

## Tai Chi as a Physiotherapeutic Approach against Osteoarthritis and Oxidative Stress

Canan BİRİMOĞLU OKUYAN<sup>1\*</sup>, Hamza Malik OKUYAN<sup>2</sup>, Menderes Yusuf TERZİ<sup>3</sup>, Aydiner KALACI<sup>4</sup>

<sup>1</sup>Mustafa Kemal University, Hatay Health School, Department of Public Health Nursing, Hatay, Turkey

<sup>2</sup>Mustafa Kemal University, Hatay Vocational School of Health Services, Department of Medical Services and Techniques, Hatay, Turkey

<sup>3</sup>Mustafa Kemal University, Faculty of Medicine, Department of Medical Biology, Hatay, Turkey

<sup>4</sup>Mustafa Kemal University, Faculty of Medicine, Department of Orthopedics and Traumatology, Hatay, Turkey

### Review Article

#### \*Corresponding author

Canan BİRİMOĞLU OKUYAN

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**Abstract:** Osteoarthritis (OA) is the most prevalent degenerative joint disease and the most important reason of the physical disability in the elderly population. Along with the fact that OA pathogenesis is not fully known, it is highlighted in the recent studies that oxidative stress is an important factor in OA progression. OA treatment comprises attenuation of pain, maintenance of functional capacity, and development of life quality. Tai Chi Chuan, also known as Tai Chi, is a traditional Chinese martial art and exercise. In recent studies, it has been reported that Tai Chi, as an alternative therapy, can alleviate the symptoms of OA and be effective against oxidative stress.

**Keywords:** Osteoarthritis, Tai Chi, Oxidative Stress.

### INTRODUCTION

Osteoarthritis (OA) is the most prevalent degenerative joint disease and the most important reason of the physical disability in the elderly population [1]. The OA prevalence in developed and developing countries increases depending on the risk factors such as aging of population, obesity, and sedentary life style [2]. It is estimated worldwide that, among the people over 60 years old, 10% of men and 18% of women have symptomatic OA [3]. OA loads a significant financial burden to both individuals and health care system all around the world [2, 4]. OA is the eleventh cause of disability worldwide and it negatively affects the life quality of the individuals due to the reasons such as restriction in activities, pain, and suffering [2, 4].

Especially in cardiovascular diseases, OA patients are under greater risk compared to general population with respect to mortality rates [2]. The high mortality rate of OA patients is closely related to the level of physical disability [2]. At the same time, the financial sources used in research and the expenses spent for prevention, diagnosis, and treatment of the disease are the direct expenditures of OA. Besides, the situations such as production loss due to reduced labor force, income loss, tax income loss, increasing of state aids due to the need of familial or household aids of the patients, are among the indirect expenditures of OA [5, 6]. Although risk factors such as genetic disposition, senility, and obesity play role in OA progression, OA pathogenesis is not fully known [6-9]. OA is clinically characterized with articular pain, stiffness of joints, crepitation, and restriction of movements [10, 11]. It was emphasized in other studies that oxidative stress is an important factor in OA progression [12-14]. OA treatment includes attenuation of pain, reduction of stiffness in joints, maintenance of functional capacity,

and improvement of life quality [10]. In previous studies, physical exercise was suggested in the treatment of knee OA (KOA) [15, 16]. Moreover, it was reported in another study that, psychophysiological intervention as a kind of alternative therapy can alleviate KOA symptoms by increasing endorphin and enkephalin levels [17]. Tai Chi is an ancient Chinese martial art and exercise which is practiced for centuries as a kind of psychophysiological intervention method [18]. Tai Chi is an effective technique in both OA treatment and also improvement of health status [19-24]. In addition it was reported in previous studies that, Tai Chi has a relation with oxidative stress and antioxidant capacity [25-27]. This present study focuses on the role of Tai Chi, as a physical therapy, on KOA and oxidative stress.

### MATERIALS AND METHODS

We performed a PubMed research for the key words; "Tai Chi and osteoarthritis", "Tai Chi and oxidative stress", "oxidative stress and osteoarthritis".

The results which were related to Tai Chi as a physiotherapeutic approach against osteoarthritis and oxidative stress were selected. The results were not evaluated with any statistical analyses.

## RESULTS AND DISCUSSION

### Tai Chi against KOA

In the body, the joints of knee, hand, hip, and spine can be affected from OA [28]. Besides, studies report that knee joint is more predisposed to be affected often from OA [29]. Joint pain, inflammation, and swelling are among the symptoms of KOA [30]. KOA is the most prevalent joint disease seen in the elderly and is the most important cause of physical disability in about %80 percent of the elderly aging 65 years and older who are manifesting radiological symptoms of OA [17, 31].

