

Sacred Heart University

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**TO WHAT EXTENT DOES MARTIAL ARTS BENEFIT CHILDREN AND
ADOLESCENTS, AND HOW DOES THIS COMPARE TO OTHER, MORE
TRADITIONAL SPORTS?**

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INTRODUCTION

Physical inactivity increases the risk of death by 20-30% compared to physically active individuals.¹ Worldwide, 80% of adolescents are not physically active enough, and with the rise in childhood obesity, the problem cannot be addressed too soon.^{2,3} Any activity that keeps children active is one that they should keep doing, but there are more efficient and beneficial ways of participating and getting the most out of the activity that children and adolescents do.^{3,4} The lasting and far reaching effects of physical activity includes the physical health, social functioning, mental health, activity levels and overall quality of life that an individual can have.^{4,5}

There are more than 100 styles of martial arts worldwide, with the most popular being Karate, Judo, Taekwondo, Kung Fu, and Mixed Martial Arts.⁶ Taekwondo alone is practiced by more than 30 million people worldwide.⁶ In the United States alone, martial arts boasts a participation of more than 6.5 million children.⁷ Martial arts falls into a category known as combat sports, which means that it is a competitive contact sport between individuals following a set of rules to simulate real fighting.⁶ To understand the full reach of the martial arts umbrella, see Appendix 1 for a visual that breaks down the types of martial arts based on location of origin and style of fighting; pay particular attention to the most common styles of martial arts as previously mentioned, as those are the ones most studied. The purpose of this literature review is to explore the topic of martial arts as its benefits children and adolescents and to compare these benefits to the benefits of other, more traditional sports.

To start this review, the first area of focus is the physical benefits that martial arts offers. These include flexibility, strength, endurance, and power.^{6,8} The participation in combat sports also causes osteogenic changes, with significant bone growth and increased bone mineral density.⁹ Another area of focus is the social functioning and mental health benefits that participation in martial arts has to offer. Benefits in feelings of independence, self-control, and self-esteem are seen in addition to social benefits such as increased sociability, patience, good attitude, and increased discipline.^{8,10} Other findings regarding social functioning demonstrated that combat sports reduced aggression, violence, delinquency, and feelings of anxiety.^{8,12} The last area of focus is a further look into how martial arts compares to more traditional sports. To do this, variables such as retention rates, perceived benefits, value for money, mental health across sports, and pain and injury levels will be examined.^{7,11,12,13} This comparison also addresses the benefits of martial arts with regards to special populations, such as those with autism.¹⁴

With only one in three children physically active every day, it has become increasingly important to look at the types of activities that will help the child and adolescent grow into adulthood the most effectively to get the most benefits and do the least harm.² The movement and sports of children and adolescents are important as the effects from such activities encompasses the development of the child into adolescence and adulthood, leaving a lasting impact on their overall health and quality of life.⁴ The purpose of this literature review is to do exactly that and explain martial arts as it benefits children and adolescents and how that compares to more traditional sports.

PHYSICAL BENEFITS

To start, it is important to look at martial arts and the physical benefits that it offers. As previously mentioned, physical inactivity is a risk factor for cardiovascular disease, heart disease, diabetes, and other conditions that lead to a premature death.¹ The physical benefits of regular movement of any kind cannot be overstated, and any movement that keeps children and adolescents active is beneficial to them.^{3,4} With that said, there are more effective options for physical activity to get increased and to get greater results for your child. Martial arts are considered one of the most effective physical activity options for children and adolescents.

