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ORIGINAL ARTICLE

Sleep quality of middle-aged Tai Chi practitioners

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Abstract

Aim: This study aimed to assess the association between Tai Chi and sleep quality in middle-aged Tai Chi practitioners.

Methods: This cross-sectional descriptive study recruited a convenience sample of 250 middle-aged Tai Chi practitioners. Sleep quality was assessed by the Pittsburgh Sleep Quality Index (PSQI). Descriptive statistics such as frequency and percentage were used to describe the demographic characteristics of the subjects. Pearson's product–moment correlation was used to determine the relationship between sleep quality and duration of practicing Tai Chi. ANOVA was used to compare difference in sleep quality among subjects practicing different styles of Tai Chi. Linear regression was conducted to determine the contribution of duration of practicing Tai Chi and the style of Tai Chi being practiced to explaining sleep quality.

Results: Subjects had practiced Tai Chi for 4.7 years. They reported a global PSQI score of 5.3. Among the subjects, 156 were classified as good sleepers (PSQI score, <5). No significant relationship was reported between sleep quality and duration of Tai Chi practice ($P = 0.175$). No significant differences in sleep quality were found among subjects who practiced different styles of Tai Chi ($P = 0.876$). Linear regression analysis indicated that the duration of practicing Tai Chi and the style of Tai Chi being practiced did not make a significant contribution to sleep quality.

Conclusion: The present study represented an initial attempt to investigate the sleep quality among middle-aged Tai Chi practitioners. It serves to generate hypotheses for future testing.

Key words: health promotion, middle-aged people, public health, sleep quality, Tai Chi.

INTRODUCTION

Sleep problems are a widespread health issue that warrant attention. According to the World Association of Sleep Medicine (2011), sleep problems are a global epidemic affecting up to 45% of the population. Studies of the middle-aged population also reveal the prevalence of sleep problems such as poor sleep quality and insomnia. In Spain, the prevalence was 46% in healthy middle-aged women (Munguía-lzquierdo & Legaz-Arrese, 2011). In China, poor sleep quality was experienced by 16% of middle-aged Chinese (Haseli-Mashhadi *et al.*, 2009). In Hong Kong, 12–41% of Chinese middle-aged adults reported insomnia (Chung & Tang, 2006; Li, Wing, Ho, & Fong, 2002; Wong & Fielding, 2010).

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SLEEP QUALITY IN THE MIDDLE-AGED POPULATION

Sleep quality is the degree of excellence in sleep (Yi, Shin, & Shin, 2006). Good sleep quality is an agent of body recovery. It can promote health-related quality

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of life (Lo & Lee, 2012). By contrast, poor sleep quality adversely affects the health of a person (Edell-Gustafsson, Kritz, & Bogren, 2002). Physically, poor sleep quality impairs daytime functioning, such as work performance (Alapin *et al*., 2000). Psychologically, poor sleep quality increases the risk of suffering from anxiety and depression (Chiu & Chao, 2010). Socially, poor sleep quality may cause people to avoid interactions and become impatient with others (National Sleep Foundation, 2011).

Middle age is a turning point in sleep quality. A number of middle-aged people are facing midlife crises and are therefore prone to poor sleep quality. Several sleep patterns, such as getting up earlier, sleeplessness, and waking up more during the night, start to occur in middle age (Vgontzas *et al*., 2001). In addition, career opportunities have commonly peaked in middle age. While some middle-aged adults can no longer foresee any career advancement, others may worry about job and salary loss (Zwemer, 2005). This group of people are in the so-called stage of "sandwiched generation". They are expected to guide their children into adulthood and deal with their aging parents at the same time (Zwemer, 2005). Such a situation can trigger a great deal of stress and sleep problems. Lastly, middle-aged adults also have declining health conditions (Vgontzas *et al*., 2001), thus further impairing sleep quality.

