

Relationship between Asian martial arts and health-related quality of life in Germany

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Abstract: Aim: Due to of the steady increase in health care costs, a greater focus on maintaining wellness and preventing health issues has been established. Historically, Asian martial arts were closely associated with maintaining healthfulness. Thus, the aim of this investigation was to determine if people who practice Asian martial arts gain any health-related quality of life benefits compared to the general population.

Subject and Methods: Therefore, 343 martial artists practicing eight varieties of martial arts answered the German standardized questionnaire 36 in a controlled setting at 24 martial arts schools (3 schools per martial art) between February 2008 and July 2008. These participants were not given information regarding the purpose of the study. Additionally, between July 2008 and December 2008, 2512 martial artists completed an online version of German standardized questionnaire 36.

Results: The results of those completing the questionnaire in person differed from those responding to the online questionnaire. Compared to the general public, both martial arts groups rated their health-related quality of life to be better. Of the parameters evaluated, the greater differences were observed for physical aspects of health than for psychological aspects.

Conclusion: Thus, these results indicate that participation in martial arts provides health-related quality of life benefits associated with the prevention of health problems. However, further studies are needed to understand the complex relationship between the practice of martial arts and improved health.

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Relationship between Asian martial arts and health-related quality of life in Germany

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Keywords

Martial arts, primary prevention, health-related quality of life, German standardized questionnaire 36

Introduction

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Currently, Asian martial arts are practiced by many thousands of Germans in all age groups. The largest association, with more than over 200,000 members, is the Judo Federation, followed by the Karate Association (~110,000 members), the Jujutsu Association (~60,000 members), and the Taekwondo Union (~45,000 members). Each of the martial arts schools are organized by the corresponding associations, but are also supplemented by both commercial and private institutions and organizations. Further, the vast number of different martial arts styles available throughout Germany underlines the popularity of this sport.

In addition to the common martial arts styles like Judo, Karate, Jujutsu and Tae Kwon Do (TKD), other lesser known styles, such as Esdo, Kendo or Wing Tsun, are also practiced. Further, there are enumerable rare styles of martial arts practiced, making it impossible to fully account for all of the different martial arts styles available in Germany. The interest of this study was to determine if those who practice Asian martial arts feel healthier – physically and psychologically – than the rest of the German population.

There has been a steady increase in health care costs in Germany over the last several years. In 2007, the cost of health care was approximately 252.8 billion Euros, which represents a 3.2% (or 7.8 billion Euros) increase over the previous year. Per person, these health care costs are 10.4% of the gross domestic product (or 3,070 Euros) per household and are slightly higher than previous years (2970 Euros and 2900 Euro in 2006 and 2005, respectively). Between 2000 and 2006 health care costs increased only 1.4% per person in Germany. This relatively slow rise in health care costs was partially due to the implementation of cost-reducing health care reform (Federal Statistical Office 2007). Given the continued increase in health care costs in Germany, ways to stimulate a broader sense of health-consciousness among the general population, as well as developing strategies for the prevention of health problems, have gained focus in political and social arenas (SPD/Greens 2005).

The Ottawa Charta WHO (1986) is regarded as a milestone of modern illness-prevention and health promotion. Preventing health-related issues and promoting wellness have become broadly relevant social topics and active areas of research. The Federal Ministry of Education and Research (BMBF 2006) in Germany has recognized the importance of primary prevention, which refers to any prophylaxis that is able to prevent an illness from occurring. This includes education for managing individual health risks and support/treatment aimed at changing high-risk behavior. Rosenbrock (2008) believes that improvements in primary prevention efforts are necessary to adequately face upcoming challenges in health politics. However, the BMBF states that the number of studies that measure the effectiveness and efficiency of primary prevention and health promotion are

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insufficient. Superior indicators and devices of elevation used to determine the quality of structure, process and result are still to be developed.

