



Older Persons Participation in Hard Martial Arts: Opportunities to Improve Psychological Well-Being? A Scoping Review

DAN SULLIVAN^{†*1}, MIKE CLIMSTEIN^{‡2,3}, BRIAN MOORE^{‡4}, LUKE DEL VECCHIO^{‡2}

¹Faculty of Health, Southern Cross University Bilinga, QLD, AUSTRALIA; ² Clinical and Health Services, Faculty of Health, Southern Cross University, Bilinga, QLD, AUSTRALIA; ³Physical Health, Well-being and Performance Research Group, Faculty of Health, University of Sydney, Sydney, NSW, AUSTRALIA; ⁴School of Education, Charles Sturt University, Bathurst NSW, AUSTRALIA

[†]Denotes graduate student author, [‡]Denotes professional author

ABSTRACT

International Journal of Exercise Science 17(5): 183-198, 2024. This study aims to explore the potential psychological and cognitive advantages for older individuals engaged in hard martial arts (HMA), through a comprehensive scoping review of literature up to 2023. Specifically, it examines the extent of changes in cognition, mental state, and quality of life among elderly participants of HMA. Inclusion criteria were studies conducted on healthy persons who were over 50 years of age. Only papers published in the English language were included. The search was undertaken in electronic databases and sources of grey literature. Thirteen papers with a total of 514 participants met the inclusion criteria. Improved cognition and decreased levels of anxiety and depression were emerging themes. Together, these factors contributed to the quality of life of participants. HMA was found to benefit cognitive abilities and psychological well-being, increasing quality of life more than traditional exercise alone. Findings suggested duration of training influenced change more than frequency. The limited number of studies exploring the effects of HMA on mental wellness and cognitive ability in older adults underscores the need for further research. The findings of this review suggest cognitive and quality of life improvements and reduced depression and anxiety in individuals engaging in HMA. This review serves as a foundation for soundly designed future research.

KEY WORDS: Cognition, elderly, karate, Muay-Thai, organised sporting activity, older, quality of life, QoL taekwondo

INTRODUCTION

Globally populations are ageing. There is irrefutable evidence (2, 17, 33) that physical inactivity and a sedentary lifestyle in older adults reduce Quality of Life (QoL). The mechanisms for this reduction include physical infirmity, cognitive decline, dementia, and psychological disorders such as depression.

The prevalence of diseases such as dementia is rising in Australia (20) and around the world (56). Participation in organised sports has the potential to lessen the incidence of premature death from causes such as dementia, Alzheimer's disease and other causes related to the reduction of cerebrovascular function (49, 59). As per current World Health Organisation (WHO) physical activity guidelines (64), it is recommended older adults complete 150 to 300 minutes of moderate-intensity aerobic activity weekly, while also minimising sedentary behaviours (2, 47). Embracing these recommendations for aerobic activity and reduced sedentary behaviour is essential for older adults to enhance well-being, QoL and reduce these risk factors.

Additionally, older age is associated with reduced activity which results in an increased incidence of physical disorders, reduced strength (42) and mental disorders such as depression (4). Some studies have found evidence that engaging in moderate-intensity exercise, such as participation in soft martial arts such as Tai Chi, and Yoga can effectively mitigate frailty, (26) provide opportunities for social interaction, (55) and increase QoL (25) in older age groups.

Much less is known about the potential benefits available to practitioners of hard martial arts (HMA) such as Karate, Taekwondo, Muay-Thai and other styles. In Australia, the popularity of HMA training across these styles has grown over time (7). However, in Western settings, younger persons (15-17 years) participate in HMA about six times more frequently than older adults (8). The underlying reasons for this age-related difference remain relatively unexplored. Some sporting organisations, like 'Running USA' (53), have successfully attracted participants from older age groups by adapting their programs to accommodate older individuals. This observation of age-adapted exercise programs suggests a potential avenue for encouraging greater participation among older adults in HMA.