Middle-aged people are the pillars of every sector in society and their contribution to society is indispensable. Poor sleep quality negatively affects one's physical and psychological health. Such a situation can ultimately have a negative impact on society such as increase in healthcare utilization (Lo & Lee, 2012). Therefore, addressing the sleep problem among middle-aged adults is crucial. Exercise is a well-known approach for promoting sleep quality (Lira *et al*., 2011). It induces muscular relaxation and decreases sympathetic tone, thereby promoting sleep. Tai Chi, a type of mind and body exercise, may have a positive effect on sleep quality (Irwin, Olmstead, & Motivala, 2008; Li *et al*., 2004).

TAI CHI AND SLEEP QUALITY

Tai Chi, which means "supreme ultimate", is a traditional Chinese martial art. Nowadays, Tai Chi is practiced worldwide as an exercise for promoting health. Tai Chi originated in China and began in the Chen Village in He Nan Province during the Ming Dynasty (the ruling dynasty in China from 1368 to 1644) (Bryant & James, 2004). Tai Chi is characterized by circular, slow, smooth, and continuous movements. The slow tempo promotes awareness of speed, force, trajectory, and execution of movements (Snyder & Lindquist, 2006). The practice of Tai Chi is based on the Chinese Yin-Yang theory. This theory holds that all phenomena in the universe is created, developed, and changed because of the consistent interaction, balance, and imbalance between Yin and Yang (the two energy forces) (Rones & Silver, 2007). Maintaining the balance between Yin and Yang within the body is a prerequisite for health. The movements of Tai Chi demonstrate continuous changes from full to empty, from weighted to unweighted, and from open to close. Tai Chi is a practice of a force known as Chi. Tai Chi movements guide the flow of Chi and instill the balance of Yin and Yang inside the body. Thus, desirable health outcomes can be achieved (Khor, 2002).

Tai Chi has several styles, and the most common are Chen, Yang, Wu, and Sun (Jou, 1983). Chen is the oldest, whereas Yang is the most popular. Wu and Sun were directly or indirectly developed from Yang. Each style has a different emphasis. Chen demonstrates alternating quick, slow, and large movements. Yang demonstrates slow and large movements. Wu emphasizes mid-paced and compact movements. Sun is characterized by quick and compact movements (Jou, 1983). Aside from the aforementioned styles, several uncommon ones also exist. For example, Tai Chi Chih is the westernized style and Cheng is a simplified version of Yang. Although each style has a characteristic protocol that differs from the others in posture or form, including order, pace, and level of difficulty, all styles follow the same principle of having individual movements that are linked together and slowly and continuously performed (Yang, 1991).

Tai Chi is a mind and body exercise and is regarded as a form of meditative practice. The combination of focused concentration, fluid movements, and controlled breathing plays an enormous role in achieving a state of harmony between body and mind. Such characteristics offer people the ability to calm down, find happiness, release stress, and finally, improve overall health and well-being (Frantzis, 2011).

Over the past decades, an increasing number of evidence has supported the positive effects of Tai Chi on psychological well-being (Klein & Adams, 2004; Rogers, Larkey, & Keller, 2009; Wang *et al*., 2010). When practicing Tai Chi, a person integrates mind concentration and smooth breathing into the movements. Physical and psychological relaxation can be achieved, thereby enhancing sleep quality. A previous study found that Tai Chi performance can decrease sympathetic activity through its slow movements, diaphragmatic

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breathing, and relaxation techniques (Motivala, Sollers, Thayer, & Irwin, 2006). Knowing that a decrease in sympathetic activity can promote sleep, the aforementioned mechanism justifies why Tai Chi has the potential to improve sleep quality. However, the effect of Tai Chi on sleep quality is still an emerging research topic and has only received attention recently.

