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Shen-based Qigong Exercise improves cognitive impairment in stable schizophrenia patients in rehabilitation wards: a randomized controlled study

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Abstract

Background Cognitive impairment is common in chronic schizophrenia patients. The purpose of this study was to explore the efficacy of Shen-based Qigong Exercise (SBQE) in improving the cognitive impairment of stable schizophrenia patients in rehabilitation wards.

Methods SBQE is derived from the theory of "body-spirit syncretism (xin shen he yi)" in traditional Chinese medicine (TCM) and is extracted from the four traditional Qigong techniques. In this 12-week, randomized, single-blind, controlled study, a total of 40 schizophrenia patients were randomly assigned to either the SBQE group or the control group. The scores for the Scale for the Assessment of Negative Symptoms (SANS) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) were recorded at baseline and week 12, respectively.

Results At week 12, the mean RBANS total score was 84.5 points in the SBQE group and 72.8 points in the control group. The estimated mean difference was − 11.60 points (2-sided 95% CI, -22.41 to -0.79; $P=0.04$). This difference was statistically significant (time-by-group interaction effect estimates, $F_{(1,38)}=5.07$; $P=0.03$).

Conclusions Our preliminary findings indicated that SBQE led to an improvement in cognitive impairment in stable schizophrenia patients in rehabilitation wards. Further research with robust design and larger sample sizes is necessary to validate the effects of SBQE on cognitive function and psychiatric symptoms in schizophrenia, thus providing more substantial evidence for the clinical application of SBQE.

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Keywords Qigong, Schizophrenia, Cognitive impairment

Introduction

Schizophrenia is a severe, chronic psychiatric disorder characterized by psychiatric symptoms, cognitive impairment, and decreased functional abilities [1]. The prevalence rate of schizophrenia is approximately 1% [2], and its disease burden is enormous [3]. While there are antipsychotic agents available for treatment, a considerable number of patients with schizophrenia do not respond well to them or continue to experience residual negative symptoms and cognitive impairment over the course of their illness, leading to poorer prognoses [4–6]. In addition, patients with poorer cognitive function tend to exhibit more severe negative symptoms [7–9], and impairment in verbal memory can predict the persistence of these symptoms [10]. Cognitive function and negative symptoms are significantly correlated and directly impact functional outcomes in schizophrenia patients [6]. Therefore, intervention in negative symptoms and cognitive impairment of schizophrenia is a crucial aspect of schizophrenia rehabilitation. For centuries, traditional Chinese medicine (TCM) has been utilized to address various mental disorders [11]. One of the TCM practices is Qigong, a mind-body exercise marked by gentle rhythms and moderate intensity, including Tai Chi, Baduanjin, Liuzijue, Wuqinxi, and Yijinjing. Qigong focuses on integrating physical poses with conscious relaxation and breathing techniques to foster harmony of the mind and body [12–14]. Previous studies have indicated that Qigong can enhance both positive and negative symptoms in individuals with schizophrenia, reducing the frequency and duration of re-hospitalization [12, 14, 15]. Additionally, Qigong has shown promise in improving the cognitive function of schizophrenia patients. For instance, Tai Chi has been found to alleviate motor deficits and enhance short-term memory and attention [16]. These improvements were measured using the Chinese Wechsler Adult Intelligence Scale's forward and backward digit spans. However, the notable effects of these interventions on outcome variables tend to dissipate by the end of the study period at the 6th -month follow-up. Yijinjing has been linked to improvement in the mini-mental state examination (MMSE) score in schizophrenia patients [17], while Baduanjin has shown the potential to enhance logical memory in long-term hospitalized schizophrenia patients [18]. Despite these findings, cognitive function assessment tools used in these studies may not fully capture the cognitive function of these patients. Furthermore, there is currently no Qigong exercise that offers precise intervention for cognitive function in schizophrenia.

