this training can significantly improve neuromuscular coordination and movement speed. These results are consistent with previous studies on physical fitness in combat sports, which emphasize the importance of speed and coordination in achieving sports success [4,10,16,17].

Studies on flexibility also showed significant differences in favor of children training in Ju-jitsu. These results are statistically significant, indicating the high effectiveness of Ju-jitsu training in improving flexibility. Flexibility is crucial in many aspects of combat sports, allowing for a greater range of motion and reducing the risk of injury. Improving flexibility in children training in Ju-jitsu can also bring benefits in daily life, enhancing their posture and overall physical fitness. Other authors have concluded that yoga, Brazilian jiu-jitsu, and tai chi are effective in improving trunk flexibility. Yoga appears to be the most effective of these methods, followed by Brazilian jiu-jitsu, and tai chi [18–23].

The explosive strength test showed that children training in Ju-jitsu have significantly greater explosive strength than non-training children. This is consistent with previous research on combat sports, which emphasizes the importance of dynamic strength in such disciplines [24]. In the context of Ju-jitsu, explosive strength is essential for performing quick and dynamic movements, such as throws, takedowns and counterattacks. Better explosive strength also brings benefits to overall physical fitness, improving children's ability to perform other activities requiring speed and power, such as running, jumping, and throwing [25].

The results of the static strength test did not show significant differences between training and non-training children. This may suggest that Ju-jitsu training, while effective in improving other aspects of physical fitness, does not have a significant impact on static strength in children. However, the results of another study suggest that Ju-jitsu training is effective in improving static strength. Individuals who participated in a Ju-jitsu training program showed a significant improvement in plank hold time, which is a measure of static strength [26].

The abdominal muscle strength test showed that children training in Ju-jitsu have significantly stronger abdominal muscles than non-training children. Strong abdominal muscles are crucial in Ju-jitsu, helping in defense against takedowns, performing joint locks, and maintaining positions. These results are consistent with previous studies that emphasize the importance of abdominal muscle training in combat sports [4]. Better abdominal muscle strength can also bring benefits in daily life, improving stability and reducing the risk of injuries.

The results of the arm and chest strength tests showed that children training in Ju-jitsu have significantly stronger arms and chest compared to non-training children. This is consistent with previous studies that emphasize the importance of arm and chest strength in combat sports [27–29]. In Ju-jitsu, strong arms and chest are essential for controlling the opponent, performing joint locks, and defending against chokes. Better arm and chest strength can also bring benefits in daily life.

The results of the running endurance test suggest that children training in Ju-jitsu have significantly better running endurance than non-training children. Statistically significant differences ($t = 6.56$, $p < 0.001$) show that regular ju-jitsu training significantly improves cardiovascular endurance, which is crucial for maintaining a high level of intensity throughout the duration of the fight. Better running endurance can also facilitate participation in other physical activities.

Limitations of the Study and future research directions

Although the results are promising, certain limitations of the study should be considered. Firstly, the sample size was relatively small, which may affect the representativeness of the results. Secondly, the study included children only from one primary school and one Ju-jitsu club, which may limit the diversity of the sample. Future research should include a larger and more diverse group of participants, as well as additional physical fitness tests, to better understand the impact of Ju-jitsu training on various aspects of physical fitness. It is important to note that this study was cross-sectional, meaning that no causal conclusions can be drawn. To determine whether Ju-jitsu training actually causes these changes, further research, such as experimental studies with a control group, would be necessary

Conclusions

Studies have shown that regular Ju-jitsu training significantly improves various aspects of physical fitness in children, including speed, flexibility, explosive strength, abdominal muscle strength, arm and chest strength, and endurance. Significant differences can be observed between training and non-training children, indicating the benefits of practicing this martial art.

Ju-jitsu training enhances coordination and movement speed of hands and feet, which is crucial for effectiveness in combat. Increased flexibility resulting from Ju-jitsu training allows for performing more advanced techniques, which can contribute to better sports performance. Explosive strength is a key element in Ju-jitsu, enabling quick and effective execution of certain techniques.

Cardiovascular endurance is essential for maintaining a high level of intensity throughout the duration of the fight, emphasizing the importance of endurance in Ju-jitsu training.

Practical Implication

Ju-jitsu coaches should focus on developing all aspects of physical fitness, including speed, flexibility, explosive strength, abdominal muscle strength, arm and chest strength, and endurance, to ensure the comprehensive development of children training in Ju-jitsu. Coaches should regularly monitor the progress of children in various aspects of physical fitness to adjust the intensity and type of exercises to their needs. It is worth considering Ju-jitsu training as a form of activity that shapes overall physical fitness, providing a foundation for other sports.

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