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Commentary

The public health benefits of Tai Ji Quan—Addressing the unmet needs of aging populations in the 21st century

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1. Introduction

With the increase in older populations worldwide[1] comes an increased health burden related to chronic diseases.[2–4] One of the most disabling of these is knee osteoarthritis (OA), which occurs in millions of older adults who subsequently live with joint pain and stiffness, leading to chronic disability and a diminished quality of life.[5,6] Epidemiological evidence shows a higher prevalence of OA in older adults living in urban and rural areas of China than in older adults living in the United States.[7–9] Although a wide range of treatment strategies exist,[10] non-pharmacological modalities for long-term management of knee OA, including controlling pain and improving movement function and quality of life, remain largely underexplored.

Tai Ji Quan[11] is a component of traditional Chinese medicine that has been popularized throughout the world as a means to improve health and prevent disease.[12] As a potential treatment for knee OA, Tai Ji Quan is attractive from the standpoint of public health and clinical rehabilitation because it involves highly choreographed exercises that engage participants in mindfully controlled, fluid multi-joint and multi-planar motions and regulated breathing. These characteristics make Tai Ji Quan, when practiced with low load-bearing, clinically suitable for people with joint pain and movement limitations since it promotes balance, joint lubrication, and stability. There is emerging research evidence from western countries showing that Tai Ji Quan lessens pain and improves physical function in those with knee OA.[13,14]

In the article by Zhu and his colleagues[15] in this special issue of the *Journal of Sport and Health Science,* additional evidence of the clinical value of Tai Ji Quan in improving gait kinematics and physical function in a sample of older Chinese women with knee OA is detailed. The study makes clear the need for generating convincing evidence of the efficacy of Tai Ji Quan as an alternative treatment modality for reducing pain and maintaining joint movement for older adults who have the disease. The study has some laudable features. It is the first randomized controlled trial (RCT) in China that specifically targets a population of Chinese women with knee OA. Additionally, in terms of design elements, the use of radiography to objectively define knee OA, biomechanical laboratory-based measures of gait, adequate blinding of data collection staff to group assignment of participants, appropriate intervention duration, and a modified Tai Ji Quan routine tailored to the population under scrutiny are all strengths.

Notwithstanding these strengths, the authors acknowledge some significant design and methodological weaknesses and limitations. First and foremost, the age range (between 60 and 70 years old) for the study population is quite narrow in light of the evidence that knee OA occurs primarily in adults aged 65 and over.[16] Additionally, the study would be stronger had the authors considered a study population based on clinical prototypes (bilateral *vs.* unilateral knee OA, medial *vs.* lateral tibiofemoral involvement) rather than just the presence of knee OA.

From a clinical perspective, the study lacks a comprehensive assessment of dynamic stability and gait variability resulting from the intervention. Because Tai Ji Quan emphasizes postural alignment and weight centering, an evaluation of gait and weight-bearing symmetry would enhance its clinical relevance to the knee OA population. The tailored Tai Ji Quan routine used is not well delineated and lacks substantive detail in its protocol, especially regarding why the 8 forms were chosen and how they were modified based on the clinical symptoms and movement characteristics of knee OA. Finally, the interpretation of the data may be marred by the failure to control for important confounders such as the severity of the disease at baseline, changes in medication use, and levels of physical activity. Collectively, these issues raise questions regarding both internal and external validity and the generalizability of the intervention.

The weaknesses of Zhu et al.'s[15] study serve as a compelling reminder of the difficulty of finding rigorously designed and well controlled clinical Tai Ji Quan trials conducted in China, a situation that may have created a significant knowledge gap and,

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subsequently, barriers to meeting public health needs in China. Promoting evidence-based medicine to improve the health of the country's rapidly growing population of older adults[17] is crucial, especially since this population is significantly affected by the increasing prevalence and burden of chronic diseases,[4,17] as well as the financial strains and deficiencies inherent in the healthcare system.[18–20] Therefore, this perplexing situation should serve as an impetus for accelerating scientific research to develop safer and more efficacious chronic disease care interventions for China's aging populace.

