

A review of the benefits and risks associated with the practice of martial arts

Baldwin, H.R. ^a

a. Assistant Chief Instructor, Bushido Martial Arts, Welkin Mill Dojo, Stockport, SK6 2BH, United Kingdom.

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Abstract:

Martial arts are becoming an increasingly popular sport for children, adolescents and adults. It is estimated that around 1% of the UK population (roughly 650,000 people) currently practise martial arts and the industry is continually growing. The benefits of martial arts are extensive and include reduced levels of anxiety, aggression, hostility and neuroticism, as well as improved levels of self confidence, self reliance, self esteem and independence, alongside numerous health benefits associated with physical training. As with other sports, there are injury risks associated with martial arts, the most common being contusions (bruises), sprains, strains and abrasions. Experience, belt rank and training hours per week were directly correlated with increased injury risk in both children and adults and karate appeared to carry a lower risk of injury than other martial arts such as aikido, taekwondo, judo or jujitsu. However, the overall injury rate for combat sports such as martial arts is reportedly lower than the injury rate for other popular non-contact sports such as football and hockey.

Glossary of terms:

Uke = the athlete on whom the technique is being performed, or who “receives” the technique.

Dojo = traditional training space for martial arts.

Blocks = techniques used to stop or deflect an attack, usually involving a limb.

Locks = articular (joint) manipulation such that the joints reach their maximal degree of motion (extension or flexion).

Throws = a technique that involves lifting or off balancing an opponent and throwing them to the ground.

Breakfall = a movement performed on landing to prevent injury to oneself from falling.

Karateka / Judoka = practitioner of karate / judo.

I. Introduction

Martial arts are becoming an increasingly popular sport for children, adolescents and adults. It is estimated that around 1% of the UK population (roughly 650,000 people) currently practise martial arts and the industry is continually growing. Although the term martial arts is often used when describing the fighting styles of eastern Asia, the combat styles of Europe were described as martial arts as early as the 1500s. The term itself is actually derived from Latin and means “arts of Mars”, referencing the Roman god of war. The present term encompasses a wide array of fighting styles and sports and the martial arts are considered effective tools for learning self-defence, increasing fitness, developing muscle strength, improving balance and flexibility alongside developments in self-esteem, self-awareness and spirituality (Demorest, 2016).

There are a number of well recognised and well documented benefits to the practice of martial arts, although there is also a known and well reported risk of injury. This paper aims to review the literature around these topics and determine whether the benefits outweigh the injury risk and to determine whether there are any suggestions within the literature for techniques or practices that can be implemented at a club level to reduce the risk of injury in participating athletes. It should be noted that the term “risk” is used as a descriptive factor to describe findings of the papers reviewed, although the author is aware that statistically, this term is difficult to quantify and statistical analysis of risk and injury rates associated with martial arts has not been performed in this paper.

II. Benefits

The benefits of practicing martial arts have been reported across numerous studies, spanning several decades, as well as being noted in Eastern teachings for hundreds of years. The therapeutic benefits of martial arts have been extensively documented; it has been shown that practicing martial arts regularly can provide psychosocial benefits (Binder, 2007; Twemlow, 2008), as well as numerous health benefits. Martial arts can improve fitness and exercise capacity, assist weight loss, improve manual dexterity, improve self-confidence and self-reliance, increase strength, provide an increased sense of safety, provide opportunities for spiritual development and provide a more empathetic approach to others alongside providing a new and valuable set of life skills (Demorest, 2016; Kusnierz, 2011; Binder, 2007). Certain martial arts styles such as karate have been shown to improve cognitive function in older adults (Witte, 2016) and elderly patients who took regular tai chi sessions were much less likely to suffer falls and had improved balance and lower fear of falling than control groups (Li, 2001). Regular training in martial arts at moderate to high intensity can increase cardiovascular health, increase metabolic rate, lead to improved fitness and improve physiological health in participants (Chaabene, 2015).