Commonly held views of categorising martial arts as either hard or soft tend to be simplistic. Styles such as Jeet Kune Do made famous by practitioners such as Bruce Lee spring to mind when HMA are discussed, however defining styles is in reality more complex (18, 50). For example in North America, Kung Fu is usually categorised as a soft style (43). However, Kung Fu encompasses many styles, some of which incorporate explosive 'hard' movements such as those found within the different styles of Shaolin Kung Fu (54). Historically these styles have been used in warfare by Chinese soldiers (54). Within Chinese martial arts a distinction has long been recognised between 'external' and 'internal' styles (40) which loosely reflect harder and softer styles. Therefore, a generally accepted categorical differentiation between hard and soft styles does not exist. It is perhaps more helpful to think of different styles of martial arts as on a continuum with softer styles such as Tai Chi at one end and more combative mixed styles at the other. In general, hard martial arts rely upon explosive, forceful movements and countering forceful blows by returning them. This contrasts with softer styles which rely upon circular movements and redirecting the energy of an opponent's strikes. This review has taken an inclusive definition of which styles are considered 'hard' to include styles likely to be practised by older persons and therefore gather meaningful evidence.

Studies which have evaluated the potential health benefits of participation in HMA to older adults are limited, and many have examined specific outcome variables of physical health such as tumour markers (24) or the prevalence of hypertension (46). The objective of this scoping review was to gather and analyse both published and unpublished (i.e., grey literature) information on the broader impact of participation in HMA on the well-being of older individuals. Measures such as reduced depression or anxiety, or improved cognition which extrapolated to improved QoL were included in this study.

This review used the definition of health provided by the World Health Organisation (WHO) (61, para. 2) which considers health to be 'a state of complete physical, mental and social well-being not merely the absence of disease or infirmity'. Gaining insights into how individuals can actively maintain their well-being as they age is of paramount importance as the number of older persons increases. Government policies have begun to emphasise the involvement of older individuals (6) in organised recreation and sporting activities. However, it is important to understand that not all persons affiliate with mainstream activities. For example, Lee (32) noted the reciprocal relationship between an individual's choice of group leisure activity and the activity's reflection on their identity. When individuals decide to engage in physical activity, they consider various factors, including the degree of conformity or individuality they wish to project (10). Accordingly, a strong alignment between individuals' perception of their chosen activity and their identity serves as a powerful predictor of commitment.

Consequently, it becomes evident that individuals exploring non-mainstream physical activity options will actively seek detailed information (16, 31). To address this demand, governments aiming to reduce the burden of disease among older populations and sporting organisations endeavouring to boost participation must provide insights into the advantages of engaging in non-conventional, physical activities (27, 31). Additionally, they should adapt their programs to accommodate older individuals, thereby extending the opportunity for enhanced mental health and improved quality of life among older adults who may not identify with conventional, physical activities. By doing so, societies can effectively maximise participation in non-mainstream physical activities and, in turn, reduce the burden of disease on society from older persons.

This review aims to investigate the impact of participation in HMA on the psychological well-being of individuals aged 50 years and older, and to examine how changes may influence their overall QoL. Specifically, it is hypothesised that active participation in HMA by individuals aged 50 years and older will lead to significant improvements in cognitive function, reduced depression, and decreased anxiety levels. These factors are known to significantly contribute to an individual's QoL. Through this review, we aim to gather and analyse evidence that supports the hypothesis, shedding light on the potential benefits of HMA for enhancing the mental health and well-being of this demographic.

