

The Therapeutic Effect of Edible Horticultural Therapy on Extrapyraxidal Symptoms in Patients with Schizophrenia

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Abstract. Extrapyraxidal symptoms (EPSs) are common adverse reactions to antipsychotics in patients with schizophrenia. The purpose of this study was to investigate the effects of edible horticultural therapy (EHT) on EPSs in schizophrenic patients. This study assessed the changes in psychopathological symptoms and extrapyramidal symptoms in patients with schizophrenia before and after participating in a six-session EHT. Forty schizophrenic patients, recruited from Wuhan Wudong Hospital, were randomly assigned to the EHT group (average age: 45.40 ± 13.960 years) or the control group (average age: 49.30 ± 12.516 years). The EHT program held weekly sessions from May 2020 to June 2020. A psychiatrist assessed the psychopathological symptoms and extrapyramidal symptoms of schizophrenic patients in both groups with the Chinese version of the Positive and Negative Syndromes Scale (PANSS) and the Rating Scale for Extrapyraxidal Side Effects (RSESE). After six courses of horticultural therapy, the terms of positive, negative, and general symptoms on the PANSS significantly improved in the EHT group. Moreover, the EPSs were also significantly improved in the EHT group. However, there was no change in the PANSS and RSESE scores in the control group. This study shows that EHT has the potential to improve not only psychopathological symptoms but also EPSs in psychiatric patients. This adds new evidence for EHT as an adjunct to treatment for schizophrenia.

Schizophrenia is one of the common psychiatric diseases in clinical practice, affecting $\approx 1\%$ population worldwide (Ammar et al., 2016). Despite great advances in treatment techniques, schizophrenia still presents an enormous burden to the patients and their relatives. It is a mental disorder under the action of genetic, environmental, and immune factors, and the pathogenic cause is not clear (Falkai et al., 2005). At present, drug therapy is still the main treatment for schizophrenia. Currently, widely used antipsychotics are generally

classified into first-generation antipsychotics (FGAs, formerly known as “typical” antipsychotics) and second-generation antipsychotics (SGAs, formerly known as “atypical” antipsychotics). EPSs are one of the common side effects of FGAs. In general, the drug side effects of SGAs are less than FGAs, especially the incidence of extrapyramidal symptoms is lower (Gerlach and Peacock, 1995) and the types are less (Inada et al., 2002), but the EPSs are still an important problem in terms of clinical (Dayalu and Chou, 2008).

The main clinical symptoms of EPSs include akathisia, parkinsonism, dystonia, and tardive dyskinesia. EPSs can occur in most patients (50% to 75%) receiving FGAs (Burguone et al., 2004). These symptoms can range from mild discomfort to permanent involuntary muscle movements, and they can occur after a single dose of antipsychotic medication (van Harten et al., 1999) or develop

gradually over several weeks of treatment (Braude et al., 1983; Gray and Gournay, 2000), with some late-onset symptoms occurring even months to years after antipsychotic medication (Courey, 2007). Clinical symptoms of EPSs vary and occur at different times, and interventions for EPSs in clinical therapy must be based on the specific category of EPS shown (Courey, 2007; Dayalu and Chou, 2008). The usual treatment is to lower the dose of antipsychotics in combination with the appropriate medication (Caroff and Campbell, 2016). But drugs used to treat EPSs can produce new side effects. For example, when anticholinergic or antiparkinsonian medications are used as prophylactic therapy for EPSs, the potential risks of overdose include dry mouth, blurred vision, constipation, tachycardia, urinary hesitancy, dizziness, confusion, and the potential to aggravate tardive dyskinesia (Burguone et al., 2004; Houlttram and Scanlan, 2004).