Asian martial arts have a tradition and culture dating back several thousand years. In addition to the physical aspects of martial arts, traditional martial arts training programs also include the teaching of social values and methods to establish and maintenance of health. For example, part of the original martial arts curriculum included respecting creation, treating your fellow men right and peacefully, obtaining from alcohol and tobacco, moderating your eating habits, and the regular practice of meditation techniques (Dolin, Popow, Tolstikow 1988).

The concepts taught through martial arts are similar to the primary prevention concepts established by the German compulsory health insurance companies. Their head organizations have defined the standard primary spheres of preventive activity, such as motion, nutrition, relaxation, handling strain, prevention of addiction, and the general competence of life (Head organization of health insurances 2008). Since these ideas are all covered by martial arts education, the practice of Asian martial arts could be one means to improve the health standards of the German population and therefore help to reduce public health care costs.

Present studies show only what impacts the practice of martial arts can have on the person's psychological and physical health. A study by Held (2004) that examined 180 people showed the practice of TKD provided a positive impact on the person's subjectively felt state of health. Participants reported that they had more energy and felt less stressed than before the workout. A report by Binder et al. (2007) showed that several investigations over the last 30 years about the health benefits of martial arts had concluded that positive psychosocial changes are observed in people practicing martial arts. In contrast, three studies did not detect any changes (positive or negative) in the participants and three other studies showed that martial arts training has a negative impact on healthfulness. It is widely held that including only the physical aspects of martial arts training and omitting the teaching of ethnical and moral values is responsible for the observed negative impacts. Although this question remains unanswered, martial arts are viewed as potential alternative or additional therapy to treat mental-health problems. The benefit of martial arts for mental-health problems was supported by a case study by Weiser, Kutz I, Kutz S, and Jacobson (1995). Further, studies by Terry (2006) and Bitzer-Gavornik and Unterrainer (2006) on Karate show that athletes of different ages consider themselves to be mentally tougher.

Other studies have shown that breaking off training has an opposite effect on the psychology of advanced karate athletes. Both males and females reported increased anger, negative emotions, depression, and noticed strain and mood swings (Szabo 2001). While in

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other studies, martial artists were found to not be more violent (Grabert 2001) and did not display increased aggression (Hoffmann 2006).

The risk of injury associated with martial arts could be seen as a negative factor for the prevention of health issues. The number of injury experience by 263 martial artists coming from five different styles was investigated by Zetaruk, Violán, Zurakowski, Micheli (2005). Athletes who practiced TKD had a risk of injury three-times higher than those who practiced Shotokan Karate or Kung Fu. The number of injuries was similar between males and females. Burke, Barfoot, Bryant, Schneider, Kim, and Levin (2003) investigated the number of injuries during a Taekwondo tournament with 2498 participants. Previous tournaments had a rate of injury as high as 25/1000 to 12.7/100; however, this tournament had a 0.4/1000 rate of injury. These authors concluded that TKD was safer than other martial arts styles as long as the required security measures are maintained.

Parzeller and Raschka (2003) performed a 20-year long study (1981-2000) on 2969 cases of unexpected deaths Germany associated with sports. The finding showed no martial artists among these casualties. Instead, the greatest number of deaths were associated with soccer (n= 919), tennis (n= 209), and cycling (n= 187). Thus, martial arts have been extensively investigated in several studies that analyzed different problems from different points of view.

Many of these investigations have definitively shown an improvement of the athlete's physical condition over that of people who do not practice martial arts. However, the above studies have not determined whether martial artists are healthier and more resistant to illnesses than those who do not participate in sport. Therefore, the aim of this investigation was to determine if there are additional health-related quality of life benefits observed in those who practice martial artists compared to the general population.

Method and procedure

From February 2008 to June 2009, 343 martial artists practicing eight different martial arts styles from 24 different schools answered the German standardized questionnaire 36 (SF-36) questionnaire in a controlled setting and without prior knowledge of the aim of the evaluation. To guarantee objectivity, the questionnaire was given before training in each of the schools. The authors of this paper, as well an informed fellow student who had not participated in any martial arts prior to conducting the study, supervised the procedure.