The School of Rehabilitation Science at Shanghai University of Traditional Chinese Medicine collaborated with the Rehabilitation Department of Shanghai Mental Health Center to select specific movements from four types of TCM Qigong (Liuzijue, Baduanjin, Wuqinxi, and Yijinjing) and integrate them into a Shen-based Qigong Exercise (SBQE) designed to intervene the cognitive function of schizophrenia patients effectively. SBQE is rooted in the fundamental TCM theory of "body-spirit syncretism (xin shen he yi)," which posits that recuperating "xin" such as zang-fu organs and qi-blood can enhance "shen" such as mental cognition. The exercise involves stretching limb movements combined with breath and meditation, integrating form, breath, and spirit to promote overall balance and rehabilitation of the body and mind [19].

Based on the theory of "body-spirit syncretism," we assume that the selective incorporation of various Qigong movements aimed at enhancing "shen" could potentially improve cognitive function in schizophrenia.

Methods

Design

We conducted a single-blind, superior, randomized controlled trial (RCT) comparing conventional therapy combined with SBQE and conventional therapy for patients with schizophrenia. Once the recruitment process was completed, all eligible patients were randomized 1:1 to either the SBQE or the control group. The trial protocol has been published elsewhere [20].

The trial was registered at ClinicalTrials.gov (identifier: NCT05310955, on 22/02/2022) and http://www.chictr.org.cn/ (identifier: ChiCTR2200057373, on 10/03/2022). The study was approved by the Internal Review Board (IRB) of Shanghai Mental Health Center and was conducted following the Helsinki Declaration of 1975.

The recruitment process included a detailed introduction of the study by the study leader to the researchers responsible for recruitment. Subsequently, the researchers recruited participants in the rehabilitation ward. Upon registration, the recruiters conducted a comprehensive evaluation of the participants. Recruiters also provided detailed information regarding the study's purpose, content, and potential benefits or risks to participants who met the research criteria. Finally, participants who agreed to participate in the study signed an informed consent form.

Participants

Patients diagnosed with schizophrenia were recruited from four rehabilitation wards at the Shanghai Mental Health Center from August 2022 to December 2022. Recruiters used the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (DSM)-5 to confirm the diagnosis of schizophrenia and determine if the patients met the inclusion criteria.

The study's inclusion criteria were as follows: (1) Han Chinese ethnicity; (2) aged ≥ 18 years; (3) had an education level ≥ 6 years; (4) met the diagnostic criteria for schizophrenia based on DSM-5; (5) were stable patients with schizophrenia living in a rehabilitation ward without relapse for the past 6 months; (6) exhibited residual negative symptoms, with at least one item ≥ 2 on the negative subscale of the Positive and Negative Syndrome Scale (PANSS) (N1-N7) [21]; (7) were taking second-generation antipsychotics; (8) had no history of Qigong training; (9) not participated in any other researches in the past 6 months.

The exclusion criteria were as follows: (1) were suffering from severe physical illnesses such as cardiovascular, lung, liver, kidney, and hematopoietic diseases; (2) were having severe cognitive impairment and/or mental retardation; (3) received electroconvulsive or rTMS therapy in past three months; (4) were having vision and/or hearing problems. The Mini-Mental State Examination (MMSE) was used for assessment, and patients with an MMSE score < 24 were identified as having severe cognitive impairment [22, 23].

Randomization and masking

Participants in this study were divided into SBQE and control groups in a 1:1 ratio using a random number table generated by SPSS V.24.0. An independent research coordinator placed the random numbers in opaque envelopes, which were labeled with the participant's name and date of birth to ensure allocation concealment and prevent subversion of the allocation sequence. Before receiving the intervention, the therapist responsible for the intervention opened the envelope. In this study, evaluators and data analysts were blinded and only knew the number of participants but not their other information or grouping status. The therapists in charge of the intervention were not blinded, but they did not have contact with the evaluators and data analysts. Participants could not be blinded to their group assignment but were asked not to reveal their treatment status to the evaluators during the assessment. To prevent bias, an independent research coordinator directly contacted the patients instead of being approached by the researchers.

Interventions

Conventional therapy

Patients in the control group maintained their conventional therapy for 12 weeks. This therapy involved the use of psychiatric medication treatment and a routine rehabilitation program.

The routine rehabilitation program lasted 12 weeks and took place once a day for 1.5 h from Monday to Friday. It included activities such as general health education, reading, painting, annual work, gardening, and training in daily life skills. Therapists in the rehabilitation department conducted the program and kept records of the patients' participation.