A few studies have attempted to examine the effect of Tai Chi on sleep quality among different populations. A structured Tai Chi program was consistently used and its health benefits on the target participants were investigated. These programs included a 15-week Tai Chi program for college students (Caldwell, Harrison, Adams, & Triplett, 2009), a 24-week Tai Chi program for community-dwelling older adults (Li *et al*., 2004; Nguyen & Kruse, 2012), a 25-week Tai Chi Chih program for older adults with moderate sleep complaints (Irwin *et al*., 2008), and a 12-month simplified Tai Chi program for older adults in long-term care facilities (Chen *et al*., 2007). Aside from the study conducted by Caldwell *et al*. (2009), the other four studies revealed significant improvement in sleep quality among their specific populations. The relatively short duration of the Tai Chi program adopted by Caldwell *et al*. (2009) might have prevented the study from detecting potential health benefits. The findings made by existing studies provided preliminary pieces of evidence supporting the potential effect of Tai Chi in promoting sleep quality in older populations. Moreover, the necessity of practicing Tai Chi with adequate duration (≥24 weeks) to achieve health benefits is highlighted.

Middle-aged individuals are considered as the backbone of all walks of life and their health is vital to the sustainable development of the society. Middle-aged people are prone to poor sleep quality. Tai Chi may be a possible means to address their problem. Previous studies have revealed that practicing Tai Chi for several months to a year is effective in promoting sleep quality among older adults. However, there is no information on whether Tai Chi can have a positive effect on the sleep quality of middle-aged individuals. The relevance of previous findings to the middle-age population is limited because individuals of different age have different health conditions and physical abilities in performing exercise. Although Tai Chi is an exercise that advocates long-term practice to achieve health benefits, investigation on the health benefits of long-term Tai Chi practice such as over years is limited. To fill the knowledge gap, a study that aims to assess the association between Tai Chi and sleep quality in middle-aged Tai Chi practitioners is indicated. A cross-sectional descriptive design is preferable because such a design enables the researcher to recruit subjects who have practiced Tai Chi for a long period (over years) and to examine the association between long-term Tai Chi practice and sleep quality. By contrast, most previous experimental studies on Tai Chi examined its health effects after the subjects had practiced Tai Chi for a short period of time (several weeks to months). The present findings will contribute to better understanding of the health benefits of Tai Chi and may identify a possible way to address the sleep problems of middle-aged individuals.

METHODS

Design and objectives

This study adopted a cross-sectional descriptive design. It aimed to assess the association between Tai Chi and sleep quality in middle-aged Tai Chi practitioners. The objectives of this study were: (i) to assess sleep quality of middle-aged Tai Chi practitioners; (ii) to determine the relationship between sleep quality and duration of Tai Chi practice among middle-aged Tai Chi practitioners; (iii) to compare difference in sleep quality among middle-aged Tai Chi practitioners practicing different styles of Tai Chi; and (iv) to determine the contribution of duration of Tai Chi practice and the style of Tai Chi being practiced to explaining sleep quality among middle-aged Tai Chi practitioners. The findings contributed to facilitate the integration of traditional Chinese health promotion measure into Western medicine-based health practice. This study is relevant to international nurses involved in promoting the health of the middle-aged population.

Operational definitions

1 Tai Chi is operationally defined as a traditional Chinese exercise that works according to the Chinese Yin-Yang theory and is characterized by having individual movements that are linked together in a slow, smooth, and continuous manner.
2 Chen-style Tai Chi is a style of Tai Chi characterized by alternating quick, slow, and large movements.
3 Yang-style Tai Chi is a style of Tai Chi characterized by slow and large movements.
4 Wu-style Tai Chi is a style of Tai Chi characterized by mid-paced and compact movements.
5 Cheng-style Tai Chi is a style of Tai Chi which is simplified from the Yang style. It shares similar characteristics with the Yang style.

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6 Duration of Tai Chi practice is the length of time that a Tai Chi practitioner performs Tai Chi practice in a Tai Chi association with a frequency of at least once a week.
7 Sleep quality is the degree of excellence in sleep. In this study, it is measured by the Chinese version of the Pittsburgh Sleep Quality Index (PSQI).

