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Karate for beginners at an advanced age – A Magdeburg Concept

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Abstract

For the increasingly aging population and their health maintenance, it is important to offer appropriate sports activities. This article uses the example of karate (Shotokan style) to illustrate the special features that need to be taken into account when conducting karate courses for beginners of advanced age. The main aim of the karate course is not to pass belt examinations but to prevent falls. It is demonstrated that karate is particularly suitable for making an important contribution to this. Kihon, kihon kumite, and kata can be used to improve balance, general movement coordination and strengthen the muscles of the lower extremities. The proposed training advice results in the one hand from physiological changes in the aging process and personal experience. Learning and practicing the Heian katas is a special focus of the karate training. Graphic materials and simplified exercises should be used to support the learning process. Participants are expected to do the following in a karate course: improve their fitness, get to know a new sport, improve general health, reduction of the risk of falling, increase social contacts, and learn self-defense techniques.

Keywords: karate, advanced age, beginners, kata

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1 Motivation

In 2016, around 42.2 % of the German population was inactive in sports (Guthold et al., 2018). However, healthy aging is determined by the ability to maintain both mental and physical abilities (Beard et al., 2016). It is well known that physical and sporting activities are the key to health and well-being (Izquierdo, 2020). There are also some sports offers for seniors in clubs or organized directly by the health insurance companies. However, there are some main problems: High dropout rate, difficulties in reaching men, and that the sports level is too high or too low. A Germany-wide study, by Techniker Krankenkasse, shows that especially men are increasingly interested in popular sports (Voermana, Hombrecher et al., 2016). Since 2021, we have been trying to address these problems as part of the "Otto VEREINt aktiv 60+" project, by offering low-threshold sports programs and involving local sports clubs to provide sports activities for senior citizens, who have not previously been active in sports. In 2011, we started a study on the effectiveness of age-appropriate karate. To this day, these courses are offered as part of “Studieren ab 50” in our university.

2 Theoretical background

2.1 Influence of karate on the performance and quality of life of elderly people

Endurance sports such as walking, swimming, and cycling are mainly recommended for older people. There are enough studies that confirm the health benefits of these activities. However, our opinion is that martial arts is particularly suitable for improving strength, quickness, endurance, and coordination thanks to its full body training. Martial arts or combat sports as full body training is particularly suitable for improving strength, speed, endurance, and coordination. In particular, many studies on tai chi show that this training improves balance, gait, and dual-task ability (performing a physical activity, e.g. walking, and a mental task, e.g. arithmetic, at the same time) in older people (Huang & Liu, 2015; Li, 2014). In addition, improvements in cognitive performance and well-being have been demonstrated by several studies. From this, it can be concluded that similar effects could also be achieved through karate if it was adapted to the age group. Wagner (2009) conducted a six-month karate training program with people aged between 50 and 60 years. Compared to a control group, the risk of falling was reduced and cognitive performance and quality of life improved. The studies by Jansen & Dahmen-Zimmer (2012) and Dahmen-Zimmer & Jansen (2017) prove the enhancement of balance and well-being through karate training.

In our study, focused on fall prevention, we compared three groups with each other. They completed an age-appropriate karate training, an age-appropriate fitness training program, or were participants in the control group. The age range was between 63 and 83 years. They trained twice a week (60 minutes each time). Significant improvements were found for the karate group in the strength of the lower extremities, gait velocity, dynamical balance, gait stability with dual tasks, reaction capacity, attention, and general cognitive ability (Witte et al., 2015, 2016, Pliske et al., 2015, 2017).

2.2 Physical, sensory, and cognitive changes in the aging process

In many of the sports clubs where karate is practiced, senior citizens also have the opportunity to practice this sport. Such courses are designed for older people who want to get to know the sport of karate or certain aspects of it, or who simply want to improve their physical and mental fitness. These courses differ from courses for Jukuren (translated: experienced) in that Jukuren already have previous

experience in karate. Because our focus is on fall prevention, it is not about passing belt exams. As a consequence, a karate course for older people (aged 55 and over) is not the same as a beginners' course for children or young people. We have two goals with our exercise programs: using elements of karate to maintain or improve motor skills, in particular, to reduce the risk of falling, and familiarization with the sport of karate. To be able to offer age-appropriate karate training, it is necessary to know in prior which physiological processes occur with increasing age that can hurt physical and cognitive functions. This relates in particular to sensory functions, motor functions (e.g. posture and locomotor system, balance, gait, and fine motor skills), and the cardiovascular system.

Table 1 contains the main physiological changes in the individual components of the musculoskeletal system that must be considered for age-related sports.