METHODS

Protocol

This study complied with and adheres to the ethical standards of scientific discovery in exercise science as described and required by the International Journal of Exercise Science (45). A scoping review protocol was registered with the Open Science Framework (OSF) (<https://doi.org/10.17605/OSF.IO/DJPHN>). The review was conducted using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) extension for scoping reviews (57) (Figure 1). Scoping reviews are the preferred tool for exploring the literature in order to establish what is known about a topic which has had limited exploration (35) such as this one. Scoping reviews include studies with a diverse range of methodologies and these are analysed with the aim of collating a current knowledge base and identify knowledge gaps (5). Given the multifaceted nature of research methodologies related to HMA, a scoping review was identified as the most suitable approach for this investigation. Thematic analysis (14) was selected as the most sensitive and flexible way of interpreting the data. Table 1 provides a detailed description of the search protocol, encompassing databases and keywords employed during the search process. We considered thematic analysis an essential and methodologically sound tool for achieving the research objectives. This approach allowed us to extract valuable insights and provide a comprehensive overview of the available evidence.

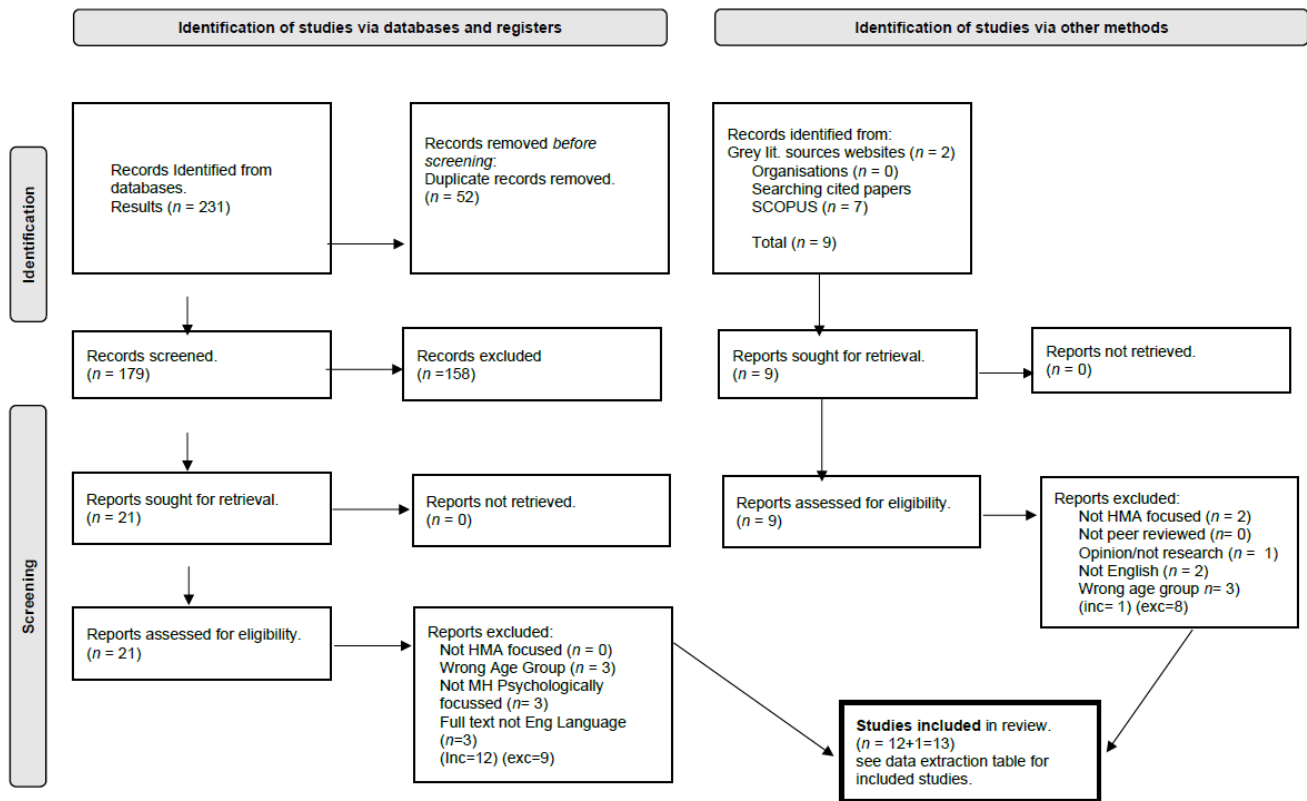


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

Table 1. Search Protocol

	Inclusion Criteria	Exclusion Criteria
Time Period	1900 - 2023	None
Setting	Community Programmes	Studies reporting on professional or competitive athletes. Studies aimed at performance enhancing.
Study design	Experimental and quasi experimental studies. Qualitative studies reporting participants experience, opinions or perception.	Case studies, papers expressing opinion, non-original research
Martial Art	Hard Martial Arts: Judo, Karate, Taekwondo, Thai Boxing, Kendo, Ju-Jitsu, Kung Fu,	Soft Martial Arts: Qigong, Tai Chi, Aikido
Participants	Studies with a mean participant age of over 50 years old	Studies with a mean participant age of 49 years old or younger
Outcomes	Studies that aimed to report on psychological, cognitive or Quality of Life changes as a result of participation in HMA as a primary or secondary objective.	Studies which did not report psychological, cognitive or QoL changes. Studies which reported on physical health changes.
Language	English	Translation from languages other than English was beyond the available resources of this study
Databases	Academic Search Premier, AMED, CINAHL, MEDLINE, Cochrane Database of Systematic Reviews, Global Health, Health Source-Nursing/Academic Edition, APA PsycINFO, Scopus, SportDiscus and Web of Science, Opengrey, Google Scholar	No source was excluded