Sampling

Two hundred and fifty middle-aged Tai Chi practitioners were recruited from seven Tai Chi associations in Hong Kong using convenience sampling. Because the Tai Chi associations allowed only minimal disturbance to the Tai Chi practitioners, convenience sampling was the only practical sampling method in this study. Inclusion criteria were: (i) aged 45–64 years; (ii) had practiced Tai Chi for at least 24 weeks (a duration which was long enough to bring health benefits) (Chen *et al*., 2007; Irwin *et al*., 2008; Nguyen & Kruse, 2012); (iii) received Tai Chi coaching from qualified Tai Chi coaches; and (iv) could read Chinese. In Hong Kong, it is common to practice Tai Chi in a Tai Chi association or in a park. The former is more prevalent among people who have regular jobs, are studying, or have family commitments; whereas the latter is more popular among elders and retirees. Recruiting subjects from Tai Chi associations matches the common practice of middle-aged practitioners and providers better guarantee that the subjects are practicing Tai Chi properly. The researchers recruited the maximum number of subjects within the available budget and time. It followed the principle that "the larger the sample, the greater the statistical power" (Portney & Watkins, 2008, p. 423).

Data collection

The Chinese version of the PSQI was used to assess sleep quality. The PSQI is a 19-item, self-rated scale that assesses sleep quality for a certain period over 1 month intervals (Buysse, Reynolds, Monk, Berman, & Kupfer, 1988). The performance of subjects in these items can be used to formulate seven component scores, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction (Buysse *et al*., 1988; Tsai *et al*., 2005). A global PSQI score can be obtained by adding the score of each component. This global score ranges from 0 (no difficulty) to 21 points (severe difficulty in all assessed areas). The global score can also differentiate poor sleepers from good sleepers by using a cut-off value of 5 (a score <5 indicates a good sleeper).

The Chinese version of PSQI demonstrates good construct validity through known group techniques. Significant difference ($P < 0.001$) in the score from the seven components and in the global score is found between two contrasting groups (the insomnia group and the control group). Moreover, this instrument has a high sensitivity of 98% to differentiate poor sleepers from good sleepers by using a cut-off value of 5. This instrument has satisfactory stability, with a test–retest reliability coefficient of 0.85. It has satisfactory internal consistency with a Cronbach's alpha of 0.83 and 0.82 (Tsai *et al*., 2005). Cronbach's alpha for the present Chinese sample is 0.80. Permission to use the Chinese version of PSQI was granted to the authors.

Lastly, a questionnaire was developed to record subjects' demographic characteristics including age, sex, marital status, employment status, style of Tai Chi being practiced, and duration of practicing Tai Chi.

Data analysis

Data were analyzed using the software Statistical Package for Social Sciences (version 17.0; SPSS, Chicago, IL, USA). Descriptive statistics were used to summarize subject demographic characteristics. Pearson's product–moment correlation was used to determine the relationship between sleep quality and duration of Tai Chi practice. ANOVA was used to compare difference in sleep quality among subjects practicing different styles of Tai Chi. Linear regression was conducted to determine the contribution of the style of Tai Chi being practiced and duration of Tai Chi practice to explaining sleep quality, when the effect of all other assessed variables was controlled for. The significance level was set at $P < 0.05$.

Procedures

Contact information of Tai Chi associations were obtained from the Yellow Pages (a telephone directory for businesses) and via the Internet. Forty-seven Tai Chi associations were identified and eight of them granted access approval for the study. Invitation letters and questionnaires were distributed to their Tai Chi practitioners after they had finished the class. Tai Chi practitioners were invited to join the study and were reminded to return the completed questionnaires to the staff of the association who would then pass the questionnaires to the researchers. Practitioners who returned the questionnaire implied that they agreed to participate in the study.

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Ethical considerations

Ethical approval to conduct the study was obtained from the ethics board of the authors' affiliated university. Explanations about the purpose and nature of the study were provided through an invitation letter. Subjects were assured of the freedom to refuse and withdraw from participating. Their identities were kept anonymous. Subjects gave their informed consent. All data were only used for research purpose and were kept confidential. Collected questionnaires were shredded upon completion of research.

Pilot study

A pilot study was conducted to determine the feasibility of the recruitment procedures and the data collection method. Thirty Tai Chi practitioners joined the pilot study and spent 10–15 min completing the questionnaire. The operation was generally smooth. Five returned questionnaires were found to be invalid either because of ineligible subjects or missing data. Two modifications were then made. First, the inclusion criteria for subjects were stated in the invitation letter to avoid collecting data from ineligible subjects. Second, single-sided printing instead of double-sided printing of the questionnaire was adopted to avoid subjects overlooking some of the questions.