Table 1: *Changes to the musculoskeletal system and their effects (modified and summarized according to Richter, Weidemann-Wendt & Greiff, 2017).*

	Physiological Changes	**Effects**
Bones	• Changes in the osteoblast activity • Decrease in vitamin D3, concentration and calcium absorption	• Decrease in bone mass • Increase in bone fracture risk
Cartilage, Tendons, Bands, Joints, Spinal discs	• Decrease in the basic substance, water binding capacity, number of cells, cell activity, volume, and elasticity	• Wear, instabilities • Restriction of stretching • Decrease in body size • Decrease in healing and ability to regenerate
Muscles	• Decrease in muscle mass • Increase in fat tissue • Reduction in the number and size of the muscle fibers • Decrease in the conduction velocity of the nerve impulses and the capillary thickness in the musculature	• Increasing muscle weakness with loss of strength and endurance • Decrease in coordination and stabilization ability • Reduced regenerative capacity • Risk of injury, especially during eccentric activities

With age, the cartilage substance and the total bone mass decrease with the risk of osteoarthritis and osteoporosis. Concerning the aging processes of the musculature, the muscle mass of the legs decreases more than that of the arms. The phasic musculature (movement function) is also affected more than the tonic musculature (holding function). The control and monitoring of movements take place using sensory feedback (Table 2).

Table 2: *Sensory changes and their effects (modified and summarized according to Richter, Weidemann-Wendt & Greiff, 2017).*

Physiological Changes	Effects
• Reduction in the number and sensitivity of the various receptors • Reduction in the conduction velocity of sensory and motor neurons • Reduction in stimulus processing • Decrease in vestibular functions	• Quantitative and qualitative decrease in functional performance • Impairment of postural control (risk of falling) • Reduced skin sensitivity • Delayed recognition of joint position and movement • Making sensorimotor learning more difficult • Deterioration of fine motor skills • Reduction of the movement velocity

We receive about 80% of information via the eye, and even more with increasing age. What visual impairments need to be considered during training? These are restriction of the visual field, impaired spatial orientation, slowing of the visual process, and impaired orientation in complex situations. The following should be noted concerning acoustic perception. Even with technologically advanced hearing aids, hearing loss cannot be fully compensated for, especially if there is background noise. This is the case, for example, when music is used for training and the trainer's instructions have to be followed at the same time. Furthermore, speech comprehension is also more difficult in such situations. About the balance, we know that vestibular deficits are increasingly compensated for visually.

Areas of the brain that are particularly affected by the aging process are:

- Basal ganglia (lie in deep areas of the brain and realize controlled voluntary movements through their extensive network),
- Cerebellum (plays an important role in the motor learning process, especially for movement coordination),
- Hippocampus (important for the transfer of information from short-term to long-term memory) and
- Prefrontal Cortex (important for situation-appropriate behavior control).

As brain volume decreases during the aging process, learning, memory performance and general performance in cognitive, motor, and sensory tasks are reduced. Loss of working memory with increasing age means that information is processed more slowly and the brain works less efficiently. This makes it harder to memorize and recall information. Inhibitory control (inhibition or control of automatic reactions to stimuli) also decreases with age. As a result, irrelevant information is more likely to enter working memory due to the neglect of relevant information. Due to neuroplasticity, structural and functional losses can be compensated with age. For example, healthy parts of the brain can take over the tasks of damaged parts. This means that the aging brain is also able to continue learning. Even in old age, there are a variety of interventions that can delay the aging process and maintain cognitive functions (cf. Godde & Voelcker-Rehage, 2017). In general, cognitive abilities can also be trained. There

were positive findings with memory training, but? six weeks of juggling training also led to structural changes in the brain (cf. Godde & Voelcker-Rehage, 2017).

To summarize, the following aspects should be considered when training older people:

- Slower reaction, especially to new situations,
- Delaying adaptation processes during training,
- Delay in learning processes,
- Slowed execution of complex (movement) tasks for which the coordination of several partial movements is necessary,
- Faster cognitive overload,
- Problems in recalling personal experiences,
- Slower processing of verbal information,
- Difficulty memorizing and recalling information, and
- Decrease in inhibitory control.

3 Introduction of the Concept

Age-appropriate karate training is designed to prevent falls by improving balance and muscle strength in the lower extremities. Furthermore, it should enhance responsiveness and motor learning of new and complex movements. The following is required: no explosive strength exercises and falling exercises. Especially, the fall prevention includes increasing the strength capabilities of the lower extremities, improving static and dynamic balance, inclusion of dual-task requirements, and maintaining age-appropriate flexibility.