Key words	Older, elderly, aged, senior, older adult, well-being, mental well-being, mental health, wellness, psychological well-being, psychological health, depression, quality of life, cognition Kung-Fu, Muay Thai, Thai-boxing, kickboxing, jujitsu, kendo, Karate, Taekwondo, hard martial arts, Silat, Kempo	

HMA = Hard Martial Arts, AMED = Allied and Complementary Medicine, CINAHL = Cumulative Index to Nursing and Allied Health Literature, MEDLINE = Medical Literature Analysis and Retrieval System, APA = American Psychological Society.

A number of existing systematic and scoping reviews were identified which had related aims to this review (see Table 2). However, no reviews were identified with the same aims as this review. Of these reviews some ($n=3$) were not reviewing HMA. Other reviews reported only findings related to non-psychological or cognitive outcomes ($n=6$). One review (58) investigated a similar population (> 45 years old) and incorporated some studies using karate and other HMA, however, the review also included fencing, boxing and wrestling which are not included in this review. Linhares, et al. (37) had similar aims to this study and was methodologically sound; however, the review included only seven studies which were all Taekwondo-based. Additionally, that review had minimal discussion on changes to mental health or well-being. A methodologically sound systematic review by Origua Rios, et al. (49) had similar aims to this review and sought to identify physical and psychological benefits of HMA to participants, however, that study was not focused on older persons.

Table 2. Systematic Reviews and Meta Analysis Evaluating Related Criteria

Author and Year	Title	Comment
Zhou et al., 2022	Effects of traditional Chinese exercises on cognitive function in older adults with mild cognitive impairment: A systematic review and meta-analysis.	Not focussed on HMA
Linhares et al., 2022	Effects of taekwondo on health in older people: a systematic review.	Not focussed on psychological or cognitive change
Origua-Rios et al., 2018	Health benefits of hard martial arts in adults: a systematic review	Not focussed on psychological, cognitive or older persons
Polumbo et al., 2023	Risks and Benefits of Judo Training for Middle-Aged and Older People: A Systematic Review	Not focussed on psychological or cognitive change
Singh et al., 2023	Effectiveness of physical activity interventions for improving depression, anxiety and distress: an overview of systematic reviews.	Not focussed on HMA or older persons
Valdes-Badilla et al., 2021	Effects of Olympic Combat Sports on Older Adults' Health Status: A Systematic Review.	Not focussed on psychological change. Based on competition.
Ciaccioni et al., 2019	Effects of Judo Training on Bones: A Systematic Literature Review.	Not focussed on psychological, cognitive or older persons
Barbeta et al., 2019	Effects of combat sports on bone mass: Systematic review	Not focussed on psychological, cognitive or older persons