RESULTS

A total of 550 Tai Chi practitioners were approached and screened for eligibility. A total of 340 questionnaires were delivered to the eligible Tai Chi practitioners and 257 questionnaires were collected. The participation rate was 75.6%. The reasons Tai Chi practitioners did not participate were mainly because either they were in a hurry and would leave the association immediately after the class, or were reluctant to answer the demographic part of the questionnaire. Out of the 257 collected questionnaires, 250 questionnaires were found valid. The collected data were used for analysis. The remaining seven questionnaires were discarded because subjects did not complete the whole questionnaire. The completion rate was 97%.

Sample characteristics

Sample characteristics are presented in Table 1. Among the 250 subjects, 181 (72.4%) were female. The mean age was 55.4 years (range, 45–64). Among them, 200 subjects (80.0%) were married and 130 subjects (52%) were retired. On average, the subjects had practiced Tai Chi for 4.7 years. Lastly, 107 subjects (42.8%) were practicing the Yang style.

Table 1 Subjects' characteristics ($n = 250$)

Characteristic	Mean	Standard deviation
Age	55.4	4.9
Duration of practicing Tai Chi (years)	4.7	4.2
	Frequency	Percentage (%)
Sex		
Male	69	27.6
Female	181	72.4
Marital status		
Single	20	8.0
Married	200	80.0
Divorced	9	3.6
Widowed	21	8.4
Employment status		
Employed	107	42.8
Unemployed	13	5.2
Retired	130	52.0
Style of Tai Chi being practiced		
Chen	72	28.8
Yang	107	42.8
Wu	36	14.4
Cheng	35	14.0

Sleep quality

The subjects exhibited a mean global PSQI score of 5.3 (range, 0–17). Using 5 as the cut-off point to differentiate good sleepers from poor sleepers, 156 subjects (62.4%) were found to be good sleepers (global PSQI, <5), whereas 94 subjects (37.6%) were found to be poor sleepers (global PSQI, ≥5). No significant relationship was reported between sleep quality and duration of practicing Tai Chi ($r = 0.059$, $P = 0.175$). No significant difference in sleep quality was found among subjects who practiced different styles of Tai Chi ($F = 0.350$ [4, 245], $P = 0.876$]. The linear regression model, which included age, sex, marital status, employment status, style of Tai Chi being practiced, and duration of practicing Tai Chi, only explained 9.6% of the variance in sleep quality ($F = 4.292$ [6, 243], $P = 0.000$]. Of these variables, both duration of Tai Chi practice and style of Tai Chi being practiced did not make a statistically significant contribution.

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DISCUSSION

The present study attempted to examine sleep quality among middle-aged adults after practicing Tai Chi for a long period (mean, 4.7 years). This research is distinct from previous studies which examined the health benefits of Tai Chi for a relatively short duration of practice (15 weeks to 12 months). The present consideration was based on the philosophy of Tai Chi, in which long-term practice is necessary to guarantee proper performance. This study represents initial efforts in this direction.

Sleep quality among middle-aged Tai Chi practitioners

Tai Chi practitioners in the current study demonstrated a mean global PSQI score of 5.3, which was only slightly higher than the cut-off point of 5. Previous studies using the PSQI to assess sleep quality in middle-aged Chinese subjects in Hong Kong aged 45–59 years reported a score of 5.8 (Chong & Cheung, 2012), in healthy middle-aged women in Spain reported a score of 7.2, and in middle-aged women with fibromyalgia syndrome in Spain reported a score of 11.6 (Munguía-lzquierdo & Legaz-Arrese, 2011). The prevalence of poor sleepers in the present sample was 37.6%. The prevalence was 46.0% in healthy middle-aged women in Spain, and 96.0% in middle-aged women with fibromyalgia syndrome (Munguía-lzquierdo & Legaz-Arrese, 2011). Although the present subjects appeared to have better sleep quality than those in previous studies, difference in study methodology and subjects' characteristics might have led to difference in result. The present findings can only suggest the potential of Tai Chi in bringing positive impact to sleep quality.