Additionally, from June 2008 to December 2008, 2512 martial artists answered the online questionnaire found on the website www.forschung-kampfsport.de (investigation in

1 martial arts). The IP-address of each responder was recorded to increase transparency and
2 limit the possibility of external manipulation.

3
4 Approximately 4000 e-mails were sent to associations, schools, and individual martial
5 artists inviting people to participate in the project. Furthermore, announcements appeared in
6 the magazines "Fitness Tribune" and "Kampfkunst International" (Martial Arts International),
7 as well as on the website www.kampfsport-deutschland.de (martial arts in Germany).
8 Several associations and martial arts schools added the above link to their websites to
9 promote the project.

10
11 The in-person questionnaire had martial artists describe themselves in regard to their
12 health-related quality of life based on the SF-36. The SF-36 is the most frequently used
13 international standard method of evaluating a person's health. It contains 36 items, 35 out of
14 which belong to the following eight scales:

- 15 1. Physical Operational Capability (10 Items)
- 16 2. Physical Role Function (4 Items)
- 17 3. Physical Pain (2 Items)
- 18 4. Average Cognition of Health (5 Items)
- 19 5. Vitality (4 Items)
- 20 6. Social Operational Capability (2 Items)
- 21 7. Emotional Role Function (3 Items)
- 22 8. Psychological Well-being (5 Items)

23
24 This questionnaire covers the multidimensionality of a person's state of health, including
25 their psychological and physical cognition, social relations, and functional competence.
26 Common treatments like the energetic terminal point diagnosis (Mandel 1990), blood
27 examinations, and more involved physical methods of evaluating the participants were not
28 used because the intent of this study was to examine a large cross-section of a variety of
29 martial arts styles in Germany. Therefore a procedure including physical treatments would
30 be too complex for a large sample size.

31
32 After consulting with experts in the area of illness prevention from accident and health
33 insurance agencies, additional questions were developed and added to the SF-36
34 questionnaire. These questions were also answered by the participants. The use of the SF-
35 36 questionnaire with additional questions was designed to show any gain of cognition
36 through the practice of martial arts. The question regarding the change of the state of health
37 in relation to the last year is not integrated in any scale and is evaluated separately (Bullinger
38 1998, p. 51-62). Further, different criteria, such as the number of participants that practiced
39 each style of martial arts were recorded to show the demographics of the sample population.
40 Including a variety of styles with different cultural backgrounds and histories of development

into the design of the investigation was regarded as very important. Martial artists could only participate in the online questioning after naming their style of martial arts.

Table 1: Martial arts representation in Present and Online groups

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Esdo Present	55	16.0	16.0	16.0
	Esdo Online	93	3.7	3.7	3.7
	Aikido Present	35	10.2	10.2	26.2
	Aikido Online	200	8.0	8.0	11.7
	WingTsun Present	37	10.8	10.8	37.0
	Wing Tsun Online	228	9.1	9.1	20.7
	Judo Present	39	11.4	11.4	48.4
	Judo Online	197	7.8	7.8	28.6
	Jujutsu Present	33	9.6	9.6	58.0
	Jujutsu Online	255	10.2	10.2	38.7
	Karate Present	54	15.7	15.7	73.7
	Karate Online	672	26.8	26.8	65.5
	Taekwondo Present	53	15.5	15.5	89.2
	Taekwondo Online	248	9.9	9.9	75.4
Kendo Present	37	10.8	10.8	100.0	
Kendo Online	156	6.2	6.2	81.6	
Philippine Martial Arts Online	66	2.6	2.6	84.2	
Kickboxing Online	80	3.2	3.2	87.4	
Kung Fu Online	84	3.3	3.3	90.7	
Miscellaneous Online	233	9.3	9.3	100.0	
Entire Present	343	100.0	100.0		
Entire Online	2512	100.0	100.0		

