THE PSYCHO-PHYSIOLOGICAL EFFECTS OF "TAIJI SENSE"
IN TAIJIQUAN EXERCISE

LIXIN WANG¹, YUNFA LIU², KANICHI MIMURA³) and SHIGEO FUJIMOTO¹

Abstract

The usage of "Taiji sense"(a kind of image) is required during Taijiquan(TJQ) exercise, but some practitioners virtually ignore it all the time while exercising. The significance for the usage of "Taiji sense" is still completely unknown. This study assessed the psycho-physiological effects of "Taiji sense" during 24-style TJQ exercise(24TJQ) 25 middle-elderly 24TJQ-experienced subjects were divided into Taiji-sensed group(TS) non-Taiji-sensed group(NTS) and ergometry exercise group(EE) by balancing their age and TJQ experience time. The division of TS and NTS was determined by a self-reported investigation, based on whether the practitioner usually uses or does not use the image of "Taiji sense" while exercising TJQ. Electroencephalography and profile of mood states were examined and compared. After exercise, TS showed greater increase of α activity(P<0.05) and greater decrease of β activity(P<0.05) than EE, respectively. α hemispheric asymmetry score indicated by Fp1-Fp2 showed significant decrease change(P<0.05) in TS after exercise( Post2) and to be lower(P=0.056) than that of NTS. Even though all conditions significantly decreased Tension-Anxiety(T-A) scores(P<0.05, for all), only TS significantly increased Vigor (V) score(P<0.05). The change of α activity inversely correlated to the change of T-A score(r=-0.78, P<0.0001) in all conditions. Conclusively, the usage of "Taiji sense" might help to produce stronger psycho-physiological responses during 24TJQ practice, and give rise to effective relaxation after exercise, as classics pointed out.

key word: 24-style Taijiquan exercise, Ergometry exercise, Electroencephalogram, Profile of mood states

Introduction

Taijiquan(TJQ), a traditional martial art borne in ancient China(1368–1911), has increasingly become a popular conditioning exercise in China, Japan and other countries, and has been recommended as a candidate contest item in 2008 Beijing Olympic. It is considered that the unique exercise characteristics of TJQ such as low velocity, low impact, moderate intensity and beneficial psychological effects¹,² make it easily accepted, especially by the elderly people.

TJQ emphasizes the usage of a kind of image named “Taiji sense” during practice, which verbally signifies the encompassing or circular state of the universe before the creation of heaven and earth.

Within the circular movement are many concealed variations and changes: mixing emptiness with fullness, supporting strength with softness, seeking serenity in action, or action in serenity³. Aiming to exercise the mind and body together, “Taiji sense” requires the practitioner not only to exercise with an imagined opponent, and utilizes every motions to respond to his/her offensive and defensive motions, but also have to focus on deep respiration.

Previous studies about the effects of TJQ, particularly those focusing on the middle–elderly people have provided the understanding of the characteristics of TJQ exercise and the physiological impact on health. TJQ was reported as a moderate intensity exercise⁴–⁶, and was claimed beneficial to cardiorespiratory and muscular–skeletal function⁷, post-

1) 大阪市立大学医学研究科 運動生体医学
〒545-8585 大阪市阿倍野区旭町1-4-3

2) 大阪大学大学院 人間科学研究科 人間科学専攻
〒565-0871 大阪府吹田市山田丘1-2

3) 大阪教育大学 教養教育課程 保健体育教育 体育コース
〒582-8582 大阪府柏原市旭ヶ丘4-698-1

Department of Sports Medicine, Graduate School of Medicine, Osaka City University
Behavior Science, Human Science Department, Osaka University
Department of Healthy Sports, Osaka Kyoku University
ure control capacity and the reduction of falls\textsuperscript{8–11}, immune system\textsuperscript{12} and so on. Some studies have investigated the psychological effects of TJQ. The combination of deep diaphragmatic breathing and relaxation with slow gentle movements as well as the usage of “Taiji sense” might be effective to suppress the mental stress induced by quick, tight and erratic movement\textsuperscript{13} or to increase confidence in balance and movement\textsuperscript{14}. Jin\textsuperscript{15,16} has published two studies on the effects of TJQ exercise on mood, mental and emotional stress. In his first study\textsuperscript{15}, he found that relative to baseline levels, TJQ exercise could be useful to decrease tension, depression, anger, fatigue, confusion, anxiety and total mood disturbance, and to increase vigor; and in his second study\textsuperscript{16}, the efficacy of TJQ was compared with brisk walking, meditation, and reading in reducing mental and emotional disturbance, and concluded that the stress reduction effect of TJQ was characterized as that of moderate physical exercise. In addition, it is reported that the combination of low intensity exercise and Taiji cognitive strategies could improve the general mood states\textsuperscript{2}.