In terms of psychosocial benefits, there has been some debate within the literature over whether these apparent benefits are myth or reality (Binder, 2007), though it appears that more studies point in favour of reality than in favour of myth. There are studies that suggest regular martial arts sessions can dramatically improve social interaction skills and concentration rates for ADHD sufferers (Harris, 1998; Woodward, 2009), and can assist recovery in people

recovering from substance abuse, eating disorders and growing up in dysfunctional families (Binder, 2007). Judo training has been shown to increase the psychosocial skills for blind, developmentally disabled children (Gleser, 1992), increase the social adjustment scores for developmentally disabled adults (Davis, 1975) and reduce dysfunctional behaviour in male adolescents with behavioural disorders (Greene, 1987) (as has karate – Gorbel, 1990). Judo has also been shown to be a useful addition to community programs for the treatment of pre-delinquent children (Fleisher, 1995). Aikido has been shown to be beneficial in teenagers with severe emotional disturbances (Edelman, 1994) and there are numerous studies that indicate that martial arts may reduce behavioural problems in children (Kusnierz, 2011; Twemlow, 2008; Binder, 2007; Gonzalez, 1989). Twemlow et al. (2008) showed that boys who participated in a “Gentle Warrior Program” as part of a large school violence intervention became more empathetic, exhibited greater self-control, were less aggressive and were able to use more peaceful strategies to resolve conflict; though curiously, no significant results were noted for girls.

Binder (2007) reviewed the findings of over sixteen separate studies spanning over 30 years; the main findings are summarised below:

- There is an inverse relationship between belt rank or length of time practicing a martial art and anxiety.
- There is an inverse relationship between belt rank/length of time practicing and aggression or hostility.
- There is an inverse relationship between belt rank/length of time practicing and neuroticism.
- There is a positive correlation between belt rank/length of time practicing and self-confidence.
- There is a positive correlation between belt rank/length of time practicing and self-esteem.
- There is a positive correlation between belt rank/length of time practicing and independence or self-reliance.

These findings appear encouraging, though it must be noted that those who attain higher ranks and practise for longer may be those who enjoyed the martial art and chose to continue training, whereas individuals who did not have such a positive outlook on their training sessions may have dropped out and not attained higher grades, and are therefore not included in the results of the studies. However, one study did account for this (Nosanchuk, 1989) by studying both current and former students of jujitsu, karate and taekwondo; the study discovered an inverse relationship between belt rank and aggression in both former and current students studying in more traditional settings, suggesting that the decrease in aggression noted can be attributed to the training, regardless of whether the student still trains or has dropped out. The most concerning aspect of Nosanchuk’s study, however, was that in modern martial arts settings (e.g., mixed martial arts (MMA) & kickboxing), the length of time training was directly proportional to aggressiveness seen in students. The study hypothesised that more traditional approaches to martial arts included guidance or training in meditation, philosophy, respect and empathy for others, discipline and emphasis on kata, whereas modern schools did not include

these subjects. The findings of this study mirrored findings of an older study conducted by Trulson in 1986, which adds further strength to the theory that a more traditional approach may produce students that are more balanced.

Some practitioners believe that the Eastern martial arts were traditionally viewed as part of the Trio of Life Skills that consist of the healing arts, the self-exploration arts and the vital or combative life skills arts. The healing arts consisted of acupuncture, acupressure and herbal medicine, while the self-exploration arts focused around developing mental focus and concentration via the practice of spiritualism and meditation, though has also expanded in Western society to include yoga (Burke, 2007; Khalsa, 2007). In the West, when practising martial arts, a large number of practitioners have largely focused solely on the third section of the Trio of Life Skills – the combative life skill, meaning some practitioners may have lost the context of the roots of the martial arts (Burke, 2007). This is particularly apparent in the more modern or competitive full contact combat sports such as kickboxing, MMA, Brazilian jiu-jitsu (BJJ) and taekwondo, which are often viewed as “sports” rather than martial arts, perhaps due to their inclusion in national and international sporting competitions. These findings are supported by a 2001 study by Zivin et al., who also found that aggression in violent school children was reduced by studying traditional martial arts. Zivin’s study suggested that the fighting skills glorified in films and television (which is thought to be why a lot of students begin martial arts classes initially) vary considerably from traditional martial arts training.