Importantly, differences observed for martial arts styles between the in-person (Present) group and the Online group result from the use of a layered sample method for the Present questioning procedure. The average age in the groups were 31.9 and 30.6 year for the Present (n=343) and Online (n= 2512) groups, respectively, and were lower than the general population comparison group (47.6 years; n= 2906). The educational background was higher for the martial artists. Furthermore, there was a difference between both sexes. In the Present group, 74.1% were men, 24.4% were women, and 1.5% did not specify their gender; in the Online group, 74.9% were men and 25.1% were women, and in the comparison group 44.4% were men and 55.6% were women. The average amount of training performed weekly for the Present and Online groups was 3.4 and 4.7 hours, respectively.

Results

Table 2
Comparison of Standard control group with Present group, Online group, and Combined Present and Online groups (Entire)

	Type	N	Mean	Standard deviation	p value + Sig. (1-sided)
SF-36 Physical operational capability (0-100)	Standard	2906	85.4061	22.49627	.000
	Present	343	95.8529	7.89559	.000**
	Online	2512	93.0018	14.15667	.000**
	Entire	2855	93.3443	13.58879	.000**
SF-36 Physical function (0-100)	Standard	2900	82.6041	32.91789	.000
	Present	343	95.1373	16.71499	.000**
	Online	2512	89.1699	25.67206	.000**
	Entire	2855	89.8868	24.84136	.000**
SF-36 Physical pain (0-100)	Standard	2908	78.8336	27.54676	.000
	Present	343	86.9684	16.51923	.000**
	Online	2512	79.9413	23.88882	.000**
	Entire	2855	80.7855	23.23817	.000**
SF-36 Average cognition of health (0-100)	Standard	2913	68.0338	20.63557	.000
	Present	343	79.4088	11.73618	.000**
	Online	2512	75.7795	19.61551	0.50
	Entire	2855	76.2156	18.87920	.000**
SF-36 Vitality (0-100)	Standard	2894	63.2480	18.52809	.000
	Present	343	64.6455	12.01420	.029*
	Online	2512	60.8065	18.15372	.109
	Entire	2855	61.2677	17.57287	.183
SF-36 Social operational capability (0-100)	Standard	2913	88.8027	18.34065	.000
	Present	343	87.6796	14.23899	.091
	Online	2512	88.3542	14.89307	.000**
	Entire	2855	88.2731	14.81522	.000**
SF-36 Emotional function (0-100)	Standard	2902	89.4719	26.96125	.000
	Present	343	94.4832	16.13849	.000**
	Online	2512	81.1596	32.00766	.000**
	Entire	2855	82.7603	30.84390	.000**
SF-36 Psychological well-being (0-100)	Standard	2906	73.8195	16.76168	.000
	Present	343	77.6868	10.25162	.000**
	Online	2512	70.7263	20.45838	.000**
	Entire	2855	71.5626	19.64588	.000**
ROH SF-36 change of health	Standard	2914	2.9044	.98696	.000
	Present	343	2.3920	.79594	.000**
	Online	2512	2.4752	.99311	.000**
	Entire	2855	2.4652	.97179	.000**

Standard = general population control group; Present = group who completed questionnaire in person; Online = group who completed questionnaire online; Entire = Present + Online groups.

+There is heterogeneity of variance within all t-tests.

Significance *($p < 0.05$) **($p < 0.001$)

The mean values for the questionnaire answers for the groups individually (Present and Online) or combined (Entire), which was weighted with respect to age, education, and sex, and the comparison group (Standard) underwent t-tests to determine significant differences between groups. The results are presented in Tables 2 and 3.

Table 3 Comparison of Standard and Martial Artists' groups' physical and psychological amount scale – group statistics.