However, to our knowledge, almost no study has ever examined the psychological effects of TJQ by other methods than self-evaluation ones. In the past 5 years, we have been investigating the physiological and psychological effects of 24-style TJQ\textsuperscript{17} or simplified TJQ, a relatively newly developed one that gets the essential contents of traditional TJQ together. The influences of 24TJQ exercise on central nervous system were assessed by electroencephalography (EEG) and the psychological effects by Profile of Mood State (POMS)\textsuperscript{17,18}. Our studies showed that, 24TJQ characterizes as a moderate intensity exercise, \( \alpha \) activity in the skilled practitioners indicated a central dominance change during and after 24TJQ exercise instead of ordinary occipital dominance\textsuperscript{17}. In our recent study, we investigated the different responses of EEG between 24TJQ and cycle ergometry exercise with the same intensity determined by the same heart rate during two exercises. 24TJQ exercise significantly increased \( \alpha \) activity and decreased \( \theta \) activity in the frontal region, while \( \theta \) activity significantly decreased both in the central and occipital regions, significant correlations were found between the increased \( \alpha \) in the frontal region, the decreased \( \theta \) activity in the central or occipital region and the vigor of the POMS test. Thus we concluded that 24TJQ exercise induced a resting awakening state and exhibited a relaxing effect on both mind and body\textsuperscript{18}.

Even though TJQ exercise generally focused on the homeostasis of the body’s internal environment, the interaction between mind and body has long been seen as more important than the development of any martial arts skills, but the interaction between mind and body or the effects of “Taiji sense” has never been clarified. Because the significance for the usage of “Taiji sense” is still completely unknown, lots of practitioners (\( >50\% \) subjects don’t use “Taiji sense” according to our unpublished investigation) virtually ignore it all the time while exercising TJQ. The psycho-physiological effects of “Taiji sense” need to be examined.

Because our previous studies\textsuperscript{17–19} as well as others have confirmed that, as an aerobic exercise, TJQ could significantly improve the positive mood (Vigor) and increase \( \alpha \) activity in the frontal region or induced \( \alpha \) activity shift to central or frontal regions. However, the increases of \( \alpha \) activity were paralleled with anxiety reduction induced by aerobic exercise\textsuperscript{20} or positive affective response\textsuperscript{21,22}. According to a cerebral lateralization hypothesis, exercise may differentially influence the degree of activation in the two cerebral hemispheres\textsuperscript{23}, relatively less activation in the right hemisphere, notably in the anterior regions, might be associated with more positive affective states\textsuperscript{24,25}. Based on these previous studies, while this study examined the psycho-physiological effects of “Taiji sense” on relaxation and mood, we also focused on the investigation of cortical activity in the frontal region and its asymmetry. Because both classics and previous studies reported that TJQ benefits psychological health on the practitioners, we hypothesized that the
usage of “Taiji sense” during TJQ practice might cause some measurable psycho-physiological response, such as in EEG and POMS.

**Materials and methods**

**Participants**

Twenty five healthy, right-handed, physically active middle–elderly subjects (20 F, 5 M; age: 53.3 ± 11.06) with 2–13 yr of 24TJQ experience volunteered to participate in the study (Table 1). The subjects were divided into three groups, including eight Taiji-sensed group (TS, age: 46.4 ± 15.2; TJQ experience: 5.8 ± 3.1 yr), eight non-Taiji-sensed group (NTS, age: 53.6 ± 8.3; TJQ experience: 3.0 ± 2.7 yr), and nine ergometry exercise group (EE, age: 55.3 ± 10.5; TJQ experience: 2.9 ± 1.3 yr). The division of groups was balanced among three groups by their age and between EE and NTS groups by their TJQ experience years. The use or non-use of “Taiji sense” during TJQ practice was investigated by a questionnaire before the testing. In detail, each subject was asked to answer the following two questions: 1) whether he/she exercises with an imagined opponent or enemy, and initiates every motion offensively or defensively corresponding to the opponent’s offensive or defensive motions; 2) whether he/she focuses his/her attention on deep respiration while exercising. Any positive answer from the two questions would be considered as the usage of “Taiji sense”, and classified to TS, the subjects with both negative answers would be classified to NTS. The EE group consisted of both Taiji-sensed subjects (three subjects) and non-Taiji-sensed subjects (six subjects). The subjects agreed to refrain from smoking, drinking alcohol or caffeine, drugs, taking high intensity physical activity during 24 hr and from eating during 3 hr before testing. Each subject provided an informed consent, and no details concerning the experiment purpose were given to subjects until the finish of testing. Institutional approval was obtained at Graduate School of Human Science, Osaka University.