HMA = *hard martial arts*

RESULTS

Two hundred and thirty-one studies were identified via the search strategy in the traditional literature. After removal of duplicates ($n=52$) and articles not meeting the inclusion criteria ($n=158$) a total of 21 studies were marked for review. Of these, further studies were excluded due to not being available in English ($n=3$), not having a primary psychological focus ($n=3$), or participants not being in the correct age group ($n=3$). This meant twelve studies were included

in the review from traditional media. One study which met inclusion criteria was identified through other search methods, therefore 13 studies were included in this review (see Table 3).

Of those included five studies reported health effects from Karate practice, three from Taekwondo, and one each from Judo, Kung Fu, Thai boxing and Kendo and one was mixed. Interventions were between eight weeks and 15 months duration with HMA exercise sessions scheduled between one and five times weekly, with session durations of either 40 (n=2), 60 (n=6) or 90 (n=1) minutes.

There were 514 participants in the 13 studies which were identified and these took place in 10 different nations. These included Brazil (n=2), Belgium, South Korea (n=2), Germany (n=2), French Polynesia, Poland, The Netherlands, Thailand, Spain, and Switzerland. Of the thirteen studies, nine used a quasi-experimental or experimental design and included a control group (9, 15, 21-23, 30, 38, 52, 63) one study used an experimental design which was not controlled (39) and three studies were cross-sectional (41, 44, 60).

Table 3. Summary of Included Studies

Authors	Country	Participants	HMA style	Study Design
Baek <i>et al.</i> , 2021	South Korea	24 females	Taekwondo	RCT
Cho, S. & Roh, H. 2019	South Korea	37 females	Taekwondo	RCT
Jansen <i>et al.</i> , 2012	Germany	45 persons	Karate	Q. Exp.
Jansen <i>et al.</i> , 2017	Belgium	55 males	Karate	RCT
Janyacharoen <i>et al.</i> , 2018	Thailand	56 persons	Thai Boxing dance	RCT
Kujack <i>et al.</i> 2022	Poland	45 persons	Judo	RCT
Lopes <i>et al.</i> , 2019	Brazil	33 persons	Karate	Q.Exp
Ludivine <i>et al.</i> , 2010	French Polynesia	15 males	Karate	Q. Exp.
Muinos, M., Ballesteros, S. 2015	Spain	20 persons	Kendo	RCT
Mendonca <i>et al.</i> , 2017	Brazil	15 persons	Karate / Judo	Cross Sectional
Pons <i>et al.</i> , 2013	Netherlands	24 persons	Taekwondo	Q. Exp.
Walther <i>et al.</i> , 2018	Switzerland	56 persons	Kung-Fu	Observational
Witte <i>et al.</i> , 2016	Germany	89 persons	Karate	Q. Exp.

RCT= Randomized control trial; Q. Exp = Quasi-experimental.

Themes

After data extraction, reflexive thematic analysis (14) was used to explore the identified themes within the papers and compare the findings between studies. All authors reviewed the data and agreed on the structure of the final findings. Finally, the data were collated, summarised, and presented as a narrative synthesis of findings. Two themes were identified, and these two themes captured the major findings of studies that have been conducted in this age group of persons who participate in HMA. These themes were: (i) Psychological Effects, (ii) Cognitive effects.

Theme one: Psychological Effects

There were 272 participants in studies measuring psychological effects. Most of these studies had small numbers of participants, however the studies conducted by Jansen, et al. (22) and Janyacharoen, et al. (23) were both slightly larger with 55 and 56 participants respectively. Studies measured psychological well-being in differing ways. These included, both the Short Form 12 (SF12) and Short Form 36 (SF36) (36), the Beck Depression Inventory (BDI) (1), the WHO QoL BREF (65) and the Geriatric Depression Rating Scale (3). Four studies were gender-specific (men n=126, women n=24).