3.1 Contents of the Concept

Training twice a week is recommended. The duration of a training unit is max. 60 min. The necessary intensive warm-up phase (approx. 15 min) includes coordination and balance exercises. The main part (30-35 min) is organized according to the karate-specific objectives. Fitness and stretching exercises take place at the end of the training unit. The training session should end with positive and motivating remarks.

We have divided an introductory course into seven modules. Specific information can be found in (Emmermacher & Witte, 2012). This introductory course focuses on basic karate stances, single techniques with many variations, step combinations with rotations, and kata Taikyoku-Shodan. Further instructions for continuing karate training were published in Witte & Emmermacher (2022).

The following table 3 shows which elements are particularly suitable for training sports motor skills in old age.

Table 3: *Using karate to improve balance, strength, movement coordination, and reaction skills.*

Karate	Training of sports motor skills
Stances, forward and backward walking	• Static and dynamic balance, • Strength capabilities of the muscles of the lower extremities and trunk, • Gait stability, • Dual-task capability by performing additional arm exercises (thus also training the arm and shoulder muscles)
Single techniques	• General movement coordination, • Increase complexity by combining the techniques with stands and walking forward or backward, • Dual-task capability
Kihon-Kumite	• Reactivity, • Adapting to the partner, • Quickness, • Precision, • Application of the techniques and thus the ability to vary and adapt to partners, • Full body coordination
Kata	• Memory, • Spatial orientation skills, • Rhythm skills, • Balance (especially when turning and twisting), • Full body coordination

It could be shown that karate can train important skills and abilities that decline with age. However, what needs to be considered concerning physiological aging processes during training? Table 4 shows the conclusions for learning and training karate under age-specific conditions.

Table 4: *Conclusions for learning karate under age-specific conditions.*

Physiological Aspekts	Conclusions for training
Changes in the passive musculoskeletal system	• Intensive warm-up, • Avoid fast and powerful movements (no quick stretching), • High stands, • Adapt foot positions to the anatomical conditions of the ankle joints
Changes in the active musculoskeletal system	• Intensive warm-up, • Strengthening leg and trunk muscles, • Compromises in the stands (reduced expansion capacity), • Slow but precise technical execution
Sensomotoric changes	• Focus: Balance exercises, • Learning primarily via the visual system, • Training the sensorimotor system (recognizing muscle tension and joint positions), • Training spatial orientation skills
Cognitive changes	• Kihon Kumite: very slow and then slightly faster, • Lots of repetitions, • Participation of the trainer, and mirror during Kihon (visual system) • Explaining the function of the techniques, • Lots of individual feedback, • Kata in basic form with an understanding of the techniques

3.2 Special instructions for learning kata

As running a kata is particularly popular for our seniors, some essential aspects for learning a kata should be discussed. It should be taken into account, that many seniors are unable to cope with videos from the Internet to repeat a kata at home. Therefore, until Heian Nidan we used a special graphic work material that you can give the participants to take home with them. However, the material should also be explained during training and used at the beginning. This work material contains all the techniques of the kata as pictures in chronological order as well as graphic indications for the directions and rotations and necessary explanations. When teaching the kata Heian Nidan, it had already become obvious that it is very difficult for the course participants to learn, memorize, and practice the complex movement sequences sufficiently. For this reason, a new approach was adopted from the Kata Heian Sandan to Kata Heian Godan. A general teaching opinion is that an understanding of the meaning of the individual techniques is a precondition for training a kata. In this way, the kata can be disassembled—also from a historical perspective. Applications that would be useful in a "realistic" fight or in self-defense can be practiced and thus techniques can also be varied. Sufficient examples are illustrated by Janson (2019). In our opinion, however, this is only feasible if they are experienced karateka.

We want to concentrate exclusively on the Shotokan style and use the teaching method from the simple to the complex. This means first teaching a simple form of kata that does not include some techniques and whose embusen may be slightly modified. Once again it should be emphasized that it is not

about changing the kata, which would be contrary to the rules of Gichin Funakoshi, but about a teaching method to increase the motivation and joy of practicing kata through small successes. We present 2 forms: 1. for returners and 2. for newcomers or beginners (here the techniques are also explained verbally more simple). This will be illustrated by using the example of the first sequences of the kata Heian Sandan (see Table 5). It can be seen, that especially in No. 4 we practice the form without the technique combination Uchi Uke / Gedan Barei. The complete simplified forms for the Katas Heian Sandan to Heian Godan can be found by Witte & Emmermacher (2022).