SBQE

Patients in the SBQE group received 12-week SBQE while maintaining the same routine rehabilitation program as the control group. A professional traditional Chinese exercise teacher instructed them for one week before the formal intervention began. The SBQE sessions occurred daily for 30 min, from Monday to Friday, for 12 weeks, totaling 60 workshops. The participants gathered in a quiet, spacious rehabilitation hall, and the researchers supervised the entire exercise. The exercise intensity was monitored using the Borg CR10 scale, targeting a level of 4–6, where the participant should feel somewhat severe but not very severe fatigue. If a participant's Borg self-rated score was less than 4 or greater than 6, they were instructed to adjust their range of motion, speed, and breathing to increase or decrease exercise intensity. Exercise recording cards were used to monitor participants' compliance in the SBQE group, and two research assistants recorded each exercise session. The intervention was considered valid if the participant's actual exercise times accounted for more than 85% of the estimated exercise times.

We selected 6 sets of Qigong movements that can improve cognitive function from 4 TCM Qigong (Liuzijue, Baduanjin, Wuqinxi, and Yijinjing) and reorganized them into an SBQE for treating schizophrenia patients. As shown in Fig. 1, SBQE consists of the following eight actions: starting posture, 'HE exercises' in Liuzijue, 'raising a single arm to regulate the spleen and stomach', 'looking back to treat five strains and seven impairments', 'shaking head and buttocks to expel heart-fire' in Baduanjin, 'plucking fruit like a monkey' in Wuqinxi, 'Wei Tuo presenting the pestle' in Yijinjing and ending posture.

The 30-min SBQE includes (1) a 3-min warm-up period including joint activities such as head movement, chest expansion, arm vibration, body rotation, wrist and ankle movement and leg pressing followed by calm breathing and mental focusing; (2) a 20-min SBQE exercise period and (3) a 7-min cool-down period with the main content of muscle stretching and relaxation, including leg

Fig. 1 SBQE for treating schizophrenia patients

stretching, upper-back stretching, waist stretching, neck stretching and shoulder stretching while paying attention to breathe adjustment and mind relaxation.

Outcome measures

The primary outcome measure was the Chinese version of the Scale for the Assessment of Negative Symptoms (SANS) [24]. The SANS, the first diagnostic scale directly referring to deficit symptoms, was used to assess negative symptoms [25, 26]. It consists of five subscales: affective flattening, alogia, avolition-apathy, anhedonia-asociality, and attention. A higher SANS score indicates more severe negative symptoms. The assessment was carried out by blinded assessors at baseline and at the 12-week mark, which was the primary endpoint.

The secondary outcome measure was the Chinese version of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) [27, 28]. The Chinese version of RBANS has good reliability and validity in the application of schizophrenia patients. It can be used as a tool for the cognitive function level of schizophrenia patients [28]. It includes five dimensions: immediate memory, visuospatial/construction, language, attention, and delayed memory. Higher RBANS scores indicate better cognitive function. Similar to the SANS assessment, the RBANS assessment was conducted by blinded assessors at baseline and the 12-week mark, the primary endpoint.

All blinded assessors received training in the assessments of SANS and RBANS prior to the commencement of the study. The inter-rater correlation coefficients exceeded 0.8.

Sample size calculation

This study was a superiority trial. We used the calculation formula to determine the sample size for the superiority test based on the previous Scale for the Assessment of Negative Symptoms (SANS) scores (10.02±1.66; 7.20±0.11) found in related literature [29]. By setting alpha=0.05, power=90%, and superiority margin=1, we obtained the minimum sample size of 15 for each group. We selected a superiority margin of 1 as it was deemed the minimum acceptable level for improving clinical experience. Assuming a 20% dropout rate and considering clinical operability, we enrolled 18 participants in each group.

Statistical analysis

The study adhered to the intention-to-treat principle (ITT) to analyze outcome data from all enrolled patients, including those who dropped out. Missing data for primary and secondary outcomes at 12 weeks were imputed using multiple imputations through predictive mean matching.

The Kolmogorov-Smirnov one-sample test was used to assess the distribution of the data. The chi-square test was used for categorical variables. The Mann-Whitney U-test was used to measure the continuity of non-normal variables. The t-test was used to assess the continuity of normal variables.