The subjects in the present study have practiced Tai Chi for an average of 4.7 years. It has been argued that the experienced practitioners have moved beyond the basic level to a higher level of practice. They can better grasp the essence of Tai Chi and their practice brings forth various health benefits (Chen, Snyder, & Krichbaum, 2001). Theoretically, the present subjects are different from those novice practitioners in previous studies who mainly practiced by learning the movements and memorizing their sequence. However, a true comparison between the novice and experienced practitioners can only be performed when there is a concrete definition for these two types of practitioner. At present, this definition has yet to be developed. This is a significant and urgent issue to be addressed in coming Tai Chi studies.

It has been stated that all styles of Tai Chi share similar principles, and thus result in similar health outcomes (Yang, 1991). The present findings reveal no significant difference in sleep quality between subjects practicing different styles of Tai Chi. To further confirm the study result, it is desirable that the subjects can be matched before the comparison is made and when the dose of Tai Chi practice is certain.

Findings from regression analysis illustrated that both the duration of practicing Tai Chi and the style of Tai Chi being practiced did not make a significant contribution to sleep quality among the middle-aged Tai Chi practitioners. The non-significant findings, to a certain extent, revealed the inadequacy of not having considered the dose and performance level of Tai Chi practice among the practitioners during data analysis.

Limitations of the study

This research has several limitations. Self-reporting was adopted to assess sleep quality, making the study results prone to recall bias. Although this method is not as objective as other measures such as polysomnography, it is feasible and economical for a large and dispersed sample. The authors purposely chose the PSQI as the data collection instrument because it has sound psychometric properties, and it has been validated by polysomnography (Osorio, Gallinaro, Lorenzi-Filho, & Lage, 2006). This study was also limited by the use of non-probability sampling. Sampling bias might have occurred. However, convenience sampling was the only feasible sampling method in this study. Therefore, interpretation of findings should consider the specific background of the subjects who were middle-aged Chinese and with continuous Tai Chi practice within the Tai Chi associations. Probability sampling, if feasible, may be used in the future to get a better representative sample and to enhance the generalizability of the study results. Although the present study attempted to compare its findings with previous studies, the single-group design limited its ability to draw a valid conclusion. Incorporating a well-matched comparison group or follow up of the same group over time can add strength to the study design. Lastly, the inability to ascertain the exact dose of Tai Chi practice that the subjects have pursued, and without matching the subjects for subgroup comparison, limited the ability of this study to form any definite conclusion.

In spite of the above limitations, this descriptive study represents an initial and essential step in the logical process of knowledge expansion. It documents the sleep quality of middle-aged Tai Chi practitioners. With the

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present effort, this study serves to generate hypotheses for future studies to confirm the relationship between Tai Chi and sleep quality.

CONCLUSION

Sleep quality is significant to health. Middle-aged people are prone to impaired sleep quality because of various life challenges. Promoting sleep quality is of great importance to this age group. Tai Chi has potential for improving sleep quality. The present study serves to set up a platform for future testing to confirm the relationship between Tai Chi and sleep quality. Well-designed comparative studies using probability sampling are indicated to fill up existing knowledge gaps. Increasing current knowledge will facilitate the adoption of appropriate means of promoting sleep quality among middle-aged people. The present experience is relevant to international nurses who are working actively in promoting the health of middle-aged individuals.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with respect to this publication.

AUTHOR CONTRIBUTION

L. Y. K. L., K. W. T., M. L. L., N. Y. L., J. C. Y. L., Y. M. L., C. H. W. L., W. K. K., D. C., B. C. and P. Z. K. C. contributed to the conception of this study. K. W. T., M. L. L., N. Y. L., J. C. Y. L., Y. M. L., C. H. W. L., W. K. K., D. C, B. C. and P. Z. K. C. collected data, performed data analysis and interpreted the data. L. Y. K. L. drafted the manuscript. All authors read and approved the final manuscript.

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