	Type	S	Mean	Standard deviation	p value + Sig. (1-sided)
STANDARD. Physical amount scale	Standard	2868	50.0042	10.46447	.000
	Present	343	54.9039	4.34939	.000**
	Online	2512	53.9320	7.53140	.000**
	Entire	2855	54.0488	7.22992	.000**
STANDARD. Psychological amount scale	Standard	2868	51.4362	8.34471	.000
	Present	343	51.2193	5.34598	.254
	Online	2512	48.0615	10.25729	.000**
	Entire	2855	48.4409	9.85122	.000**

Standard = general population control group; Present = group who completed questionnaire in person; Online = group who completed questionnaire online; Entire = Present + Online groups.

+There is heterogeneity of variance within all t-tests.

Significance *(p< 0.05) **(p< 0.001)

The data from the SF-36 questionnaire allow a quantitative comparison of the subjective evaluation of health from the point of view of the interviewees. Compared to the general population (Standard), the martial artists from both the Present and Online groups report a higher degree of health and are closer to the ideal values for a healthy person. The most striking differences were observed for categories dealing with physical functions. Further, there were different results between the Present and Online groups and both martial artist groups and the comparison group.

Difference between the Present and Online groups originate from the different basic conditions and context of the questionnaire. The participants who completed the questionnaire in-person rated their subjective health condition directly before a martial arts training session and therefore were in a different physical, hormonal, and psychological context than the online interviewees. Additionally, the participants who completed the online questionnaire did so at different times of the day. Finally, seasonal effects could have altered the results, since the Present group completed the questionnaire during February-July and the online questionnaire was completed during July-December.

There were also differences in the composition of the Present and Online groups, as listed in Table 1. The martial art Esdo is a small association with approx. 15,000 members. Esdo refers to itself as a sport of health and defense. This group represents 16.0% of the Present group and only 3.7% of the Online group. Differences were also seen for those practicing Karate. This particular style was practiced by 15.7% of the Present group and

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26.8% of the Online group. In addition, 18.4% of martial artists responding to the online questionnaire practiced styles such as Kick Boxing or Philippine martial arts, which were not represented in the questioning of interviewees in-person at martial arts schools.

On the questionnaire, the 'Physical function' refers to the impact a person's physical health condition has on that person's daily work or activity. The mean of the 'Physical function' of the Present group was significantly higher (12.53) than that of the Standard group ($p < 0.05$). Further, while the mean of the Online group was also significantly higher (6.56) than the Standard group ($p < 0.05$), the Present group had an overall better score than the Online group.

The 'Physical operational capability' provides a measure of everyday physical activities, such as self-supply, hoisting, stooping, climbing stairs, as well as medium heavy or exhausting actions. In this category, there was also a highly significant difference of 10.45 between the Present group and the Standard group ($p < 0.05$). The difference between the Online group and the Standard group was 7.59. This was also a significant difference ($p < 0.05$) but less than the Present group by 2.85.

The subject areas 'Physical pain' and 'Average cognition of health' are part of the 'Physical amount scale'. The Present group was 8.13 and 11.37 points better than the Standard group for 'Physical pain' and 'Average cognition of health', respectively. These were also significant differences ($p < 0.05$). For 'Physical pain', the results of the Online group were 1.10 better than the Standard group but 7.02 worse than the Present group. Further, in the 'Average cognition of health' category the Online group was 7.74 better than the Standard group but 3.62 lower than the Present group. The difference between the Online group and the Standard group for the 'Physical pain' category was significant ($p < 0.05$) but for 'Average cognition of health' the difference did not reach statistical significance.

The results of the Present group for the 'Psychological amount scale' as well as in the 'Health changes in comparison to the previous year' category are not as clear as those of the 'Physical amount scale'. Parts of the 'Psychological amount scale' are: Vitality, Social operational capability, Emotional function, and Psychological well-being. There was no significant difference for the 'Psychological amount scale' between the Present group and the Standard group ($p > 0.05$); however, there was a significant difference between the Online group and the Standard group ($p < 0.05$). Further, there were significant differences between the Online group and the Standard group for the subcategories of the 'Psychological amount scale'. Specifically, there was a 5.01 difference in 'Emotional function' ($p < 0.05$) and a 3.86 difference in 'Psychological well-being' ($p < 0.05$). There were no significant differences for the 'Vitality' and 'Social operational capability' categories for the Online and Present groups, respectively.