Traditional martial arts have ancient Buddhist/Taoist origins and philosophy which is deeply pacifistic and teaches a centred, calm mind that can be applied to all areas of life, with the goal of developing physical skill alongside a respectful attitude, spiritual clarity and a deep understanding of the body and physics of action (Zivin, 2001). The Budo and Bushido philosophies that underlie the Japanese martial arts teach moral values such as courtesy, kindness, goodness, honour, righteousness and justice, with the aim that, when practised frequently, these traits will become intrinsic to the character of the practitioner, serving as a path to self-perfection and in doing so the elevation of human spirit will contribute to social harmony and prosperity, thus benefiting the people of the world as a whole (Nippon Budō Kyōgikai, 2009). In traditional Budo/Bushido teaching it is crucial to understand these major goals when teaching karate or other Japanese martial arts as a sport discipline and not to focus on the combat techniques alone (Kusnierz, 2011).

In traditional martial arts schools, meditation is often included as part of the teaching schedule and is usually included at the beginning and/or end of most yoga and tai chi sessions. It has been shown that regular meditation can significantly reduce clinical signs of stress, anxiety and depression and enhances mindfulness (Schreiner, 2008) and brief 20 minute sessions can reduce heart rate and blood pressure as well as reduce negative mood and signs of depression (Zeidan, 2010).

Although we have direct evidence of certain aspects of traditional martial arts teaching leading to improved health benefits (e.g., meditation reducing stress, anxiety & depression and physical training improving fitness, strength & cardiovascular health), we can only speculate on the reasons for improved psychosocial wellbeing in traditional martial arts practitioners as it is not known which exact aspect of the teaching leads to the improved psychosocial wellbeing seen in the aforementioned studies. Nevertheless, these findings suggest that it is important to include traditional teaching aspects in Western martial arts schools.

The studies suggest that instructors should allocate time in each lesson for meditation and martial arts philosophy from the first lesson onwards as this may provide greater health and psychological benefits for students, decrease aggression, and may help to decrease the attrition (drop out) rates from classes, thus enabling students to train for longer, attain higher ranks and obtain the associated benefits of increased self-confidence, self-esteem, self-reliance and decreased aggression, anxiety and neuroticism as noted in Binder's 2007 review.

III. Risks

Despite numerous benefits, there are also risks in the practice of martial arts (it should be noted that the term "risk" is used as a descriptive factor to describe findings of the papers reviewed, although the author is aware that statistically, this term is difficult to quantify and statistical analysis of risk and injury rates associated with martial arts has not been performed in this paper). Injury rates across various martial art styles have been studied and reviewed by multiple authors. Combat sports usually present the highest rate of injuries during training sessions (Buse et al. (2006) and martial arts with contact-based sparring or competitive training carry a higher risk of injury (Demorest, 2016). The wide range of different martial arts styles, striking methods, throw techniques and contact or combat levels means that each different style comes with its own range of potential injuries. The types of injury seen vary with the martial art style and this is likely due to the differences in techniques and methods used in different martial arts.

Karate is mostly performed standing and encompasses a number of strikes and kicks performed singularly or in combinations, often with students standing in lines with their own space in which to perform the techniques. The basic goal of karate is self-defence by using strikes to block their opponent's strikes and then disabling their opponent with quick, powerful strikes in turn. Takedowns are rarely executed though can be performed in certain styles. Weapons are occasionally used though weapon injuries are rare due to the use of artificial weapons during training and the use of weapons in competitive karate is often limited to kata, which carries a low risk of injury as it is usually performed alone or in teams with adequate space for manoeuvring between teammates. Because of the non-contact nature of karate, injuries are usually less severe than other martial arts though studies have shown that there is still a risk of injuries such as contusions (bruises), sprains, strains and abrasions to karateka.