2. Future research considerations

Because it originated in China,[11,12] Tai Ji Quan is considered a national treasure deeply rooted in Chinese culture. Over the past century, martial artists, practitioners, and researchers have successfully disseminated this heritage internationally, burnishing its health value,[12] primarily through anecdotal evidence. However, creating an evidence-based case for the clinical value of Tai Ji Quan must now become a priority for the research community. Chinese scholars have the responsibility to continue to spread Tai Ji Quan by transforming it into a contemporary health care/clinical intervention that can be utilized to address significant public health issues facing the country's aging population.

In reviewing the current state of research on Tai Ji Quan, researchers should carefully consider the following issues as they develop their research plans.

2.1. Transformation

Tai Ji Quan was originally developed as a martial art (Wu Shu) to be used primarily for self-defense.[11] Thus, in research studies its techniques are not always applied appropriately to address the effects of chronic diseases in older adults. A "one size fits all" approach in the application of Tai Ji Quan to clinical research is often misguided, and its direct application is not always acceptable given the unique needs and capabilities of older adult populations. Therefore, instead of using Tai Ji Quan as a generic exercise for health promotion and disease prevention, it is time to consider a paradigm shift that transforms its movements into a therapeutically and functionally useful intervention[21] that can ultimately help older adults reduce their health risks and maintain their ability to live independently.

2.2. Tailoring

Parallel with the notion of transformation is the need for "tailoring". Just as with prescription medicine, the forms and movements of Tai Ji Quan must be adjusted to address the signs, symptoms, and causes of a particular chronic disease. Specifically, adaption should be purposefully made for specific pathologies (e.g., Alzheimer's, cancer, arthritis) and/or health risk factors (e.g., comorbidity, polypharmacy, physical inactivity). A tailoring approach in research studies makes the intervention more meaningful in practice, and study outcomes can more readily be used to guide community and/or clinical decisions. As an example, older adults with a balance disorder and a history of falls tend to experience a worsening in their motor-sensory systems over time. Therefore, a Tai Ji Quan exercise routine that specifically integrates balance-recovery strategies and sensory organization techniques may be especially beneficial therapeutically since it is designed to improve a person's physical and mental capacity to proactively and reactively respond to and resist unexpected perturbations and/or falls.[21]

In the same vein, a tailored intervention would ideally consider the functional relevance of Tai Ji Quan through a task-oriented approach.[22] At this functional level, Tai Ji Quan movements practiced by older adults should be specifically oriented toward developing their ability to carry out functional weight-transferring tasks, such as walking, turning, sitting-to-standing/standing-to-sitting, and reaching; and these movements should be tailored for use in natural environments (at home or in a neighborhood) and in varying circumstances (differing surfaces or visual conditions).

2.3. Integration and delineation

The classical conception of Tai Ji Quan involves uniting a focused state of mind with synchronized breathing while executing a set of intertwined, choreographed, and engaging and disengaging actions. In theory, the successful execution of Tai Ji Quan integrates the following components:

(1) mindful intention that leads to the initiation of a purposeful action;
(2) regulated respiration closely synchronized with the intended action;
(3) physical maneuvers that complete the action.

Behind these actions is the philosophy of yin–yang interaction, which underlies the development of the continuous and circular motion of Tai Ji Quan as reflected in bipolar but highly complementary actions (offensive and defensive, motion and motionless). In practice, however, it is difficult to scientifically quantify these inherent martial art characteristics in a coherent way, and the current literature does not provide much practical information on how the three elements work synergistically or can be incorporated in a way that produces directed movement or actions.

In many research studies, Tai Ji Quan has been conceived of as a physical/callisthenic-like activity and operationalized as such. This approach is not in accord with the essence of Tai Ji Quan practice as described above. When used as a research protocol, this approach makes it difficult to delineate the true effects of Tai Ji Quan in regard to health outcomes. To accurately evaluate and validate the health benefits and effects of Tai Ji Quan, the current paradigm, which typically uses an active experimental *vs.* a control design, should be augmented with an additional exercise (comparison) modality involving either straightforward exercise programs (strength training, aerobics) or diaphragmatic breathing exercises. This would control for both the physical and breathing effects of Tai Ji Quan training, thereby maximizing the potential for identifying the unique contributions of Tai Ji Quan *per se* in improving health outcomes. The mechanisms by which Tai Ji Quan may improve health, ranging from the specific contributions of each