Martial Arts Explained

To understand the physical benefits of martial arts, the movements in martial arts needs to understand in order to exact how the benefits come about. To focus in, martial arts are used to simulate real fighting, however this can take on many facets.⁶ In taekwondo, there are two main groupings of activity: forms, called poomse, and sparring.⁸ Forms involve repeated movement patterns of foot and hand techniques to simulate fighting against an imaginary attacker, whereas sparring is when two opponents put on safety gear and fight in a match against one another using those hand and foot techniques. While both simulate real fighting and the same types of moves, they are distinctly different parts of the practice, but work together to get the physical results that are seen.⁸ Martial arts is therefore understood to have an impact on overall physical fitness through trainings of stretching, aerobics, punching and kicking techniques, poomse, and sparring.⁸

Muscular Changes and Fitness Variables

There have been a number of demonstrated physical benefits from martial arts. In regard to fitness variables, martial arts showed increased muscular strength, explosive power and endurance.^{6,8,15} Findings also support that martial arts participation increases cardiovascular endurance, with evidence supporting that martial arts athletes had cardiac adaptations similar to those of endurance athletes.^{8,15} These variables mean that martial arts are an effective tool for increasing the force generation, the speed, and the ability of the muscles to repeat the movement before fatiguing.¹⁵ With regard to agility and muscular endurance, martial arts were found to be more effective than other physical activity at improving these variables.⁸ Martial arts have been shown to increase flexibility, balance and muscle mass of participants.^{6,8,15} These are important as flexibility means a greater range of motion to be able to move about and an increase in muscle mass means that more muscle is being made, which results in improved body composition.^{8,15} The levels of appendicular muscle mass gain as a result of martial arts were found to be greater than that of other sports athletes.¹⁵ Additional findings include left ventricular hypertrophy, increased stroke volume, and decreased resting heart rate, all of which indicate that the heart is increasing efficiency of pumping oxygen through the blood.¹⁵ These physical benefits also have an effect on overall quality of life, and those who participated in martial arts had higher scoring health-related quality of life, specifically in regard to physical benefits.⁸

Balance and Postural Control

Martial arts have also been found to have a positive effect on balance.¹⁶ While other sports wear shoes, martial arts are typically performed without shoes on or with modified lightweight shoes.⁶ This means that the intrinsic musculature of the foot is recruited to maintain balance via

postural control of inversion and eversion, whereas with shoes on, the shoes do more of the work. Martial arts are also a sport that requires fast kicks and actions, which make single-leg stability essential for success.¹⁶ This is coupled with the fact that martial arts trains participants to rely on somatosensory and vestibular inputs when sensory alone is conflicting, allows for martial arts to uniquely attain higher levels of postural control and balance.¹⁶ Both short-term and long-term adaptations to martial arts training found decreases in postural sway and a more effective increase in visual-somatosensory-vestibular pathway integration.¹⁶ The practicing of these movements also creates for lower limb and spinal alignment, specifically when maintaining balance in more difficult single-leg kicking positions. Martial arts might also be more effective at attaining balance gains as it emphasizes postural awareness, in line with the mind body connection that martial arts like taekwondo particularly reinforce.¹⁶ Balance of martial arts participants is therefore greater than those who participate in other sports as they get to work an otherwise ignored aspect of postural control.¹⁶

Changes in the Brain

There are also physical changes that occur with regard to the brain. Participation in martial arts resulted in increased gray matter volume within the brain, which means an increased volume of cell bodies within the brain, after 10 years from one study.¹⁵ The areas of gray matter increase were from regions associated with memory, cognitive processes, motor learning, planning, and execution of movement.¹⁵ This is a result of the complex motor skills, learning of new tasks, as well as the memory of techniques and movement patterns that martial arts participants undergo.¹⁵ This increase in brain matter also translates to increased cognitive ability in other aspects of the adolescent development, such as classroom learning and cognition. These functional changes

within the brain as a result of martial arts participation are another physical benefit to take into consideration.