**Exercise Testing**

The exercise testing was conducted on two separate days with an interval of seven days. On the first day, the subjects practiced a set of 24TJQ, which took an average time of 6 min, and the individual heart rate (HR) changes were recorded. On the latter day, the subjects were asked to perform an ergometry (Computronic aerobike 75 XL, Combi corporation, Tokyo, Japan) exercise in 6 min like practicing 24TJQ. The individual intensity of ergometry exercise was determined by regulating the workload to make the HR response equivalent to that one when practicing 24TJQ on the first day. The same levels of HR responses (100 ± 14: 101 ± 14: 102 ± 13 bpm for TS, NTS, EE, respectively) were observed during exercise. All twenty-five subjects participated in the two exercises testing, and they didn’t know in which group he or she was assigned.

Before entered the laboratory room, the subjects were instructed to do 5 min light warm-up exercise including stretching and joints movement, then was

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<tr>
<td><strong>Age (yr)</strong></td>
<td>46.4 ± 15.2</td>
<td>53.6 ± 8.3</td>
<td>55.3 ± 10.5</td>
</tr>
<tr>
<td><strong>Height (cm)</strong></td>
<td>156.3±6.5</td>
<td>158.8±4.7</td>
<td>154.6±5.4</td>
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<tr>
<td><strong>Body mass index (kg/m²)</strong></td>
<td>24.7±2.1</td>
<td>24.8±1.8</td>
<td>25.6±1.6</td>
</tr>
<tr>
<td><strong>Taijiquan experience time (yr)</strong></td>
<td>5.8 ± 3.1</td>
<td>3.0 ± 2.7*</td>
<td>2.9 ± 1.3*</td>
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Note: Values reported are mean±SD. *: P<0.05, compared with TS value. TS, Taiji-sensed group; NTS, non-Taiji-sensed group; EE, Ergometry exercise group.
led to the testing room, prepared for data collection by having EEG electrodes and HR monitor applied. The exercise testing started with the order (a) sat quietly for 3 min before exercise (Post 1); (b) perform a set of 24TJoQ or 6 min ergometry exercise, (c) sat quietly for 3 min immediately after exercise (Post 1); (d) sat quietly until HR recovered to rest HR, which took about 3 ± 1.12 min for 24TJoQ and 2.9 ± 2.20 min for ergometry exercise, (e) sat quietly for another 3 min after recovered to rest HR (Post 2). EEG data were collected on Pre, Post1 and Post 2 session, while the subjects were asked to close their eyes.

For the testing of EE, the subject began pedaling at 60 rpm and 60 watts. The pedaling speed was consistent and the workload was gradually increased until the HR equaled to the one similar to that of 24TJoQ and was consistently adjusted to keep HR on a corresponding level. The ergometry was equipped with toe straps to secure the feet on the pedals and seat position was comfortably adjusted to maximize efficiency.

**EEG data recording and processing**

EEG and HR data were obtained by using an EEG Telemeter System WEE-6112 (Nihon Kohden, Tokyo, Japan). EEG data were recorded from 10 mm Ag-AgCl disc electrodes (supply code H503A, model NE-113A, Nihon Kohden, Japan) attached to the scalp with Elefix EEG paste at left and right frontal-parietal (Fp1, Fp2), central (C3, C4) and occipital (O1, O2) locations according to the international 10-20 system. These sites were selected in order to simultaneously record the EEG data from occipital to frontal region. The body earth was located at Fpz and the reference electrodes at left and right earlobe. Three electro-oculographic leads (FPL-A1, PGL-A1 for vertical and PGL-P2 for horizontal eye movements) were added for artifact monitoring. A gauze strip was placed over the electrode and was firmly pressed onto the scalp and then got a rubber cap on. Light gauze pads were placed over the closed eyelids to reduce blink artifacts. The electrode impedance was kept below 5 kΩ throughout the recording session.