Discussion

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2 An exemplary evaluation of the health insurance company Innungskrankenkasse
3 (Guild Health Insurance Company) Baden-Württemberg, which included 753 test persons
4 showed no backed findings but a tendency that persons using primary prevention methods
5 had improved health-related quality of life. The longitudinal evaluation with additional
6 questions taken from the SF-36 questionnaire could detect that all dimensions of health-
7 related quality of life significantly improved while the persons were enrolled in exercise and
8 relaxation courses. However, the sustainability and the stability of these effects were not
9 evaluated (Riemann & Gläser 2001). In the 'activity' primary prevention sphere used by the
10 compulsory health insurance agencies, activities like cardiovascular trainings, workouts for
11 the back and spine, walking, aqua-jogging, Qigong, Tai Chi, Yoga, autogeous training,
12 progressive relaxation of muscles, and others have been promoted. Except for Qigong and
13 Tai Chi, martial arts have not been recommended as primary preventive measures (TKK
14 2006).
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24 The current study was conducted to determine if martial arts qualify as a primary
25 prevention activity. The suitability of martial arts as primary prevention measures can only
26 be recommended if people who practice martial arts are actually healthier then people who
27 do not. However, a person's state of health is not an easily defined concept. Rather it is a
28 complicated interaction of many factors that require overall health to be examined from a
29 multidimensional point of view. Thus, we developed a questionnaire that considered multiple
30 parameters associated with health-related quality of life and considered psychological well-
31 being, physical condition, social relations, and functional competence.
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38 The results indicate that those who participate in any kind of martial art perceive their health-
39 related quality of life to be better than those in the general population. However, it is
40 necessary to look closer at the different dimensions before making an overall assessment.
41 Compared to the Standard group, who did not practice martial arts, those who practiced
42 martial arts scored significantly better on the questionnaire overall. This result confirms the
43 results of other studies that reported practicing martial arts improves the person's
44 psychological constitution. Importantly, for the psychological assessment in the present
45 study significant improvement in the Present group was only observed in the 'Emotional role
46 function' and the 'Psychological well-being' categories.
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54 A 30-year longitudinal study by Binders (2007) showed that positive psychosocial
55 changes in people who practice martial arts were always observed. In contrast, the present
56 study shows that a sophisticated picture of the health promoting effects of martial arts can be
57 constructed by including a series of questions that evaluate multiple aspects of psychological
58 well-being. We assume that there is a complex relationship between practicing martial arts
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1 regularly and any possible psychosocial benefits. For instance Dorscher and Preuß (2005)
2 elevated 50 martial artists and reported that focusing only on physical training for martial arts
3 competitions did not provide a positive change to the athlete's psychological health. Thus,
4 the success of a martial arts program for primary prevention may hinge on the scope of the
5 training program. A broad program that includes social, spiritual, and physical aspects may
6 be superior to a more narrow, purely physical training program designed to prepare an
7 athlete for a competition. Thus, the relationship between the practice of martial arts and
8 improved health likely includes other influences. For instance, the ultimately goals of the
9 training, as well as the social and occupational surroundings of the person may have a
10 deeper impact on their social operational capability than the physical movements of the
11 martial arts itself.
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18 Research on a person's quality of life traditionally requires the person to be present,
19 in-person, and to complete a paper questionnaire. However, due to factors such as costs
20 and time constraints, numerous studies have been adapted to utilize the Internet to collect
21 data. One complication of this is that internet based data gathering can influence the
22 subject's answers; though most studies do not report differences among the answers given
23 between in-person and online participants (Kongsved, Basnov, Holm-Christensen, Hjollund
24 2007). Because of that, the present study was conducted using both questionnaires
25 completed by participants in-person and those completing an online questionnaire. These
26 two questionnaires were administered at different times. The results were compared
27 according to the type of questionnaire and compared individually or as a whole to a standard
28 group (Tables 2 and 3).
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37 The different results between the Present and Online groups could result from
38 differences in the styles of martial arts practiced by the groups or differences in the
39 participant's behavior/activity prior to completing the questionnaire. No difference in sex or
40 relationship status was seen between the Present and Online groups. However, there were
41 behavior related differences between the groups, such as: voluntary work: Present 33.5%
42 and Online 45.7%; smoking: Present 7.6% and Online 15% Further, the Online group
43 practiced martial arts 1.3 hours more each week, on average, than the Present group. Of the
44 Online group, 78.2% practiced martial arts at a licensed nonprofit association, whereas in the
45 Present group 61.5% practiced martial arts at a licensed nonprofit association and 38.5% did
46 so in a private school. Finally, there were religion-related differences. In the Present group,
47 59.2% identified themselves as religious, while only 45.9% of the Online group interviewees
48 identified themselves as religious. Thus, in addition to difference in the martial arts styles,
49 differences in behavior and religious beliefs were observed between the groups and between
50 those practicing a martial art and the Standard group. Kral (2009) obtained similar results in
51 a recent report examining health-related effects of Karate in Austria. She concluded that the
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1 Asian concept of exercise can be used as a multiple health-factor promoting instrument,
2 which has positive effects on the complex psychosocial and psychological dimensions of
3 overall health.
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7 **Limitations**