Several studies have explored reducing the side effects of antipsychotics, such as the combination of antipsychotics and herbal drugs to reduce the side effects of antipsychotics (Kane and Correll, 2010; Wang et al., 2015), and developing new dosage forms, such as injections, emulsions, and complexation processes, to improve antipsychotic delivery, ensuring drug effectiveness while reducing drug side effects (Annu and Ali, 2021). Complementary therapies to reduce EPSs have also been explored. Tani et al. (2005) reported that acupuncture treatment has a positive effect on tardive dystonia. Lichtenberg et al. (2009) suggested a possible role for shiatsu in treating extrapyramidal symptoms in patients with schizophrenia. A recent study showed improved EPSs in the experimental group participating in Internet video games compared with the control group (Han et al., 2008). To date, there are still few non-pharmacological treatments for EPSs in patients with schizophrenia. But complementary treatments have a positive effect on improving clinical outcomes and reducing iatrogenic injuries (Zessin and Nebraska, 2014).

Horticultural therapy is defined as complementary and alternative treatment provided by trained professionals who use horticulture-related tasks to help improve or recover the health of patients (Oh et al., 2018). Horticultural therapy is used in different health care and hospital settings in the world, such as nursing homes, rehabilitation centers, psychiatric hospitals, and prisons. It has been shown to have positive effects on mental disorders [e.g., schizophrenia (Ascencio, 2019)] and major depression (Kam and Siu, 2010), neurological diseases [e.g., Alzheimer’s disease (Uwajeh et al., 2019)], stroke (Son et al., 2004), and musculoskeletal diseases [e.g., chronic musculoskeletal pain (Verra et al., 2012)]. Horticultural therapy, as one of the complementary rehabilitation therapies used for schizophrenia (Kane, 1987), has been shown to reduce psychopathological symptoms (Oh et al., 2018), improve schizophrenia (Eum and Kim, 2016), reduce anxiety and depression (Kam and Siu, 2010), and improve social functioning (Sisman et al., 2020).

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Schizophrenia, as a mental illness, causes more obvious mental symptoms. In the case of individuals with schizophrenia, studies have been concentrated on the impact on psychosocial health (Vancampfort et al., 2012). In recent years, realizing the burden of somatic also has a deleterious impact on an individual's mental health and quality of life, researchers have been increasingly concerned about the individual physical fitness level of patients with schizophrenia and the side effects of antipsychotic medications (Vancampfort et al., 2010), such as sedentary lifestyle (Lee et al., 2018; Stubbs et al., 2016) and obesity caused by physical inactivity, poor diet, and the side effects of antipsychotics (Vancampfort et al., 2010). This paper attempts to investigate another side effect of antipsychotics by hypothesizing that edible horticulture therapy has a positive effect on extrapyramidal symptoms in patients with schizophrenia.

EHT, which uses edible plants, is one type of horticultural therapy (He et al., 2020). EHT is a process in which trained professionals use edible plants, like fruits, vegetables, herbs, and spices, as gardening materials and provide patients with standardized gardening tasks to achieve specific therapeutic goals. Research shows that individuals who garden, especially those who grow their own vegetables and fruit, have better mental and physical health (Demark-Wahnefried et al., 2018). In a previous study (He et al., 2020), patients with schizophrenia who preferred edible plants as materials to ordinary flowers and bonsai plants could derive a sense of accomplishment from caring for and harvesting edible plants. The purpose of this study was to investigate the therapeutic effect of EHT on extrapyramidal symptoms in patients with schizophrenia to further examine its potential application in psychiatric hospitals.

Materials and Methods

Participants. A total of 40 eligible women with schizophrenia participated in this study. All participants and their family members (guardians) volunteered to participate in the study and signed written informed consent before data collection. There were 20 patients in the control group and 20 patients in the EHT group, and all patients were assigned by random number table method.

The inclusion criteria included being female, with schizophrenia [meeting the diagnostic criteria of the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10)], duration of disease >1 year, duration of hospitalization >1 year, using antipsychotics, and RSESE score >2 points. The participants were able to communicate and express themselves verbally and had a degree of motor ability to ensure they were able to complete the experiment. Patients with a family history of Parkinson's disease, suicidal and/or self-destructive behavior, communication difficulties, pollen/plant allergies, and severe physical illness were excluded. The study was approved by the Ethics Committee of Wuhan Wudong Hospital.

The average age of patients in the experimental group was 45.40 ± 13.960 years old, and that in the control group was 49.30 ± 12.516 years old. There was no significant difference in the scores of PANSS and RSESE between groups before the experiment.