For each session, a 50 µV sine wave provided by EEG machine was passed through all channels amplifiers, digitized on-line, and submitted to a Fast Fourier Transform (FFT). The root-mean-square of total power was used to calculate a gain correction factor to be applied to each channel to ensure interchannel comparability (within ±0.5 µV). A null calibration for zero level determination was also performed by shorting the input channels to the ground before the analog-to-digital (A/D) converter. In this way, any DC component would have been detected and corrected, although this was never the case.

The EEG signal was amplified 20,000 times using a Nihon Kohden model AE-600A with band-pass filter settings of 1.3-35 Hz and a 50 Hz notch filter.

In each 3 min recording session, subjects were instructed to relax but not to sleep, and to avoid making movements during the recording. Compliance to the instructions was monitored throughout the session. No drowsiness was noticed during the EEG recordings (no occipital α dropout and fragmentation appeared, with a shift to the anterior regions, in conjunction with background slowing).

Visual examination of the EEG recordings was performed to identify and then exclude all the EEG epochs with artifacts and/or the single leads with local artifacts (e.g. muscle activity, blinks, electrode artifacts) Only EEG recordings with at least 25 artifacts-free 5 sec epochs were included in this study.

The EEG signal was digitized with a sampling frequency of 256 Hz then submitted to a FFT for off-line using Neurofax software (EEG-1000, Ver. 03-01, Nihon Kohden, corp. Japan).

The EEG data for 3 min before and after exercise were classified into θ(4-8 Hz), α(8-13 Hz) and β (13-30 Hz) waves. Preliminary descriptive analysis revealed that none of the evaluated quantitative EEG (QEEG) indices show a normal distribution. To obtain a better approximation to this distribution, the relative power was submitted to a log trans-
formation \( x = \log y / (1 - y) \) where \( y \) is the relative power of a given frequency band and \( x \) represents the log of the relative power (LRP), whereas the absolute power was submitted to a log transformation (LAP, log absolute power). A hemispherical asymmetry score was calculated out from LAP value by \( F_p1 - F_p2 \).

Considering EEG circadian and diurnal variations\(^{26, 27}\), EEG data for 24TJQ and ergometry exercise was recorded at the same time of day. All the experiments were performed in a quiet laboratory with the same temperature and humidity, and drinking water was freely supplied during the testing.

HR was recorded from two 10-mm Ag-AgCl disc electrodes using the chest-lead method. A transmitter sent the obtained EEG and HR to a receiver that is connected with a windows 2000 computer.

**Psychological Instruments**

A Japanese version of POMS test\(^ {28, 29} \) was administered to examine the mood change before and after exercise. The subjects selected the raw score, which were converted into the respective T score. The analysis of this study stressed to investigate the relaxation-related subscales of POMS test, including T-A (tension and anxiety), V (vigor) and F (fatigue).

**Statistical analyses**

Data are presented as mean ± S.D. The Kolmogorov-Smirnov test (K-S test) was performed in advance to confirm normal distribution of each variable. 2-way RM ANOVAs (3 conditions × 3 sessions) were used to analyze \( \theta \) LRP, \( \alpha \) LRP, \( \beta \) LRP and \( \delta \) hemispherical asymmetry score, with the session serving as the repeated measures variable. Post-hoc tests (Fisher’s PLSD) were used to follow up significant F tests to determine where differences occurred. The POMS T-scores before and after 24TJQ and ergometry exercise were compared using a paired student t-test. Simple Pearson test was used to examine the correlation between the changes of POMS subscale T-score and the changes of \( \delta \) hemispherical asymmetry score. The 0.05 level of probability was considered significant for all the above analyses. All the analyses were conducted by using StatView, 5.0.

**Results**

The LRP of \( \theta, \alpha \) and \( \beta \) band by conditions and sessions (Table 2.)