Judo and jujitsu, in comparison, are contact martial arts and involve the execution of locks, throws and other takedown techniques. The most common injuries to judoka & jujitsu athletes are sprains, strains and contusions with the shoulder, arm, wrist and hand more commonly affected.

The main injury related findings of the papers reviewed are summarised below:

- Female martial artists are less likely to injure themselves falling. Females also made fewer errors when performing motor tasks (Boguszewski et al., 2015).
- Girls had higher injury rates than boys according to Pieter, 2005, though boys had higher injury rates than girls according to Yard et al., 2007.

- Contusions (bruises) are the most common injury reported across all martial arts, followed by sprains, strains, abrasions & fractures (Birrner, 1988; Zetaruk et al., 2000; Pieter, 2005; Destombe, 2006; Yard et al., 2007; Demorest, 2016).
- Judo gives more upper extremity and knee injuries than karate, which gives more head and face injuries (Pieter, 2005).
- In Judo, techniques carrying higher risk included performing kicks, performing throws or being thrown, whereas in karate punching or performing high kicks appeared to result in the most injuries (Pieter, 2005; James & Pieter, 2003).
- Judo athletes are more likely to suffer upper arm, shoulder and neck injuries (Yard et al., 2007). Strains are the most common judo injury and male judoka are more likely to be injured than females (James & Pieter, 2003). However, female Judoka are more likely to injure their elbows than males (James & Pieter, 2003).
- Most karate injuries to children are from being kicked, falling or from performing a kick, with the majority of injuries occurring to the leg, foot and ankle (Yard et al., 2007).
- Judo was more likely to result in sprains and karate more likely to result in epistaxis in some studies (Pieter, 2005).
- Women were less likely to suffer head injuries and epistaxis in karate (Pieter, 2005).
- Articular forcing techniques in jujitsu result in increased incidence of knee, shoulder, hand, wrist and elbow injuries. Arm and leg locks and/or wrenches were the cause of most injuries (Barreto, 2017).
- In jujitsu, sprains are more common than contusions (Barreto, 2017).
- In jujitsu, blue belts are most likely to become injured and injuries during training are more common than during competitions (Barreto, 2017).
- Foot and arm injuries are most common in judo, jujitsu and karate, with 50% of injuries being contusions (bruises) (Aleksandra, 2017).
- Jujitsu athletes were most likely to renew their injuries (43.5%) and were also less likely to use protective equipment (Aleksandra, 2017).
- Rapid loss of 5% or more body weight prior to competitions is associated with a much higher risk of injury, though aside from this no significant differences existed between grades, styles or genders (Green, 2007).
- Psychological stress has been linked to higher injury rates in basketball, wrestling and gymnastics but has not yet been linked to martial arts (Pieter, 2005).
- Non-contact martial arts such as karate appear to be safer for children and beginners (Demorest, 2016).
- MMA carries high risk of head injury, concussion asphyxia and neck injuries (Rainey, 2009; Demorest, 2016).
- In MMA, lower belt ranks are significantly more likely to be injured than higher ranks. Professional fighters are 3x more likely to be injured and the competition rules appear to be lax when injury risk is considered (Rainey, 2009).
- Athletes who sought medical treatment actually recovered slower than those who did not seek medical treatment (Aleksandra, 2017).

- The overall injury rate for combat sports (wrestling, boxing and martial arts) does not outstrip the overall injury rate for other popular non-contact sports such as football and hockey (Pappas, 2007).
- Karate is low risk when compared to other martial arts such as taekwondo, aikido & kung fu (Zetaruk, 2005).
- Martial arts appear to be safer for young athletes at beginner or intermediate levels (Zetaruk, 2005)
- Experience, training hours per week and belt rank were directly correlated with injury risk in young karateka (Pieter, 2005) as well as in adults (Zetaruk et al., 2000, Zetaruk, 2005, Destombe, 2006, Demorest, 2016).
- Athletes training for over 3 hours per week are more likely to become injured (Zetaruk 2000; Zetaruk 2005; Pieter, 2005; Destombe, 2006; Demorest, 2016; Vitale, 2017).
- British Championship competitors in light and touch sparring had equal injury rates with or without protective padding in the presence of a strict, experienced referee (Critchley, 1999).
- Poor control exhibited by uke was the most common reason for epistaxis and nasal haematomas (Destombe, 2006).
- Most muscle injuries were caused by high kicks with lack of appropriate warm up and stretching associated with increased risk (Destombe, 2006).