EHT program. A qualified horticultural therapist, psychotherapist, and psychiatrist developed a six-session EHT program (Table 1) that included a range of activities from young cucumber seedlings to fruit: planting, watering, maintenance, harvesting, and tasting. Considering the seasonal characteristics and session cycle (plants can mature before the sixth session), the early maturing type gherkin that conforms to the climate at the time of the experiment and has a short natural life cycle was selected. It belongs to the potted type gherkin, which is low in height and convenient for patients to work with.

The study was conducted in the healing garden of Wudong Hospital in Wuhan. Before each session, a warm-up activity and a course were organized. In the course, the horticulture therapist popularized basic edible horticultural knowledge and skills, and provided a demonstration of the horticultural activities involved in the course of that day, so that participants could intuitively understand the activities. Then, a list of tasks was provided, and all participants were divided into groups of 10, working in pairs to complete the tasks on the list. The participants were instructed in real-time as they completed these tasks, and then, participants shared and communicated with each other. Each session had its core function of training, for example, in session one, planting cucumber seedlings and naming them, writing a diary of plant observations and sharing it with others. The patient's elbow and wrist function was exercised by the implant, and their ability to communicate and express were enhanced by sharing experiences. The EHT program was run by a garden therapist and a volunteer. Each session was supervised by three psychiatrists.

Research design. A six-time EHT program was organized from 16 May 2020 to 20 June 2020. The experimental group participated in the program once a week (an average of 60 min), whereas the control group did not. Patients' medication regimens were not changed during the study period. All patients followed their regular prescriptions.

Patients in both groups were assessed using PANSS and RSESE before the EHT program. Their blood pressure and heart rate were measured before each session to determine whether subjects were physically relaxed. After completing all sessions, all participants were assessed again with PANSS and RSESE. The assessors are trained psychiatric professionals who are not familiar with the grouping of patients. PANSS and RSESE were administered by medical practitioners. In addition, the EHT group was evaluated with the Life Satisfaction Index A scale (LSIA) scale before and after the experiment to assist patients in providing feedback results.

Assessments and statistical analyses. The scales were used to assess the patient's clinical symptoms and extrapyramidal side effects. For the assessment of psychopathology of schizophrenia, the Chinese version of the PANSS (Kay et al., 1987) was used. PANSS is mainly used to assess the presence or absence of psychiatric symptoms and the severity of various symptoms. It takes into account both positive and negative symptoms of schizophrenia and general psychopathological symptoms and reflects the overall picture of psychopathology more comprehensively. PANSS consists of seven items of the positive scale, seven items of the negative scale, 16 items of the general psychopathology scale, a total of 30 items, and three supplementary items to assess the risk of aggression. It is mainly applicable to adults. In this study, patients were examined by a psychiatrist trained to use the scale. The whole evaluation time was ≈ 30 to 50 min. The positive scale is divided into the sum of seven scores of the positive scale. The negative scale is divided into the sum of seven scores of the negative scale. The score of the general psychopathology

Table 1. The six-session edible horticultural therapy program for schizophrenic patients with extrapyramidal symptoms.

Session	Title/Topic	Active content
1	A good start (feeling the life force of plants)	1) Planting cucumber seedlings in a seedling pot and naming them 2) Keeping a journal of plant observations and sharing them
2	Transplanting cucumber seedlings	1) Transplanting cucumber seedlings 2) Fertilizing and watering 3) Keeping a journal of plant observations
3	Building frames	1) Moving planting pots 2) Building frames for cucumber seedlings 3) Keeping a journal of plant observations
4	Drawing the vines of cucumber seedlings	1) Cleaning 2) Drawing the vines of cucumber seedlings 3) Keeping a journal of plant observations
5	Topdressing and vine maintenance	1) Counting bracts and gherkins 2) Learning vine maintenance and practicing
6	Harvesting and concluding	1) Picking the fruits 2) Cleaning and tasting cucumbers 3) Sharing the experience of the activity

scale is the sum of 16 scores of the general psychopathology scale. The total score is the sum of 30 points, and three supplementary items are generally not included in the total score (Zhang, 2005). Each item is rated on a scale of “1” (non-existent) to “7” (extreme), depending on the degree of symptoms. A higher PANSS score indicates severe psychopathological symptoms.