Bone Health

There was also found to be long term benefits with regard to bone health. Participation in martial arts was found to have a positive effect on bone accrual and bone mineral density.^{9,15} This means that the bones became stronger and thicker, which is important as during childhood and adolescence, you are supposed to build up a reserve of strong bones, as they weaken over time.⁹ While any weight bearing activity will help to increase bone density, martial arts was shown to have a more significant impact with regard to osteogenic changes.^{9,15} During the immense growth of children and adolescents, it is important to undergo weight bearing activity to increase bone density as it has a protective effect on individuals later as adults when bone density starts to decrease and osteoporosis starts to creep in.⁹

Overall, there are a number of fitness variables and protective effects that occur as a result of positive physical benefits from martial arts. These include muscular strength, cardiovascular endurance, body composition, muscular power, and overall physical fitness variables related to quality of life.^{6,8,15} Other physical changes include increased volume of gray matter within the brain, increased bone density, and improved sensorimotor performance, balance, and postural control.^{9,15,16} While any physical activity is beneficial in preventing disease and maintaining health, martial arts has demonstrated that it is more effective in attaining higher fitness levels with regards to these variables.^{1,8,9}

SOCIOEMOTIONAL AND MENTAL HEALTH BENEFITS

During childhood and adolescence, it is a great time of development for social, emotional, and mental health. The importance of these interpersonal and intrapersonal skills that develop during these formative years will reverberate throughout the lifetime of an individual. This relates to martial arts as they are typically taught in class settings with a number of students and one or more instructors.⁸ This setup allows for interactions between students as well as between students and instructors.¹⁰ This close environment fosters a sense of group identity and feelings of belonging. It is also important to note that martial arts, while simulating fighting, has an emphasis on respect for the instructors and peers, as well as an emphasis on discipline of when and how you are allowed to practice the martial art.

Social and Emotional Developments

With regard to social developments, martial arts offer opportunities for interactions between students and with instructors. This level of interaction is reflected in the increased social skills and increased sociability of those children who participate.¹⁰ There was an increase in levels of discipline and patience among participants as well.⁸ Other findings were learned traits of respect, bravery, and empathy.¹² This was thought to be due to the teachings and principles of martial arts instructors that are taught and demonstrated by adolescents with younger children following suit, such as respecting those who rank above you. Another influence of social behaviors is that being around other health conscious and health-oriented individuals encourages and makes it easier for other children and adolescents to do the same. It was found that adolescents who participate in martial arts have a greater intensity of healthy behaviors, namely eating better, avoiding risky behaviors, engaging in more exercise, avoiding drugs and alcohol, and more.⁸ These social

influences are all beneficial for children to expose themselves to new people and get them out of their comfort zone.

Aggression and Violence

A common concern among parents is that participation in martial arts will increase aggression and violence as it encourages children and adolescents to engage in fighting. However, it was found that participation in martial arts decreased aggression and violence among children and adolescents.^{8,12} This finding, although surprising to some, reflects the emphasis that participants of martial arts need to show a level of respect and discipline within their sport, which includes controlling their emotions and not abusing their knowledge of martial arts. One of the focuses of martial arts is that it emphasizes self-defense, and that even though you have the knowledge to fight, does not mean you should do so. This is important as it allows children to feel safe and able to protect themselves while still maintaining a level of discipline and non-violence within a fighting sport.⁸

Mental Health

Martial arts also affect the developing child's mental health. Mental health benefits of martial arts include increased self-esteem, self-control, and care of one's body and safety.^{6,8,10} This means that the child feels more in control of their own body and has a greater belief in their abilities. There was also found to be a relationship between self-regulation learned in martial arts and cognitive performance in the classroom.⁸ The self-regulation and self-control learned in the sport offered itself to other situations, such as the classroom, and benefitted the child's self-image and classroom conduct and achievement. Other benefits include a harmony of mind and

body, with martial arts placing an emphasis on breathing through techniques and some focusing on meditation itself.⁸ Also comparing anxiety and depression level of athletes compared to non-athletes, athletes consistently have lower reported levels of anxiety and depression.¹¹

Overall, it was found that martial arts contributed significantly to social, emotional, and mental health through participation. Social interactions allowed for greater sociability, while new experiences create emotional growth.¹⁰ Self-control and self-regulation benefits from martial arts were found to lend to the classroom behavior of children and adolescents as well.⁸ In addition, mental health issues are lower among physically active populations, and levels of aggression and violence decrease with martial arts exposure.¹² Martial arts are therefore seen as positively beneficial for children's and adolescent's social, emotional, and mental health.