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9 The complex subject matter in this study represents the most significant limitation.
10 The present investigation on a cross-section of the martial arts practitioners in Germany
11 indicates that the practice of martial arts has the potential for overall health benefits. This
12 can only be confirmed through a longitudinal study that looks at both subjective and objective
13 measures of health, resistance to illness, and injury rates. The SF-36 questionnaire used in
14 this study is one of the most frequently used devices for measuring a person's subjective
15 quality of life. The questionnaire's psychometric criteria, such as reliability and validity, are
16 rated as 'excellent' and are accepted as an adequate instrument for measuring a person's
17 health-related quality of life (Bullinger 1998 P. 32).
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25 While the differences between both the Present and Online groups with the
26 representative German Standard sample were statistically significant, the evaluation end-
27 point was the subjective "health-related quality of life". This is not rigorous enough to
28 establish martial arts as a suitable primary prevention activity. Further studies that include
29 historic, physical, and technical investigations of subjects are required to establish whether
30 Asian martial arts are suitable as a health prevention method.
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38 **Conclusion**

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40 The present study shows that 343 martial artists from eight different styles, when
41 questioned in-person, had higher health-related quality of life scores than the average
42 population. A greater difference was seen for physical aspects of the questionnaire than for
43 psychological aspects. Further, 2512 martial artists completed an online questionnaire and
44 also had a higher health-related quality of life than the representative standard group. While
45 both the Present and Online martial arts groups had a significantly better perceived health-
46 related quality of life than the Standard group, specific differences were observed between
47 the Present and Online groups. Different periods of when the questionnaires were
48 administered and differences in the composition of the groups likely account for disparities in
49 the results. Despite these differences, the study shows that people who practice martial arts
50 consider their health-related quality of life to be better than people who did not practice a
51 martial art. Thus, martial arts appear to benefit a person's subjective perspective of their
52 health.
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Potential disadvantages of martial arts, such as increased violent or aggressive behavior and increased risk of injury, have been disproved by other studies. The results of this study indicate that martial arts are suitable as a primary prevention method. However, establishing that the practice of Asian martial arts improves a person's overall health must be confirmed with additional studies using objective physical and psychological parameters.

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Conflict of interests:

The corresponding author is a martial artist and declares that there are no conflicts of interests.

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