Mixed-effects regression analyses for repeated measures with maximum likelihood estimation were used with the assumption that data were missing at random. For the primary and secondary outcomes, the model included fixed effects of time, group, and an interaction effect of group×time, as well as a random intercept to account for individual differences. The interaction effect of group×time was used to evaluate group differences at week 12 (primary endpoint). In the post hoc test, the differences between the two groups at baseline (W0) and after treatment (W12) were reported. All statistical analyses were conducted using R Statistical software version 4.3.1 and SPSS 24.0. The 2-sided α value was set at 0.05. It was noted that due to the heightened risk of type I error resulting from multiple comparisons of outcomes, the findings should be considered exploratory.

Results

Participants

A total of 51 participants were initially assessed for eligibility. Among them, 6 patients declined to participate, 1 patient had a severe physical illness (kidney tumor), 1 patient had severe cognitive impairment, 1 patient had visual impairment, and 2 patients had undergone rTMS therapy in the past three months; thus, they were excluded from the study. This resulted in a total of 40 patients who were included and randomly assigned to either the SBQE or the control group. The study was carried out from August 2022 to April 2023. One patient dropped out after discharge (2.5%), and 39 patients completed the 12-week trial (20 in the SBQE group and 19 in the control group) during the study. All patients were in stable condition during the study. None of the patients received any prophylactic or symptomatic treatment without a prescription.

All patients participated in the result analysis. The CONSORT (Consolidated Standards of Reporting Trials) diagram for this study is shown in Fig. 2.

Demographics and base data

As shown in Table 1, there were no significant differences in demographic and clinical data (including age, gender, education, family history, and illness duration) between the two groups at baseline (all $P>0.05$). Additionally, all patients continued to receive their previous antipsychotic treatment throughout the study. The doses of antipsychotics were transformed into olanzapine equivalents [30], and there was no significant difference in the olanzapine-equivalent drug dose ($P>0.05$).

As outlined in Tables 2 and 3, there were no significant differences in the primary outcomes (SANS score) and secondary outcomes (RBANS score) between the two groups at baseline (all $P>0.05$).

Primary outcome

The data attrition for the primary outcome was minimal, with SANS scores available for 39 out of 40 participants (98%) at week 12 (primary endpoint). As shown in Table 2, the mean SANS total score at the pretreatment assessment was 41.8 in the SBQE group and 47.0 in the control group. At week 12, the mean SANS total score was 36.6 points in the SBQE group and 47.8 points in the control group; the estimated mean difference was 11.10 points (2-sided 95% CI, -1.60 to 23.80; $P=0.09$), suggesting that the control group had a mean SANS total score of 11.10 points higher at the primary endpoint, favoring SBQE. However, this difference was not statistically significant (time-by-group interaction effect estimates, $F_{(1,38)}=2.35$; $P=0.13$), indicating no statistically significant difference in the change of SANS scores between the two groups over time.

Secondary outcomes

The data attrition on the secondary outcome was minimal, with RBANS score available for 39 of 40 participants (98%) at week 12 (primary endpoint). As shown in Table 3, the mean RBANS total score at the pretreatment assessment was 77.2 in the SBQE group and 74.2 in the control group. At week 12, the mean RBANS total score was 84.5 points in the SBQE group and 72.8 points in the control group. The estimated mean difference was −11.60

