Original Article

Horticultural Therapy in Chronic Schizophrenia: A Pilot Study

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Background: Schizophrenia is a chronic mental illness with positive and negative symptoms. Medications have limited effect in obtaining remission for symptoms, especially in treating negative symptoms in patients with chronic schizophrenia. Horticultural therapy (HT) is a possible alternative treatment of schizophrenia. In addition, brain-derived neurotrophic factor (BDNF) is considered to be related to the psychopathology of schizophrenia. Therefore, we intended to study the treatment effect of horticultural therapy, and to understand the relationships between serum BDNF levels and clinical symptoms in chronic schizophrenic patients. **Methods:** During a one-year period, 20 chronic schizophrenic patients with stable medication use, were recruited in a three-month in-door HT. Patients received assessments with Positive and Negative Syndrome Scale (PANSS) and Rosenberg Self-esteem Scale (RSE), as well as had their peripheral serum BDNF levels checked before and after their three-month HT. **Results:** Fifteen participants had finished the program finally. Positive and Negative Syndrome Scale (PANSS) and 7 out of 10 Rosenberg Self-esteem Scale (RSE) were significantly improved after being enrolled in the HT program (from $p < 0.05$ to $p < 0.01$). Mean serum peripheral BDNF levels were also significantly increased from 6.6 ng/ml to 11.71 ng/ml before and after a three-month in-door HT ($p < 0.001$). **Conclusion:** In-door HT may be a cost-effective and adverse effect-free alternative therapy for chronic schizophrenic patients. In addition, serum BDNF might be involved in the psychopathology. But, it needs a large sample to prove those study results in the future.

Key words: chronic schizophrenia, horticultural therapy, negative symptoms of schizophrenia, brain-derived neurotrophic factor (BDNF)

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Introduction

Schizophrenia is a severe mental illness which presents itself with the positive and negative symptoms of schizophrnia. Associated symptoms of schizophrenia including social disability, depressive symptoms, and cognitive impairments, can also worsen the quality of life of schizophrenic patients [1]. What's more, the recent study

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showed that low self-esteem is related to the suicide risk of schizophrenic patient [2]. Antipsychotic medication is an effective treatment for patients with schizophrenia. But, most patients continue to experience symptoms under the medication control.

Horticultural therapy (HT) is defined as the process of using fruits, vegetables, flowers, and plants supervised by a trained therapist or health care provider [3]. HT has been recently shown to reach specific treatment goals or to improve a person's health [3]. HT has also been used as a therapeutic program for persons with disabilities [4, 5]. Evidence revealed that HT can improve physical and psychological well-being [6], and can be used in psychotherapy and rehabilitation for persons with various kinds of needs [5]. A systemic review of controlled and observational studies for nature-assisted therapy reported that improvements have been found to have different outcomes in diverse diagnoses and reduce obesity in schizophrenic patients [7]. Another systemic review reported that although there is insufficient evidence in the studies of HT due to poor methodological and reporting quality and heterogeneity, HT may be an effective treatment for mental and behavioral disorders such as dementia, schizophrenia, depression, and terminal care for cancer [3].

Brain-derived neurotrophic factor (BDNF) is crucial for dopaminergic [8], glutamatergic [9], and serotonergic [10] neurotransmissions. Alterations in BDNF biosynthesis may be considered a "biochemical footprint" of cognitive dysfunctions in neurodegenerative diseases as Alzheimer's disease and schizophrenia [11]. The peripheral BDNF level is lower in schizophrenic patients compared to that in general population, and is increased following an antipsychotic treatment [12].

In this study, we intended (A) to evaluate the treatment effect of HT in chronic schizophrenic patients, (B) to examine the mean peripheral serum BDNF levels before and after the HT in those patients, and (C) to find the correlation of the HT and variations of peripheral serum BDNF levels in them.

Methods

Study participants

From March 2011 to February 2012, 20 patients with schizophrenia according to *DSM-IV* criteria were recruited initially in this study [12]. All the study patients were on the chronic psychiatric ward at a medical center in the southern Taiwan. Institutional review board at Chang Gung Memorial Hospital approved the study protocol with the need of obtaining written consents from the study participants.

All voluntary participants were measured using Mini-Mental State Examination (MMSE) and Positive and Negative Syndrome Scale (PANSS), for cognitive and psychotic symptoms severity screenings. Twenty participants had MMSE scored above 18 points, and PANSS below 80 points in this study [14, 15]. The all assessments were done by one experienced psychiatrist who had received the related training.

Study intervention

Participants joined the 60-minute once-daily simple indoor HT activities for three months. Under the HT training, the head nurse of the chronic ward led the HT program. The tasks of HT included (A) seeding, planting, and harvesting the sprouts; (B) recording the growth state by painting or writing everyday on the paper; (C) joining the 50-minute group therapy once weekly, to share the planting experience, the crop, and the emotional feelings; and (D) sharing the crop with family by visiting and cooking once a month.

Measurements

Positive and Negative Syndrome Scale (PANSS) and Rosenberg Self-esteem Scale (RSE)

The study subjects received pre-test before HT activities and post-test at the end of the third month. We used Positive and Negative Syndrome Scale (PANSS) to assess positive and negative symptoms and general psychopathology of psychosis. and Rosenberg Self-esteem Scale (RSE) was also used to measure the alternation of self-esteem. All the measurements of both PANSS and RSE were performed by an experienced psychiatrist who had received study-related training.

Brain-derived neurotrophic factor (BDNF) levels

Peripheral BDNF levels in serum were checked before HT activities, and at the end of the third month after starting HT. Serum BDNF protein levels were measured using a commercially available ELISA kit of the sandwich type of BDNF Emax immunoassay system (Promega Corporation, Madison, Wisconsin, USA). The same technician assayed all samples. The intra-assay and inter-assay variations were both less than 10%.