COMPARISON TO OTHER SPORTS

While there are many demonstrated benefits to martial arts, it is important to look at how the benefits of martial arts measures up to the benefits of other sports. In order to participate in the most efficient physical activity, the factors involving other sports need to be considered.

Retention Rates

One such comparison that can be made between martial arts and other sports is that of retention rates. Retention rates are noteworthy as maintaining regular activity throughout childhood and adolescence is an indicator of higher physical activity later on in life. Martial arts were found to have greater retention rates compared to other sports.^{8,12} Specifically, there was found to be a retention rate of a minimum of two years in one study and of an average range of

four to ten years participation in other studies.^{8,12,15} The significance of these findings indicate that those who have participated in martial arts are more likely to continue physical activity later in life. Continuing activity levels means keeping the protective effects of weight bearing activity and maintaining a decreased risk of cardiovascular disease as well as other secondary health conditions.¹

Injury Rates

Another area of focus is looking at the injury and pain rates associated with martial arts compared to other sports. Injuries found in martial arts were mostly minor, with the most common being minor cuts, abrasions, or contusions.⁷ Other common injuries are sprains and strains. These are also commonly found injuries when examining participation in other sports, such as soccer, basketball, and lacrosse. The incidences of serious injuries in martial arts were found to be extremely rare, with safety equipment and training technique attributed to these much lower serious injuries rates.⁷

Gender Gap

The gender gap between male and female sports is also something to consider when looking at martial arts participation. There are benefits to being exposed to both genders in a social sport environment, and when children are young there are more equal levels of martial art participation.⁶ However, as children continue into adolescence, there is a drop off in female participation within the sport. This divide also applies to the young adults and coaches that are training the younger students. While there is some sport drop off among other female sport athletes, martial arts do have a higher rate of female dropout.⁶ This is attributed to the male

dominated culture surrounding combat, or fighting sports, being seen as something only men should participate in. The gender gap within children is extremely low but the gender gap with coaches is high.⁶ This is important because different coaches will teach things differently and have different approaches to coaching. This is also important as children needs role models to look up to, and if there are no or very few female role models, then that could be contributing to the female drop off within the sport as well.

Perceived Benefits

There is also the comparison for the perceived benefits that different sport participation offers. Martial arts were found to have perceived benefits of social and mental health, increased self-defense, and addiction avoidance behaviors.^{6,12} Martial arts were the top pick for sport conditioning, or getting ready for their main sport, for those who participated in multiple sports.⁵ Participating in martial arts as a sport for conditioning for other sports was found to produce benefits of maintaining high-intensity activities, reduced fatigued and quicker recovery of the body to baseline.¹⁵ This is important as even those who participated in other sports chose martial arts as the most effective way to condition their bodies for other high level sport activity.

Value for Money

Another consideration when comparing martial arts to other sports is the value for money. Financial considerations play a role in the parent's decision to enroll their children in martial arts, especially when children and young adolescents play in more sports before specialization in one sport later on.^{5,6} Any sport participation is typically going to cost parents money, and martial arts is no exception. The costs for martial art participation, for example with regard to

taekwondo, would be put towards class attendance, the uniform, the belts, and protective gear.⁶

However, it is not the most expensive sport, with ice hockey and lacrosse being some of the most expensive to participate in. With that said, martial arts has demonstrated its effectiveness at achieving numerous benefits, which is why it is a good value for money.

Mental Health

Another area of interest is mental health across sports. One study found that anxiety and depression rates were higher among individual sport athletes as compared to team sport athletes.¹¹ However, it is important to note the aforementioned information that when comparing overall at athlete's vs nonathletes, lower anxiety and depression rates were found among athletes.¹¹ I also think it is important to note that martial arts is a unique social environment for learning to take place, and that the team mentality and inclusiveness within a group of martial arts students seems equally possible to that of more typical team sport groups.