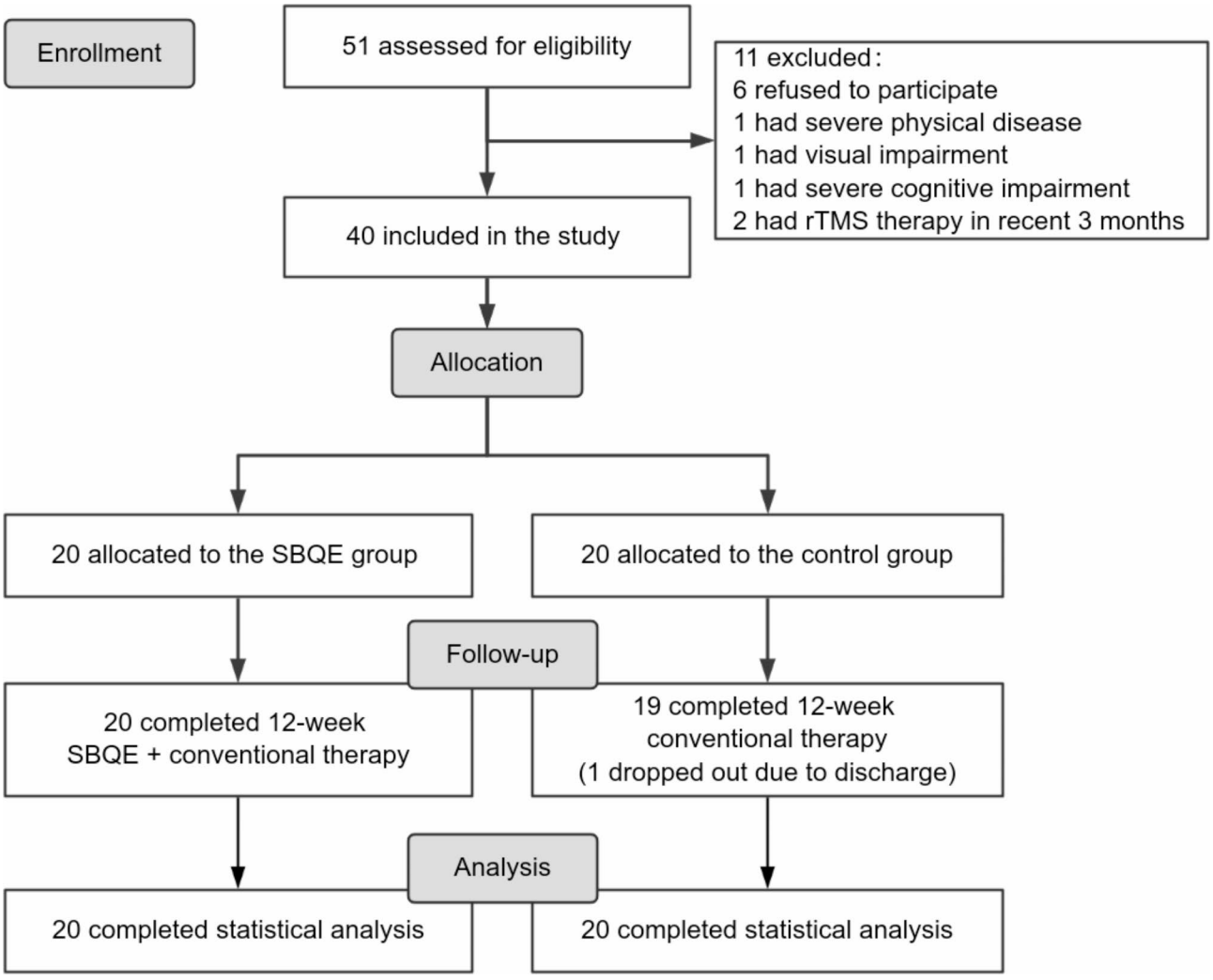

Fig. 2 Study flowchart

Table 1 Demographic and clinical characteristics of SBQE and Control Groups at Baseline (W0)

	SBQE ($n=20$)	Control ($n=20$)	χ^2, Z	*P* value
Age (years)	58.95 (12.08)	63.10 (6.76)	-1.138[a]	0.255
gender (male/female)	7/13	9/11	0.417	0.519
Education (years)	11.30 (2.92)	11.00 (2.13)	-0.102 [a]	0.919
Family history (no/yes)	15/5	14/6	0. 125	0.723
Illness duration (years)	34.40 (13.76)	34.40 (14.92)	-0.081 [a]	0.935
Drug dose of equivalent OLZ (mg/d)	10.05 (6.68)	9.06 (7.07)	-0.897 [a]	0.370

SBQE: Shen-based Qigong Exercise; OLZ: Olanzapine; [a]: Mann Whitney U-test.

points (2-sided 95% CI, -22.41 to -0.79; $P=0.04$), reflecting that the mean RBANS total score for SBQE group was 11.60 points higher, favoring SBQE, at the primary endpoint. Further analysis revealed a statistically significant difference (time-by-group interaction effect estimates, $F_{(1,38)}=5.07$; $P=0.03$), suggesting a significant difference in the slope change of RBANS total score between the two groups over time.