The session effects in \( \alpha \) LRP \( F (2, 44) = 3.597, P \leq 0.05 \) and \( \beta \) LRP \( F (2, 44) = 10.416, P < 0.001 \) were revealed, the interaction effect between condition and session \( F (2, 44) = 7.374, P < 0.001 \) was only recognized in \( \beta \) LRP. No any condition effects in any band and no session effect in \( \theta \) LRP were recognized. Post-hoc tests showed that \( \alpha \) LRP in

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<tr>
<td></td>
<td>Pre</td>
<td>Post1</td>
<td>Post2</td>
<td>Pre</td>
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<tr>
<td><strong>Theta</strong></td>
<td>-1.69 (0.46)</td>
<td>-1.71 (0.56)</td>
<td>-1.99 (0.40)</td>
<td>-1.49 (0.30)</td>
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<tr>
<td><strong>Alpha</strong></td>
<td>0.53 (0.48)</td>
<td>0.63a (0.53)</td>
<td>0.91b (0.40)</td>
<td>0.50 (0.62)</td>
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<tr>
<td><strong>Beta</strong></td>
<td>-1.34 (0.39)</td>
<td>-1.45a (0.37)</td>
<td>-1.72b (0.33)</td>
<td>-1.52 (0.70)</td>
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Note: Values reported are mean(SD). *: P < 0.05; **: P < 0.001; a: P < 0.05 compared with EE Post1; b: P < 0.05, compared with EE Post2. TS: Taiji-sensed group; NTS: non-Taiji-sensed group; EE: Ergometry exercise group.
Post 1 and Post 2 in TS were significantly greater than that in EE (P < 0.05 in both) respectively, while β LRP in Post 1 and Post 2 in TS were significantly lower than that in EE (P < 0.05 in both) respectively.

*α* hemispherical asymmetry score calculated from LAP(Fp1-Fp2) Figure 1.*

Significant session effect F(2, 44) = 9.519, P < 0.001 and interaction effect F(4, 44) = 4.868, P < 0.01 were revealed in *α* hemispherical asymmetry score, but no condition effect could be confirmed. Post-hoc tests showed the significant decrease (P < 0.05) of *α* hemispherical asymmetry score of Post 2 compared with that of Pre in TS, and the value of Post 2 tended to be lower (P = 0.056) in TS compared with that in NTS.

*Profile of mood states* (Table 3.)

The relaxation-related subscales in POMS test including T-A, V and F were picked out to investigate the change of individual subscales. After exercise, all conditions indicated significant decrease of T-A score (P < 0.05, for all) but only TS showed significant increase of V score (P < 0.05). F score indicated no significant changes in any conditions.

The change of *α* LRP values inversely correlated to the change of T-A score strongly (r = −0.78, P < 0.0001)

**Discussion**

Previous literatures reported TJQ exercise might benefit psychological effects1,2) and mind-body integration/health3,4. These effects are considered to be associated with the usage of “Taiji sense”, which is strongly recommended in classics as an essential element during TJQ exercise. This study pioneered to investigate the psychological effects of “Taiji sense”, and attempted to explain in part the necessity and significance for the usage of “Taiji sense” during TJQ exercise.

After exercise, greater *α* activity and less β activity were found in TS compared with EE. Accordingly, considering the same results between NTS and EE, and the same intensity and time for both ex-

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**Figure 1.** Alpha hemispheric asymmetry score(Fp1-Fp2) at right and left frontal-parietal region before and after exercise by conditions.
Table 3. The comparison of POMS 3 subscores before and after exercises.

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<td>T-A</td>
<td>V</td>
<td>F</td>
<td>T-A</td>
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<td>Pre</td>
<td>42.5</td>
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<td>46.4</td>
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<td></td>
<td>(5.6)</td>
<td>(12.2)</td>
<td>(4.1)</td>
<td>(6.9)</td>
<td>(6.5)</td>
<td>(6.1)</td>
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<tr>
<td>Post</td>
<td>37.3*</td>
<td>59.9*</td>
<td>41.0</td>
<td>42.6*</td>
<td>52.3</td>
<td>43.9</td>
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<td>(13.5)</td>
<td>(6.2)</td>
<td>(5.1)</td>
<td>(11.9)</td>
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Note: Values reported are mean (SD). *: P < 0.05, compared with Pre value. TS: Taiji-sensed group; NTS: non-Taiji-sensed group; EE: Ergometry exercise group. T-A: Tension-Anxiety; V: Vigor; F: Fatigue.

![Graph](image_url)

Figure 2. The relationship between the change of alpha LRP values and the change of T-A score.

eercises, the usage of “Taiji sense” might be recognized as the main affecting factor for the different cortical activities. Because the increase of α activity or the decrease of β activity is usually explicated to reflect brain deactivation\(^{29}\) or the quieting of cortical activity\(^{30,31}\), our results might suggest that TS resulted in more effective brain deactivation or quieting of cortical activity.