There is no effective therapy for OA patients yet, considering enormous personal and socio-economic burden caused by OA [32]. The main objectives in OA therapy are alleviation of pain, restoration of articular function, prevention of disease progression, and increasing life quality [33]. Therapies to cure OA can be classified as pharmacologic, non-pharmacologic (exercise, weight loss, education) or combination of both [32, 34]. Conservative treatment of KOA usually comprises physiotherapy, weight control, and therapeutic exercise [30]. In line with this, previous studies suggest regular exercise in the treatment of OA [15, 16]. The regular exercise, accepted mostly as a therapeutic approach against OA, increases muscle strength, reduces cartilage loss in knees, and augments articular stability [35]. For this reason, it is highly important to choose a proper exercise type in the treatment and the prevention of OA, since heavy exercise overloads can exacerbate the course of OA [36]. Tai Chi, which relaxes body, strengthens muscles, provides slow and controlled movement, and rhythmic breathing, is approved for older people who are willing to practice therapeutic exercise [37]. Tai Chi, a traditional Chinese martial art, has low palliative effects and is a common type of aerobic exercises [38]. Tai Chi has a potential role as an alternative therapy in cardiopulmonary, neurologic, rheumatologic, and orthopedic diseases [21, 23, 24, 36]. There are plenty of rational reasons to advice Tai Chi as an exercise program to healthy and diseased people. First of all, Tai Chi does not require any expensive equipment and can be practiced at any time and any place [21]. Secondly, Tai Chi is a low-priced and low-tech exercise and can be practiced easily in the society [21]. Lastly, Tai Chi is an effective practice in diminution of cardiovascular risk factors and in augmentation of muscle strength, aerobic capacity, and balance status [21].

Lauche and Ye reported that as an alternative therapy, Tai Chi can be an effective therapeutic method to alleviate pain and to improve physical functions of KOA patients [17, 39]. In another study conducted by

Hatman *et al.*, the effect of Tai Chi on OA patients was observed. And their results showed that the articular symptoms of the OA patients practiced with Tai Chi diminished and a significant improvement was observed in the general health conditions of these patients [40]. Wang *et al.* reported in a study, which compares Tai Chi and standard physiotherapy in KOA patients, that Tai Chi exhibited beneficial effects similar to a standard physiotherapy in the treatment of KOA [20]. Moreover, it was reported in other studies that Tai Chi attenuated pain, increased mobility and flexibility, and improved balance and mental health in KOA patients. Besides, it was observed after the exercise that the number of the patients complaining about the side effects of the Tai Chi was very low [41, 42].

### Tai Chi and Oxidative Stress in OA

It is highlighted in previous studies that oxidative stress is an important factor in OA pathogenesis [12-14]. One of the critical mechanisms playing role in OA progression is the damage of articular cartilage that is triggered by reactive oxygen species (ROS) [12, 43]. ROS variants can lead to oxidative damage in several components of the joint such as collagen, proteoglycan, and hyaluronan [44]. Suantawee *et al.* showed in a study that, while oxidative stress parameters in the blood plasma of the OA patients were higher than the one in healthy control group, the antioxidant parameters were lower in OA patients [45].

Oxidative stress signifies the imbalance between the ROS levels and antioxidant defense status [46]. The antioxidant system in human body contains enzymatic players, such as superoxide dismutase and glutathione peroxidase, and non-enzymatic players like glutathione [47]. This antioxidant system plays crucial role in prevention of oxidative stress [47]. Oxidative stress involves in the pathogenesis of many diseases including cancer, hypertension, atherosclerosis, diabetes, and OA [47, 48]. ROS production starts lipid peroxidation and increases the synthesis of oxidative stress markers like malondialdehyde [49]. More dramatically, ROS causes oxidative damage in protein and DNA as well [49]. Of which oxidative DNA damage is the most destructive one to the human health due to its role in the pathogenesis of several diseases. ROS, especially hydroxyl radical, can lead to DNA strand breaks, damage in tumor suppressor genes, and increase in the expression of the proto-oncogenes [50]. Additionally, reduction in DNA repair capacity is another reason of the accumulation of oxidative DNA damage [51].

In fact, physical exercise in an important oxidative stress-inducing factor since it triggers ROS production by causing a sharp increase in oxygen consumption. The effect of exercise on oxidative stress depends on some factors such as the duration, intensity, and type of the exercise [52]. Whereas rare bouts of

strenuous exercise lead to oxidative stress and DNA damage, regular exercise with moderate intensity reduces oxidative stress and DNA damage [53]. Low and moderate levels of ROS production induced by regular and moderately intense exercise has an overall advantage to the body since it increases the production of important antioxidant enzymes [54].

The number of studies investigating the effect of Tai Chi on oxidative stress and DNA damage is limited. It was reported in a pertinent study that, daily Tai Chi practice in the elderly was helpful in reduction of oxidative stress levels [26]. In another study it was shown that, regular Tai Chi exercise induced antioxidant enzymes and decreased the levels of oxidative damage markers [55]. Moreover it was stated in a more recent study that, 12-week long Tai Chi practice in young women improved the response against oxidative stress and augmented DNA repair capacity [56].

## CONCLUSION

It can be concluded that Tai Chi is an effective physiotherapeutic approach in both maintenance of health status and also treatment of OA patients. Therefore, Tai Chi can be suggested as an alternative exercise program to alleviate and/or control pain and to improve physical functions of KOA patients. Last but not least, Tai Chi is an effective method with respect to oxidative stress but further studies are needed for a better understanding of the relationship between Tai Chi - oxidative stress - OA.

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