Sensitivity analysis

In the sensitivity analysis, this study included age, gender, education, family history, duration, and equivalent OLZ drug dose as covariates in the mixed-effects regression model for repeated measures. As indicated in Table 4, the statistical findings for the primary and secondary outcomes (i.e., the interaction effect of group×time) remained consistent, validating the robustness of the results.

Table 2 The score of SANS at Baseline (W0) and week 12 in SBQE and control groups ($N=40$)

	Mean (SE)		The interaction effect of group-by-time		Estimated mean differences between two groups (95% CI)	*P* value
Primary outcome	**SBQE ($n=20$)**	**Control ($n=20$)**	**$F_{(df1, df2)}$**	***P* value**		
SANS total score						
Baseline	41.8 (4.46)	47.0 (4.46)			5.25 (-7.45, 17.95)	0.41
Week 12	36.6 (4.46)	47.8 (4.46)	$2.35_{(1, 38)}$	0.13	11.10 (-1.60, 23.80)	0.09
affective flattening						
Baseline	11.10 (1.63)	13.80 (1.63)			2.75 (-1.88, 7.38)	0.24
Week 12	10.60 (1.63)	13.70 (1.63)	$0.05_{(1, 38)}$	0.83	3.15 (-1.48, 7.78)	0.19
alogia						
Baseline	6.75 (1.06)	7.90 (1.06)			1.15 (-1.82, 4.12)	0.44
Week 12	6.75 (1.06)	8.35 (1.06)	$0.07_{(1, 38)}$	0.79	1.60 (-1.37, 4.57)	0.29
avolition-apathy						
Baseline	7.85 (0.78)	8.30 (0.78)			0.45 (-1.76, 2.66)	0.69
Week 12	7.00 (0.78)	8.15 (0.78)	$0.84_{(1, 38)}$	0.36	1.15 (-1.06, 3.36)	0.30
anhedonia-asociality						
Baseline	12.6 (0.97)	12.7 (0.97)			0.15 (-2.60, 2.90)	0.91
Week 12	12.1 (0.97)	13.4 (0.97)	$1.42_{(1, 38)}$	0.24	1.35 (-1.40, 4.10)	0.33
attention						
Baseline	3.60 (0.67)	4.30 (0.67)			0.70 (-1.19, 2.59)	0.46
Week 12	3.15 (0.67)	4.10 (0.67)	$0.06_{(1, 38)}$	0.82	0.95 (-0.94, 2.84)	0.32

SBQE: Shen-based Qigong Exercise; SANS: the Scale for the Assessment of Negative Symptoms; Mean (SE): the average value estimated through LMM (standard error).

Table 3 The score of RBANS at Baseline(W0) and week 12 in SBQE and control groups ($N=40$)

	Mean (SE)		The interaction effect of group-by-time		Estimated mean differences between two groups (95% CI)	*P* value
Secondary outcomes	**SBQE ($n=20$)**	**Control ($n=20$)**	**$F_{(df1, df2)}$**	***P* value**		
RBANS total score						
Baseline	77.2 (3.81)	74.2 (3.81)			-3.10 (-13.91, 7.71)	0.57
Week 12	84.5 (3.81)	72.8 (3.81)	$5.07_{(1, 38)}$	0.03	-11.60 (-22.41, -0.79)	0.04
immediate memory						
Baseline	72.8 (5.26)	67.2 (5.26)			-5.60 (-20.53, 9.33)	0.45
Week 12	82.1 (5.26)	67.2 (5.26)	$2.38_{(1, 38)}$	0.13	-14.9 (-29.83, 0.03)	0.05
visuospatial/construction						
Baseline	80.8 (3.76)	85.3 (3.76)			4.50 (-6.12, 15.17)	0.40
Week 12	80.3 (3.76)	77.5 (3.76)	$1.82_{(1, 38)}$	0.19	-2.75 (-13.37, 7.87)	0.61
language						
Baseline	86.0 (3.15)	82.3 (3.15)			-3.65 (-12.56, 5.26)	0.42
Week 12	89.6 (3.15)	79.4 (3.15)	$2.54_{(1, 38)}$	0.12	-10.20 (-19.11, -1.29)	0.03
attention						
Baseline	93.5 (3.56)	87.3 (3.56)			-6.10 (-16.15, 3.95)	0.23
Week 12	94.0 (3.56)	87.7 (3.56)	$0.001_{(1, 38)}$	0.98	-6.25 (-16.30, 3.80)	0.22
delayed memory						
Baseline	78.8 (4.81)	74.5 (4.81)			-4.25 (-17.87, 9.37)	0.53
Week 12	96.7 (4.81)	80.8 (4.81)	$3.66_{(1, 38)}$	0.06	-15.95 (-29.57, -2.33)	0.02