Special Populations

Another area of interest when looking at the benefits of martial arts as opposed to the benefits from other sports is to look at how those sports adapt to special populations, such as Autism Spectrum Disorder (ASD). With Autism being the second most common developmental disability in the United States, it is important that these children and adolescents do not get left behind with their physical activity exposure.¹⁴ Autism impacts social and behavioral functioning, with rigid maladaptive movements and difficulty regulating actions. For those with ASD, martial arts had positive social and behavioral outcomes with decreased social dysfunction and rigid behaviors as well as better self-control communication, and tolerance of discomfort.¹⁴ Reasons

for this are based around allowing for social interaction exposure in addition to the training principles of discipline and respect, and the fact that it is an individualized sport, which means that training can be adapted to each person's level of development and movement abilities. Participation in martial arts also improves sensory organization and balance for any developmental coordination issues, not just for those with Autism.^{6,8} Martial arts within the context of special populations has been studied and has repeatedly demonstrated positive outcomes.

Overall, martial arts compare to other, more traditional sports with its strengths and weaknesses. It does boast high retention rates in general, which is important for continuing movement and staying healthy in the long term.^{8,12} However, female drop-off is higher as the age increases within the athletes.⁶ Injuries in martial arts, where some might expect to see an increase in a sport that simulates fighting, are still mostly minor injuries that are going to be seen in other sports.⁷ The perceived benefits of participation were on par if not higher than other sport participation.^{5,6,12} The value for money of martial arts requires some costs, but not as much as other possible sports.⁶ Anxiety and depression rates may be higher in general among individual sport athletes, but in athletes vs. non-athletes, athletes still have lower rates of mental health problems.¹¹ In addition to all of this, martial arts provide an incredible opportunity for special populations to participate and integrate into a sport at their own level.¹⁴ For these reasons, I think that martial arts compares favorably to other sports and with the other benefits mentioned above is a viable option for those seeking physical activity options for children and adolescents.

CONCLUSION

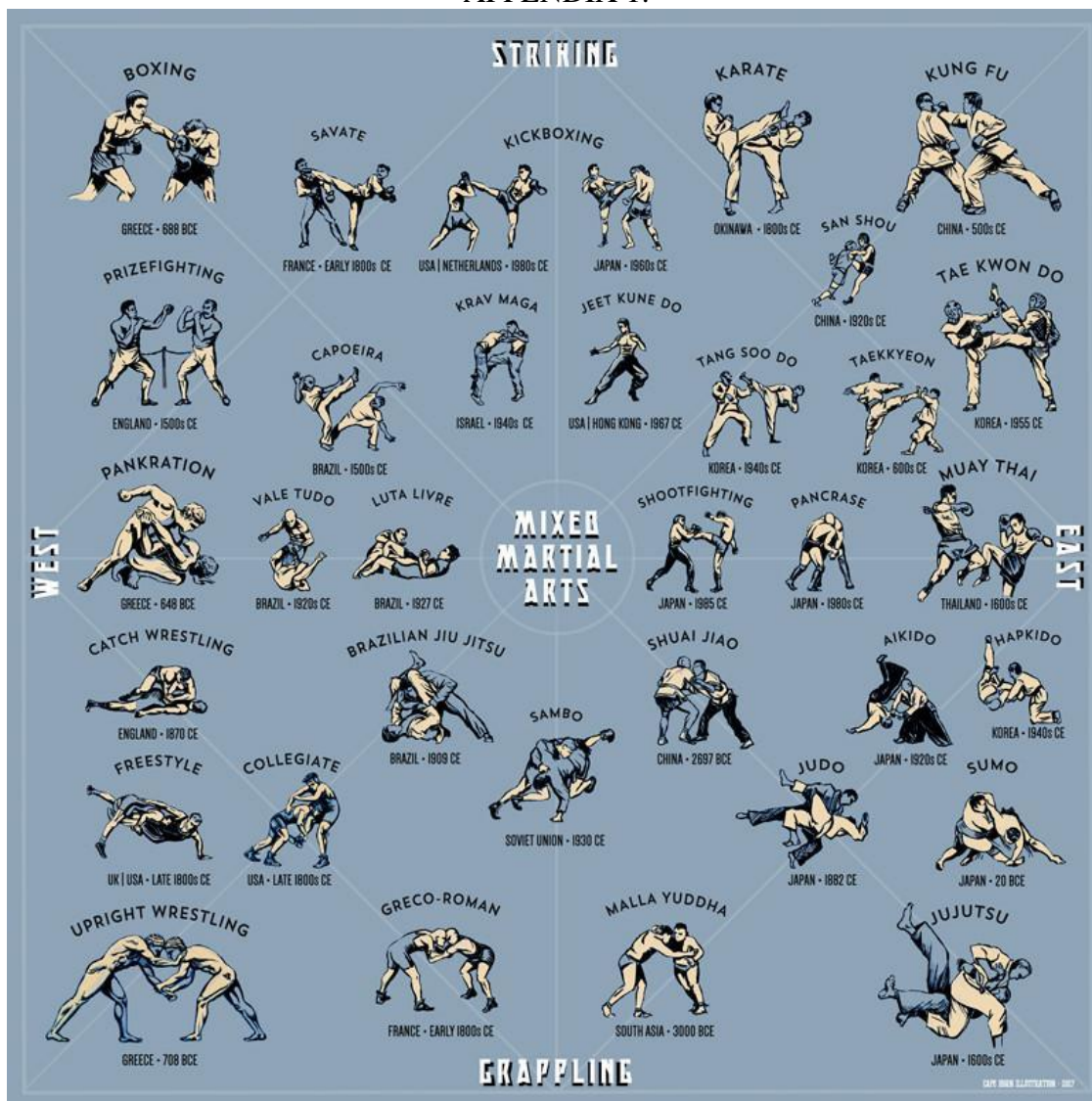
With physical activity during childhood and adolescence having a lasting impact on overall quality of life and activity levels later in life, it has been increasingly important to look at the effectiveness of the movement that children and adolescents participate in.^{2,4} With exercise during these formative years, the effects of activities encompasses all aspects of the child's development.⁴ Martial arts is a sport that uses rules to simulate real fighting, and the purpose of this literature review was to examine the benefits that martial arts offers children and adolescents and how those benefits compare to other sports.⁶