Statistical analysis

All study results were expressed as mean ± standard deviation (SD). Within-subject changes from baseline to endpoint for each treatment group were evaluated using the paired *t* test, between pre- and post- tests of PANSS scores, Rosenberg Self-Esteem Scale scores, and serum BDNF protein levels.

An alpha value of $p < 0.05$ was used for statistical significance. We used Statistical Package for Social Science software version 12 for Windows (SPSS Inc., Chicago, Illinois, USA) to computer all study data.

Results

Fifteen participants, including 9 women and 6 men, finished the HT study after three months. Table 1 shows characteristics of all study patients. Table 2 lists scores of PANSS, RSE and BDNF of those 15 patients before and after a three month HT.

Discussion

The most important finding is that we found that the whole PANSS scales were significantly decreased in positive ($p < 0.05$), negative ($p < 0.01$), general psychopathology ($p < 0.05$), and total ($p < 0.001$) scales after a three-month in-door horticultural therapy (Table 2). The negative symptoms have played as an important rôle linked to the functional impairment experienced by affected people, and the effective treatment for negative symptoms in schizophrenia remains limited [16]. Therefore, we suggest that in-door HT may be the cost-effective and the choice of adverse effect-free therapy. Based on our study findings, we also suggest that HT has the rôle of treatment to those patients with schizophrenia. Some psychiatric health care institutes have limited space in the facilities, and simple, in-door HT maybe the cost-effective therapy for the chronic schizophrenic patients.

Self-esteem was has been founded to mediate improved quality of life and decreased suicide ideation [17]. To take care of the self-esteem of schizophrenic patients during the treatment course is important. In our study (Table 2), 7 out of 10 items of Rosenberg Self-Esteem Scales were significantly improved after a three-month HT pro-

Table 1. Characteristics of patients (N = 15)

Variable	Total
Patient's sex	
Male	6
Female	9
Patient's age (years)	
21-30	3
31-40	5
41-50	4
51-60	3
Marital status	
Married	2
Unmarried	13
Educational level	
Elementary school	1
Junior high school	4
Senior high school	6
Occupational school	2
University	2

Table 2. Scores of PANSS, RSE and peripheral BDNF level at baseline, and at three months in patients who retained in the horticultural therapy program (N = 15)

Results	Baseline	3 months later	Statistic (t)
PANSS			
Positive scales*	17.45	14.86	2.659*
Negative scales**	21.66	17.13	3.031**
General psychopathology*	40.60	34.00	2.182*
Total scales***	79.40	67.80	4.790***
Rosenberg Self-esteem Scale			
1. On the whole, I am satisfied with myself.	2.45	2.0	3.943**
2. At times I think I am no good at all.	2.40	2.90	-3.249**
3. I feel that I have a number of good qualities.	2.60	2.20	3.559**
4. I am able to do things as well as most other people.	2.55	2.00	4.067**
5. I feel I do not have much to be proud of.	2.20	2.75	-3.240**
6. I certainly feel useless at times.	2.40	3.05	-4.951**
7. I feel that I'm a person of worth, at least on an equal plane with others.	2.20	1.90	2.349*
9. All in all, I am inclined to feel that I am a failure.	2.50	2.90	-2.990**
BDNF (ng/ml) levels	6.6	11.7	-4.254**

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

PANSS, Positive and Negative Syndrome Scale; RSE, Rosenberg Self-esteem Scale; BDNF, brain-derived neurotrophic factor

gram ($p < 0.001$ to $p < 0.05$). Therefore, we suggest that the process of farming, accomplishment of sharing , and the real gain of HT may have some benefits in self-esteem.

In our study (Table 2), we also found that patients' peripheral BDNF level was significantly increased ($p < 0.001$) after a three-month in-door HT. This BDNF finding was associated with significant improvements of PANSS score and Rosenberg Self-esteem scale (Table 2). In a meta-analysis, the mean peripheral BDNF has been demonstrated to be correlated with patients' reasoning and problem-solving tasks [18]. Lower BDNF level is also suggested to be related to cognitive impairment [19] and depressive symptoms in patients with schizophrenia [20]. The underlying relations of the peripheral BDNF, the psychotic symptoms, and self-esteem by HT have not been reported previously. Our study results (Table 2) may also implicate the possible association between the biomarker and the clinical symptoms.

Study limitations

The readers are cautioned not to over-interpret the study results because this study has three limitations:

- This study should be treated only as a pilot study, because the sample size was relatively small.
- We did not have any control group for the comparison.
- All the study individuals were under the antipsychotic medication use. Therefore, the effect of existing medication use cannot be ruled out. But, we did not have any main regimen changes, such as titration or tapering off the dosage, switching to different kind of antipsychotic during the program.

Due to the above-listed three limitations, we suggest that a larger sample size is needed to confirm the treatment effect of HT on changes of PANSS, self-esteem, and peripheral BDNF levels in the future. But those same limitations may occur in other studies of adjunctive therapies such as music therapy, art therapy [21, 22], and any other kinds of occupational therapies [23].

Summary

This is the first study showing that the effect of HT can improve patients' psychotic symptoms, self-esteem, and of peripheral BDNF level after the HT. In-door HT might provide a possible cost-effective and a choice of adverse effect-free therapy for chronic patients. Increased peripheral serum BDNF levels after the HT showed the possible biomedical evidence of the intervention effect. Based on the results of this study, we suggest that HT maybe the effective adjuvant therapy for chronic schizophrenia, and that further studies should be done to clarify the association of the symptom severity and peripheral serum BDNF levels.

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