Anecdotally, judoka and jujitsu practitioners will state that certain throws carry higher potential for injury than others. Unfortunately, there is a lack of peer reviewed literature describing which throws carry a higher injury risk, though anecdotal beliefs are summarised below:

- Kani Basami is potentially dangerous when performed incorrectly, with anecdotal reports of ankle and knee (anterior cruciate) injuries. This throw is banned in some Judo competitions.
- Tai Otoshi has potential for knee or lower leg damage if the throw is executed poorly.
- Morote Seoi Nage carries injury potential for the arms, which are locked over the athlete's shoulder during the throw, risking hyperextension or fracture of the elbow joints on its execution. Another version of this throw also involves one of the uke's arms being locked beneath the athlete's arms when performing the throw, thus removing the uke's ability to breakfall and therefore increasing the risk of back, rib, shoulder or head injuries to the uke on landing.
- Shio Nage has potential for causing shoulder dislocation or rotator cuff damage if performed incorrectly.
- Hiza Guruma has multiple variations and some have capacity for causing hyperextension of the uke's knee if performed too vigorously, particularly if the uke's feet do not move freely on the mats when the throw is executed.
- Tani Otoshi presents a potential hazard to both the athlete and the uke in that the throw is executed so rapidly that they are often unable to breakfall and the athlete risks landing heavily on the uke's shoulder and/or chest during the throw.

- Ura Nage may be risky for both the athlete and the uke because the athlete cannot breakfall when performing the throw and the uke may land face or head first on the mat, thus risking injury to the face, head and neck.
- Tomo Nage can also risk the uke landing face first on the mat if performed incorrectly and if the athlete's foot is placed too low it may cause injury to the groin. It is recommended by some martial arts bodies that stomach throws should not be performed on female athletes due to the risk of damage to the uterus.

The above statements are anecdotal based on experience of the author and other athletes and instructors within the author's training circle, though there is potential for further research surrounding throws and the potential for injury as this would be highly relevant for international sporting competitions.

The recommendations for injury prevention provided in each of the studies reviewed have been summarised below:

- All martial arts coaches should be experienced, qualified and insured.
- Athletes should be warned of injury risk prior to training and dojos/gyms should consider the use of consent forms and licensing prior to commencing training.
- Children should not be allowed to compete prematurely.
- Roundhouse kick and other high kicks must be carefully taught.
- The warm up should include appropriate stretches for the activities planned for each individual lesson.
- Blocks must be taught and executed well with closed fists.
- Appropriate protective equipment should be worn during competitions.
- Referees must be qualified, experienced, adhere strictly to competition rules and must be aware of injury risks.
- Padded floors must be used for training in judo, aikido and ju-jitsu.
- Students must not be thrown until breakfall techniques are adequate enough to prevent injury.
- Throws must be demonstrated well and students should be well rehearsed in the mechanism of the throw before attempting to perform it alone. Students should always be supervised by a senior instructor when performing the throw for the first time.
- Execution of stamping hip and stomach throws is contraindicated in women due to the risk of blunt trauma to the uterus.
- Higher ranks require appropriate supervision when training and be critically reflective of their own techniques, as they seem to be at higher risk of injury.
- MMA carries a high risk of head injuries, concussion, asphyxia and neck injuries and studies suggest it should be avoided by children and adolescents.
- Several studies linked increased training time with increased injury risk and suggested training time should be limited, though this shall be analysed further in the discussion section.

(Based on recommendations adapted from Aleksandra, 2017; Barreto, 2017; Vitale, 2017; Demorest, 2016; Boguszewski et al., 2015; Green, 2007; Yard et al., 2007; Destombe, 2006; Pieter, 2005; Zetaruk, 2005; James & Pieter, 2003; Zetaruk et al., 2000; Critchley, 1999; Birrer, 1988).