Then, why did the usage of “Taiji sense” during TJQ practice can affect the cortical activity more effectively or strongly? Or why did the cortical activity can be more suppressed by the usage of “Taiji sense”?\(^{32}\)

“Taiji sense” requires the practitioner to exercise in response to an imagined “rival”, whose motions might be offensively or defensively to the practitioner. According to the bio-informational theory of emotional imagery proposed by Lang\(^{32}\), the image network includes information about perceptual responses, e.g., body orientation to the stimulus, postural set, as well as psychological processing factors such as ease in resolving the image. Because the practitioners who applied “Taiji sense” must adjust their physical motions or posture to “fight” against the imagined “rival” (stimulus proposition), we believe that a specific pattern of efferent activity including various perceptual responses might occur. This specific pattern might associate with the content of “Taiji sense” image and depend on how the subjects imagined the experience. The physiology of image is firstly neurophysiological\(^{32}\), and its propositional structure is available to measurement by
EEG, thus the specific pattern of cortical activity might be brought by the specific image content of “Taiji sense” during exercise. The greater increase of α activity in TS other than NTS compared with EE means that, the usage of “Taiji sense” during practice might effectively induce to a significant suppression of cortical activity or a stronger relaxation response after exercise.

The more effective psycho-physiological responses in TS were also observed in POMS test and its correlation with the change of α activity. After exercise, T–A score decreased in all conditions and V score increased only in TS, and the change of T–A score was inversely correlated with the change of α activity. The improvement in general mood state was also seen in previous studies on TJQ\(^{15,16}\) or some other exercises\(^ {30,22,33,32}\). However, our result that no significant change of α activity was observed in EE is in disagreement with most previous studies, which claimed that moderate exercise might increase α activity after exercise\(^ {31,34}\). We suppose that this inconsistency might be possibly caused by the different exercise time, the practitioners in this study exercised only 6 min, in which a set of 24TJQ exercise was finished.

Furthermore, we analyzed the change of hemispherical asymmetry after exercise. α hemispherical asymmetry score indicated by Fp1–Fp2 decreased significantly in TS (Post 2), and tended to be lower than that in NTS. The decrease of α hemispherical asymmetry score signifies either the (relative) increase activity of the left anterior region or the (relative) decrease activity of the right anterior region. Previous studies suggested that, the asymmetry of hemispheric activity after exercise could produce the change of emotion and mood states\(^ {34}\), and the activation in the left anterior region is associated with approach–related emotions, while activation in the right anterior region is associated with withdrawal–related emotions or psychopathology\(^ {35,36}\). Even though it still remains speculation, we believe that since the practitioners must imagine a “rival”, a kind of hostile emotion might appear. After the end of exercise, the practitioner released or eased from somewhat “stressful” experience of “Taiji sense” image, which could explain the afterward psychological relaxation and significantly relative decrease of afterward α asymmetrical score in the left anterior region. These results and interpretations suggest that the usage of “Taiji sense” can significantly intensify the psychological benefits of Taijiquan.

Bixby et al.,\(^ {37}\) reported that three temporal patterns characterize affective change from baseline to exercise and recovery. One possibility is that the state experienced during exercise is maintained during recovery and that both states are different from baseline (a rebound model) a second possibility is that the affective state during exercise would be opposite from that experienced during recovery, and that both states would be different from baseline (a rebound model) the third possibility is that the affective state will change in either direction from baseline to during exercise with a subsequent return to baseline following exercise. Our results suggest that the temporal response pattern of 24TJQ might belong to the rebound model. Although the moderate intensity stimulus of 24TJQ was perceived as enjoyable or positive, the usage of “Taiji sense” is more perceived as undesirable or rival, the affective state might be relatively negative during exercise and positive following exercise.

In conclusion, even though a set of 24TJQ performance is usually completed only in about 6 min, the usage of “Taiji sense” might help to produce stronger measurable psycho-physiological responses during practice, and hence results in more effective relaxation or vigor after exercise. The temporal pattern of 24TJQ regarding affective response might belong to a rebound model, which brings an approach–related emotion change after exercise. From the above results, we could speculate, at least in part, that the usage of “Taiji sense” might have its imminent significance and is valuable to be applied during TJQ exercise.

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References


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