The study by Baek, et al. (9) recruited only women and was conducted in South Korea. This study used a randomised and controlled experimental study design and Taekwondo training as an intervention. The study aimed to measure changes in participants' depression using the Korean version of the Geriatric Depression Rating Scale (KGDS) (29) and found a statistically significant ($p<0.01$) improvement in depression among those persons in the Taekwondo group (Table 4).

Two other gender-specific studies recruiting only males (n= 55 and n=15) were both Karate based and conducted by Jansen, et al. (22) and Ludivine, et al. (39). These two studies were conducted in Belgium and French Polynesia. Both used a pre/post-intervention design, however the Ludivine, et al. (39) study did not use a control group. Both studies reported improvement in the well-being of participants as measured by reduced anxiety and depression (Table 4).

Walther, et al. (60) evaluated Swiss males who were already practising Kung Fu or Tai Chi and compared these men to a matched control to identify if frequency of training affected psychological health, this study also identified improvements to QoL and well-being through participation (Table 4). Two studies Mendonça, et al. (41) and Janyacharoen, et al. (23) specifically evaluated QoL. These studies were both RCT designs and used Kendo and Muay Thai Wai Kru as interventions. Both studies found a significant correlation between QoL and participation in HMA.

Three studies specifically measured changes in anxiety and depression (together or separately) as a result of participation in HMA. These were studies conducted by Jansen, et al. (22), Baek, et al. (9) and Ludivine, et al. (39). The study by Jansen, et al. (22) had the shortest duration at eight weeks of all studies included in the review. The findings reported only small positive changes to anxiety and self-rated mental well-being. The study conducted by Baek, et al. (9) over a longer 12-week period in a group of women suffering depressive symptoms reported increases in measures of functional fitness and a decrease in depression as measured by the KGDS (29). The study with the longest duration and highest frequency of training (39) found statistically significant improvement ($p<.01$) to participants' mood as measured by both the SF12 and the BDI (1).

Jansen, et al. (21) measured cognitive and emotional status in non-community-dwelling older persons using four different independent variables. Participants were placed in one of four

groups, and over a sixteen-week period participated in either ‘cognitive training’, a simple exercise group which included stretching and strength training, Karate or ‘no intervention’ group. Only the Karate group reported significant change, this was to improved well-being (see Table 4).

The Janyacharoen, et al. (23) study randomised 56 (mostly female) participants into Muay Thai Wai Kru or home exercise (control group). Participants had a mean age of 68 years and trained for 40 minutes per session, three times weekly. This study reported positive changes in all domains of the WHO QoL (66) measure to those in the Muay Thai group. Changes reached statistical significance in the psychological (p=0.048) and physical (p=0.018) domains. The Janyacharoen, et al. (23) and Jansen, et al. (21) studies are important as they measure HMA against simple exercise and both found the participants of the HMA groups improved more than persons doing exercise alone.

Table 4. Change to mental state and QoL related to training frequency

Study	Training frequency	Measure	Result
Jansen <i>et al.</i> , 2017	Twice weekly	Multidimensional Mood Questionnaire	No change
Mendonca <i>et al.</i> , 2017	Twice weekly	WHO QoL	Improvement QoL in social, environmental and physical domains.
Jansen, P. and Dahmen-Zimmer, K. 2012	Twice weekly	CES-D (German version) SF12	Change only to Karate group on emotional wellbeing
Baek <i>et al.</i> , 2021	Three times weekly	Geriatric Depression Rating Scale	Improvement in depressive symptoms ($p < 0.01$)
Ludivine <i>et al.</i> , 2010	Three times weekly	Beck Depression Inventory	Improvement in depressive symptoms ($p < 0.01$)
Janyacharoen <i>et al.</i> , 2018	Three times weekly	WHO QoL	Statistically significant improvement QoL in psychological and physical domains
Walther <i>et al.</i> , 2018	Up to Four times weekly	Centre for epidemiological studies depression scale (CEDS) Satisfaction with Life (SFWL)	Improvement to QoL Reduced depression

WHO = world Health Organization; QoL = quality of life; CES-D = Center for Epidemiologic Studies depression scale; SFWL = Satisfaction with life survey.