Martial arts provide a number of positive physical, social, emotional, behavioral, and mental health benefits to participants, and was more effective at getting those results compared to other sports. Physical benefits include muscular strength, cardiovascular endurance, body composition, muscular power, and overall physical fitness variables related to quality of life.^{6,8,15} Other physical benefits include increased volume of gray matter within the brain and increased bone density.^{9,15} There was also a demonstrated increase in effectiveness with regard to martial arts improving balance in single-leg stability and double leg support as well as with regard to postural control.¹⁶ On the social and emotional benefits, martial arts increased sociability, self-control, self-esteem, and classroom behavior.^{8,10} With regard to mental health, decreased levels of anxiety and depression are found among athletes, and martial arts also found reduced levels of aggression and violence.¹² This is all important to note as martial arts has demonstrated that it is more effective in attaining these benefits.^{1,6,8,9,15}

It then becomes important to look at how martial arts compares to other more traditional sports. Martial arts has increased retention rates, which are an important predictor of lifelong activity levels.^{8,12,15} There is a higher female drop off within the sport, most likely due to cultural norms and a lack of female role models within the sport.⁶ Injury rates are similar to that of other sports, with the most common injuries being minor.⁷ The cost within martial arts is somewhat in the middle, with other sports sometimes costing more, sometimes less, but the value for that money seems to more with it as the effectiveness of martial arts has been shown.⁶ Anxiety and depression levels may be higher in individual sport athletes, but still lower than the general, non-active population.¹¹ The topic of martial arts with special populations, such as those with Autism Spectrum Disorder, was also looked at and found to have particularly compelling positive evidence behind, as it allows them to engage with their peers while improving body control.^{6,8,14} Overall, martial arts is a beneficial sport that could be the more efficient option for optimizing the physical, social, and mental health benefits for children and adolescents.

APPENDIX

APPENDIX 1:



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