Table 5: *Sequence of the Kata Heian Sandan (mod. after Grupp, 2002 and Pflüger, 2004), and the corresponding simplified forms for returning practitioners (first simplified form) and beginners (second simplified form), changes in bold italics.*

No.	Stand / Technique	First simplified form for returning practitioners	Second simplified form for beginners
1	Basic stance (Shizentai)	Basic stance (Shizentai): Haiko-Dachi	Basic stance (Shizentai): Haiko-Dachi (feet are hip-width parallel to each other)
2	To left in KK with Uchi-Uke left	To left in KK with Uchi-Uke left	90-rotation to left in Kokutso-Dachi with Uchi-Uke left
3	Stand up with Uchi-Uke right and Gedan-Barai left	Stand up in Heisoku-Dachi	Stand up by pulling up the right foot and assuming Heisoku-Dachi (feet parallel together)
4	Uchi-Uke left and Gedan Barei right in Heisoku-Dachi	----------	----------

3.3 Evaluation using a Participant Survey

A small questionnaire was conducted to find out what is important to the participants. This involved a written anonymized survey of a group (n= 21, 9f, 12m, age: 60-80 years). Table 6 shows the participants' motives regarding the various training contents.

Table 6: *Participants' motives with regard to the various training contents*

	Important	Non important
Strength exercises	• I wouldn't do them alone at home, but the “group pressure" helps me.	• Because they are important to me. • There are always new exercises. • Because I feel good afterward
Balance exercise	• Because they are important to me.	• Because I feel good afterward. • Because they are especially fun in a group. • There are also some ideas for practicing at home. • There are always new exercises.
Kihon	• It gives me pleasure when the techniques work as well as possible. • Slightly, my movement execution is getting better. • Many repetitions help me to perform the techniques better. • I have the feeling that this is a particularly good way to learn or train karate.	• I get a lot of feedback that I wouldn't have at home. • As everyone participates equally, it is particularly fun. • Kihon is important to me for my next belt examination.
Kata	• I am slightly recognizing progress. • Kata is a special challenge for me that I am happy to take on. • The importance of karate becomes particularly clear to me in kata. • It gives me pleasure when I have learned the sequence of the kata. • Helping each other is particularly important to me.	• ---
Applications of techniques	• The applications increase the understanding of the techniques. • I have the feeling that this is a particularly good way to learn or train karate. • I learn the various movement techniques better in this way.	• I particularly enjoy practicing with a partner.
Kihon Kumite	• I get to know the meaning of the single movement techniques better. • I notice that my ability to react is being trained.	• I have the feeling that this is a particularly good way to learn or train karate. • I especially enjoy trying things out. • I particularly enjoy practicing with a partner. • Practicing with different partners increases the stability of my movements.

It is obvious that practicing a kata motivates in very different ways and therefore plays an important role in training. Especially the men preferred Kihon Kumite, while the female participants were rather reserved. Kihon and the application of the single techniques was very important for most of the participants, especially to better understand the meaning of the techniques.

4 Conclusions

A further survey of participants on what they expect from the course led to the following answers, sorted in descending order of significance:

- Improve their fitness,
- Get to know a new sport,
- Improve general health,
- Reduction of the risk of falling,
- Increase social contacts, and
- Learn self-defense techniques.

Here, it becomes clear once again that it is also important for the participants to get to know a new sport.

Even if we know that this small survey is not representative, some conclusions can be drawn from it.

The various components of karate (kihon, kata, kumite) can also be practiced at an advanced age. Each area poses a particular challenge for learners but can be mastered. Frequent repetition with many variations is particularly important to the participants. Even kihon, which is often considered boring in other courses, is not a problem in our course. Feedback and individual support are essential. The primary focus is on health and improving fitness. Balance training and strengthening exercises are a particular feature of this course. The idea of performance relates less to belt examinations than to recognizing one's progress. Partner exercises are popular. Social interactions, such as supporting each other, are also very important. Applications that demonstrate the meaning of the techniques help to understand them. Although katas are particularly popular for "running", the sequence must be repeated very often. The trainer cannot assume that the participants are practicing at home. Very few people also do homework in the other areas (strengthening and balance exercises). Special exercises and instruction material, such as that presented for kata, could also have a motivating effect when practicing at home. The trainer must demonstrate a lot and ideally participate actively.

The last impressions should be a few personal comments from the participants:

"I want to stay physically and mentally fit into old age. I believe that karate training can help me do this very well. In particular, because many different joints and muscle groups are addressed and, secondly, because the sometimes complex sequences train coordination and the ability to react and adapt flexibly.“ (Axel)

"For me, it's important to do something about ageing and to keep as fit as possible even when I'm over 80. This course is an ideal way to do this and is also fun and promotes social contact.“ (Ulrich)

"At my age, I was at least able to start karate thanks to this course. I think it's a great sport." (Petra)

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