SBQE: Shen-based Qigong Exercise; RBANS: the Repeatable Battery for the Assessment of Neuropsychological Status; Mean (SE): the average value estimated through LMM (standard error).

Discussion

This study was based on the theory of TCM for treating mental disorders, incorporating various traditional Qigong movements and focusing on intervening in the cognitive function of patients diagnosed with schizophrenia. This was a preliminary study to investigate SBQE on cognitive impairment and negative symptoms in schizophrenia patients. The results of this study indicated that SBQE could significantly improve cognitive impairment in stable schizophrenia patients in rehabilitation wards.

In this study, SBQE was categorized as one of the TCMs and also identified as an MBE that combines

Table 4 The score of SANS, RBANS at Baseline(W0) and week 12 in SBQE and control groups ($N=40$)

	Mean (SE)		The interaction effect of group-by-time		Estimated mean differences between two groups (95% CI)	*P* value
Outcomes	**SBQE ($n=20$)**	**Control ($n=20$)**	**$F_{(df1, df2)}$**	***P* value**		
SANS total score						
Baseline	45.6 (4.09)	47.4 (4.01)			1.88 (-9.85, 13.61)	0.75
Week 12	40.5 (4.09)	48.2 (4.01)	$2.35_{(1, 38)}$	0.13	7.73 (-4.00, 19.46)	0.19
RBANS total score						
Baseline	75.00 (3.58)	74.80 (3.50)			-0.23 (-10.45, 9.99)	0.96
Week 12	82.30 (3.58)	73.50 (3.50)	$5.07_{(1, 38)}$	0.03	-8.78 (-19.00, 1.44)	0.09

SBQE: Shen-based Qigong Exercise; SANS: the Scale for the Assessment of Negative Symptoms; RBANS: the Repeatable Battery for the Assessment of Neuropsychological Status; Mean (SE): the average value estimated through LMM (standard error).

aerobic exercise with meditation [12]. Tai Chi, Yoga, and Yijinjing are all popular forms of MBE. Previous research has shown that Tai Chi and Qigong can enhance cognitive function in elderly individuals and those with mild cognitive impairment [31, 32]. Similarly, the results of this study demonstrated that 12 weeks of SBQE led to improved cognitive function in patients with schizophrenia, with an average age of around 60 years old. SBQE can serve as a supplementary treatment to antipsychotic drugs or conventional rehabilitation therapy for chronic patients with schizophrenia.

Unlike previous studies that have focused on the improvement of cognitive function in schizophrenia through Tai Chi [16], Yijinjing [17], and Baduanjin [18], this study was the first to utilize the RBANS to assess the impact of TCM on cognitive function. The RBANS is a reliable assessment tool for assessing cognition in patients with schizophrenia [33]. However, it does not encompass working memory, executive functions, or motor speed domains that are significantly impacted in schizophrenia. In the future, more comprehensive cognitive function assessment tools are needed to clarify the effect of SBQE on cognitive function in schizophrenia.