IV. Discussion

Children may see manoeuvres on television, films or social media and attempt to emulate them without appropriate training, which could lead to an increased risk of injury that may appear as if the martial art is the source, though could be due to external sources. This does, however, mean it is crucial for children to be supervised carefully whilst undertaking martial arts classes to ensure they are not performing techniques beyond their skill or grade level.

Martial arts provide undeniable improvements in physical fitness, muscle tone, flexibility, self-esteem and self-awareness. However, it is crucial that they are practised safely and under the supervision of qualified, experienced instructors, preferably with first aid training. Instructors should have an awareness of individual student limitations based on age, maturity, stature, experience and previous injuries. Children should not be allowed to compete prematurely and should not be placed under pressure to do so until they have demonstrated clear competency in all movements and techniques (Demorest, 2016). From the studies reviewed, it appears that non-contact forms of martial arts such as karate carry a much lower risk of injury than other, full-contact forms such as jujitsu, judo or MMA, so karate would be a suitable choice for young children and beginners. Full contact martial arts requiring high levels of manual dexterity such as jujitsu and judo may not always be suitable for young children.

Multiple studies showed that higher ranks are at higher risk of injury, though very few explanations were provided within the literature for this phenomenon. We could hypothesise that it is because higher grades are performing techniques more rapidly and with heavier contact, or accelerating more simple techniques to make them more advanced, as well as developing new techniques of their own. Another factor to consider may be that higher grades are deemed more capable of training between themselves and less likely to injure themselves than lower grades, so are perhaps not supervised as much during training as the lower grades are and therefore are at higher risk of injury. It is likely that the full contact nature of higher grade techniques in combination with performance and development of more advanced techniques is the culprit responsible for the statistics shown in the aforementioned studies, though in theory, higher grades should have a more advanced level of control in their techniques and also a more in depth level of knowledge of injury risks, so one could argue that the injury rate should be lower. Because of the lack of explanation for the findings in the studies, it is difficult to recommend practices that could be implemented during training to mediate the apparent higher injury risk to higher grades, though this may be something to discuss amongst black belts, senior and chief instructors in individual dojos/gyms.

Traditional teaching methods appear to carry more psychosocial benefits than modern martial arts and most studies recommend including traditional teaching during every lesson, from day one onwards. Traditional teaching could include meditation, lessons on discipline, respect, spiritualism, anger management and teaching students when and where their combative techniques are (or aren't) appropriate. From reviewing the literature around this topic, it is

recommended that clubs should endeavour to allocate a specific amount of time per lesson for these subjects.

Because of the aforementioned risks associated with throws it is crucial that all throws are taught and executed correctly at appropriate grade level. Instructors should critically evaluate the grade at which each throw is introduced into the syllabus, as the high injury potential for certain throws may warrant them being moved to a higher grade. All throws should be correctly taught and the relevant movements practised slowly and carefully prior to executing the throw for the first time.

Multiple studies showed that training time of over 3 hours per week increases the risk of injury. It is not stated whether this is one single session of 3 hours in duration, or whether multiple short sessions contribute to this total. This finding is difficult to interpret as one could argue that more dedicated martial artists will indeed train for more than 3 hours per week, usually over multiple training sessions, and in doing so are therefore more likely to be injured because they have more exposure to the martial art than athletes training for fewer than 3 hours per week. The statement also does not take into account whether rest breaks during sessions were provided, or whether students warmed up adequately prior to their training sessions. There is also no data provided on reported rates of tiredness, fitness or skill level of these athletes during lessons, which could be potential confounding variables and nullify this finding.

From this review, it can be concluded that martial arts provide a number of benefits to individual athletes and to society. There are risks associated with martial arts (as there are with the majority of sports), and these risks must be mediated as much as possible via adequate training and good quality teaching by experienced, qualified instructors in order to provide a safe and beneficial environment for practitioners.

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