Theme Two: Effects on Cognition

Six studies (15, 30, 38, 44, 52, 63) measured changes in participants’ cognition as a result of participation in HMA. There were 204 male and female participants across these six studies. The studies were conducted in South Korea, Poland, Brazil, Germany, Spain and the Netherlands. All studies used a pre-intervention post-intervention design except the study by Muinos and Ballesteros (44), which was a cross-sectional study and compared the visual acuity of HMA athletes of different ages. Only the Lopes Filho, et al. (38) study of 33 persons and the Cho, et al.

(15) study of 37 female participants included control groups. Studies measured cognition in differing ways. These included cerebral blood flow (15), brain derived neurotrophic factor (BDNF) (15, 30) Mini Mental State Exam (MMSE) (15) and other tests such as a digit span, letter fluency and self-reported measures (52).

Taekwondo was used as the intervention in both the Cho, et al. (15) and Pons, et al. (52) studies, Kujach, et al. (30) used Judo and in the Lopes Filho, et al. (38) and Witte, et al. (63) studies both used Karate. The duration of interventions ranged from 12 weeks (30, 38) to 15 months (52) and the frequency ranged from weekly training sessions of 60 minutes (52) to 60 minutes five times weekly (15).

The study with the most intensive intervention was conducted by Cho and Roh (15) which had a duration of 16 weeks with five training sessions each week. In the 12-week study by Lopes Filho, et al. (38) which consisted of two training sessions per week, the MMSE was used as a primary measure, and a statistically significant ($P < 0.05$) difference was reported compared to the control group. Furthermore, in the study conducted by Kujach, et al. (30) which also spanned 12 weeks with twice-weekly training sessions and included measurements of BDNF, the investigators found statistically significant ($P < 0.01$) differences in levels of peripheral BDNF. These changes in BDNF levels, infer improved cognitive ability. The longest but least intensive study ran for over one year but only met once weekly (51). This study also reported significant improvement in the cognition of participants as measured by reaction and motor time tests (respectively $p = 0.004$ and $p = 0.015$). This study also used the digit symbol coding test and reported significant improvement ($p = 0.017$).

Table 5. Change to mental state related to duration of training

Study	Duration in Weeks	Measure	Result
Jansen <i>et al.</i> , 2017	8 weeks	Multidimensional Mood Questionnaire	No change
Baek <i>et al.</i> , 2021	12 weeks	Geriatric Depression Rating Scale	Improvement QoL in social, environmental and physical domains. Statistically significant improvement QoL in psychological and physical domains
Janyachoen <i>et al.</i> , 2018	12 Weeks	WHO QoL	Improvement to emotional wellbeing
Jansen, P. and Dahmen-Zimmer, K. 2012	16 weeks	CES-D (German version) SF12	Improvement in depressive symptoms ($p < 0.01$)
Ludivine <i>et al.</i> , 2010	52 weeks	Beck Depression Inventory	Improvement in depressive symptoms ($p < 0.01$)
Mendonca <i>et al.</i> , 2017	> than 52 weeks	WHO QoL	Improvement in depressive symptoms ($p < 0.01$)

Walther <i>et al.</i> , 2018	Various	CES-D, SWLS	Positive association with mood and training duration
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WHO = World Health Organization; QoL = quality of life; CES-D = Center for Epidemiologic Studies Depression scale; SFWL = Satisfaction with life survey.