Qigong's impact on improving the cognitive function of schizophrenia is not fully understood, but there are several potential explanations. Firstly, according to TCM theory, SBQE used in this study is based on the theory of 'five shen-zang', focusing on three aspects: ' heart-spirit ', ' spleen-thought ', and ' kidney-volition ', which could help improve attention disorder, memory disorder, and avolition [26]. This targeted intervention on cognitive function in schizophrenia patients may have better effects on improving cognitive function than other traditional Qigong methods. Secondly, as Qigong involves aerobic exercise, previous studies have shown that aerobic exercise can enhance cognitive function in schizophrenia patients, including working memory, social cognition, language learning, and attention [34, 35]. Aerobic exercise increased BDNF levels and hippocampal volume leading to improvements in synaptic plasticity and neurocognition [36–38]. Thirdly, Qigong is also a form of meditation exercise, which has proven more beneficial for improving psychiatric symptoms and working memory in schizophrenia compared to non-meditation exercise [39]. Meditation helps modulate brain network integration and increases DMN anticorrelations in schizophrenia patients, which improves cognitive functions such as attention and working memory [40]. Fourthly, SBQE is also an MBE, which could modulate the functional connections of dorsal (DAN) and ventral (VAN) attention networks at rest. The DAN and VAN are the two brain functional networks established to be responsible for attention and cognitive control [41]. Moreover, Short-term Qigong and long-term mind-body exercise may increase gray matter volume in various brain regions, including the frontal, temporal, and occipital lobes, limbic and parahippocampal areas, and cerebellum [41]. These brain regions are involved in various cognitive processes. In future research, we will combine electrophysiological and fMRI methods to explore how SBQE improves cognitive function.

In our study, SBQE reduced the SANS score, but the improvement did not reach statistical significance. Some studies suggested that MBE (Yoga, Tai Chi, Qigong) may have potential therapeutic effects on negative symptoms in patients with schizophrenia [15, 42, 43]. However, the available evidence remains limited and insufficient to recommend Qigong as a way to alleviate negative symptoms [42]. Meta-analytic evidence of high methodological quality and content validity of included trials is currently lacking for Qigong [43]. In this study, the SANS was used to assess negative symptoms. Still, it does not distinguish primary from secondary negative symptoms, which may hinder accurately reflecting the effect of SBPQ on negative symptoms. Another reason for negative results may be the small sample size, which increases the risk of type II errors and makes it difficult to detect subtle improvements in negative symptoms. Thus, our future research plans to expand the sample size and use the Clinical Assessment Interview for Negative Symptoms (CAINS) [26] to comprehensively evaluate negative symptoms, which can clarify the impact of SBQE on negative symptoms.

This study has some limitations. Firstly, the intervention method of this study was SBQE, without setting up a traditional Qigong group for comparison, such as Tai Chi and Baduanjin. This preliminary study aims to determine if SBQE is practical and feasible for schizophrenia, and future research will compare its therapeutic effect on cognitive function with traditional Qigong methods. Additionally, the study did not conduct follow-up after intervention, making it difficult to determine the long-term efficacy of SBQE in treating schizophrenia. Lastly, the small sample size may affect the reliability and universality of the research results. Therefore, further research with a rigorous design and large sample sizes is needed to validate the effects of SBQE on cognitive function and psychiatric symptoms in schizophrenia.

Conclusion

In conclusion, our results indicate that a 12-week SBQE intervention can contribute to cognitive improvement in stable schizophrenia patients in rehabilitation wards. This suggests that SBQE could be beneficial in clinical practice, particularly for chronic schizophrenia patients with mild to moderate cognitive impairment. SBQE could be integrated as a supplementary treatment alongside existing schizophrenia drug therapy or other psychosocial interventions. Nonetheless, our results should be substantiated by future studies with a larger sample size and longer intervention duration.

Author contributions

XDL and QF designed the study. JJZ and YL recruited the patients. LPZ, YZ, and ZHY performed the clinical rating and collected the clinical data. HS wrote the main manuscript text. YWW did statistical analysis. ABL was responsible for intervention. XDL and QF reviewed and revised the manuscript. All authors contributed to the article and approved the submitted version.

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Data availability

The data that support the findings of this study are available from the corresponding author Xiaodan Liu and Qing Fan upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Shanghai Mental Health Center's Internal Review Board (IRB). The participants signed the informed consent form after being provided with a thorough explanation of the procedures, the study's purpose, and assurances of confidentiality. This study was conducted in accordance with the Declaration of Helsinki and relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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