Witte, et al. (63) evaluated change in the cognitive function of 89 older persons with a mean age of 70 years using Karate training twice weekly for 60 minutes each session as an intervention. The study used Karate, control, and simple exercise groups which aimed to improve balance, coordination, and strength as independent variables. Measurements were collected at five months and 10 months. The control group was not included in the second part of the study at 10 months. The study used a number of measures which included the 'falling rod test' (12) to measure reaction time and the Demtect test (28) to measure mild cognitive impairment. The results found a statistically significant change in reaction time ($p < .01$) using the falling rod test between baseline and 10 months of the Karate group. The authors reported that five-months of Karate training can help to enhance attention, resilience, and motor reaction time, more than standard fitness training but a training period of 10 months is more efficient in increasing cognitive functioning as measured by reaction time.

DISCUSSION

The results of this review suggest participation in HMA can have a positive impact on cognitive function, reduced anxiety and depression and improved QoL in older adults. As acknowledged earlier in this paper the relationship between exercise generally and these variables is well established. However, the findings of this review suggest that when HMA is used as an intervention the benefits are greater than exercise alone. This proposition is based on studies (21, 23) that used simple exercise control groups and found HMA to have a greater benefit than exercise alone to psychological well-being. Similar changes to the cognitive ability of HMA participants were found (62) compared to those participating in simple exercise alone.

Studies varied in duration from eight weeks (22) to one year (39) and in frequency of training from once weekly (52) to five times weekly (15). Only the study by Ludivine, et al. (39) used training sessions over 60 minutes, and these were 90 minutes. This study also had the longest duration, the highest frequency and the longest training sessions of all studies in this review. This study reported significant ($p < 0.01$) improvements to depression as well as participants' perception ($p < 0.01$) of their health. However, this study could only report a trend as there was no control group, and the numbers of participants ($n=15$) were also small. The shortest study by Jansen, et al. (22) recorded small but significant changes to the mental component of the SF12 ($p < 0.05$) in the Karate group. They also reported improvements in other measures for the Karate group, however, these did not reach significance. The longer-duration studies of at least 12 weeks all reported an improvement in participants' depressive symptoms (9, 39) which reached statistical significance (see Table 4). It is noteworthy that even one weekly training session over 15 months can lead to measurable cognitive changes, such as improved reaction time and digit span (34). These findings suggest that while the frequency of training is important the duration

of training has the greatest influence on reducing anxiety and depression and improving QoL and cognition in older persons.

There was no difference identified in outcomes related to the style of HMA. None of the studies controlled for, or discussed the potential effect of increased social interaction through participation which may account for some of these effects. Therefore, further investigation is required to determine the mechanism of change. These findings suggest older adults benefit from improved QoL, reduced anxiety and depression and increased cognitive ability from HMA participation and are consistent with the results of other meta-analysis which have examined a wider range of age groups (48, 49). The variety of martial arts, the methodologies used to study them and a universally accepted definition of what constitutes hard and soft styles of martial arts presents challenges when attempting to collate, interpret and compare information from different studies. This review included only Asian martial arts however it may be beneficial to include other styles such as boxing (11) and wrestling (19) in future investigations. The findings of at least some meta-analysis of studies (13) conducted into these styles also support the findings of this review.

This review is subject to several limitations. Firstly, the availability of papers not written in English posed a constraint as translation was beyond the resources of the study. Secondly, the lack of a universally accepted definition for HMA posed a challenge. The absence of consensus made comparing and synthesising results across studies difficult. Finally, methodological and rigor differences were observed, potentially impacting the comparability and generalisability of the findings. These variations may introduce bias or limitations when synthesising the results and drawing overarching conclusions.

These findings highlight the potential of HMA as a therapeutic intervention for promoting psychological well-being and QoL. Further enquiry is required to establish the motivations of older persons selecting HMA as an activity. This review highlights the need for further investigations into the mechanisms for change in older persons' mental wellness that can be gained through practice in HMA utilising well designed studies with adequate sample sizes.

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