To evaluate EPSs, the RSESE (Zhang, 1998) was used. It is mainly used to evaluate EPSs caused by antipsychotics in outpatients or inpatients. RSESE has a total of 10 items, which are scored on a 5-point scale from 0 to 4. The assessor was a psychiatrist trained to use the scale and the assessment time was 15 to 20 min. The lighter the extrapyramidal side reaction, the lower the total score, and vice versa.

To assess the feedback of EHT group patients, the LSIA was used to evaluate the life satisfaction of EHT group patients. Life satisfaction represents people’s subjective experience and psychological satisfaction toward life state and is an important indicator of life quality (Shin and Johnson, 1978). The LSIA scale is self-rated. It consists of 20 items, 12 positive items and eight negative items, and reflects an individual subjective experience of the quality of life. On the positive scale, each item is scored as agree (2 points), disagree (0 points), and not easy to say (1 point). On the negative scale, each item is scored as agree (0 points), disagree (2 points), and not easy to say (1 point). The higher the total score, the higher the patient’s life satisfaction.

SPSS 24.0 (IBM Corp., Armonk, NY) was used for data analysis. Paired *t* test was used to analyze the differences in each group before and after the EHT program. The independent-sample *t* test was used to analyze the data between the two groups.

Results

Positive and Negative Symptom Scale.

There was no significant difference in PANSS between the two groups before EHT. Schizophrenic patients in the EHT group

Table 3. Effects of the edible horticultural therapy (EHT) program on the extrapyramidal symptoms of schizophrenic patients as evaluated using the Rating Scale for Extrapyramidal Side Effects (RSESE).

		EHT group (n = 20)	Control group (n = 20)	Significance
Variable		Mean (SD)	Mean (SD)	
RSESE	Pretest	21.60 (5.744)	21.55 (4.796)	0.976 ^{NS}
	Posttest	12.25 (4.518)	21.65 (4.716)	<0.001***
	D-value	-9.35	+0.1	
	Significance	<0.001***	0.567 ^{NS}	

The paired *t* test was used to compare pre- and posttest means in each group.

The independent-sample *t* test was used to analyze the data between the two groups.

NS, *, **, ***Nonsignificant or significant at $P \leq 0.05, 0.01, \text{ or } 0.001$, respectively.

showed significant improvement in terms of positive, negative, and general symptoms after receiving EHT (Table 2). But there was no significant change in positive score, negative score, or general symptoms score of PANSS in the control group.

Rating Scale for Extrapyramidal Side Effects.

The pre-values of RSESE did not differ between the two groups. In the group treated with EHT, the EPSs in schizophrenic patients were significantly improved (Table 3); however, there was no change in the control group.

Patient feedback. After attending a series of EHT sessions, most patients generally reported that they had mastered the knowledge of growing and harvesting cucumbers and looked forward to continuing the activities. Table 4 shows that the life satisfaction score of schizophrenic patients in the EHT group increased from 10.70 to 25.60 after receiving EHT. This also validates the positive feedback of patients.

Discussion

Our study showed significant improvement in positive, negative, and general symptoms of patients with EHT, which was consistent with previous studies (Eum and Kim, 2016, Rafiee Vardanjani et al., 2016). At the same time, we found that EPSs were

significantly improved in schizophrenic patients who participated in EHT. Although drug therapy has been used to stabilize EPSs, a combination of drug therapy and nondrug therapy may be more effective in treating EPSs. Because drug therapy EPS may bring more new side effects (Burgyone et al., 2004; Houltram and Scanlan, 2004), but EHT is green and harmless and it can relieve some of the patients’ symptoms.

Long-term use of antipsychotics and lack of physical activity will lead to weight gain and an increase in the incidence of cardiovascular diseases (Vancampfort et al., 2013). In a study, inactive schizophrenic patients had significantly higher levels of affective, positive and negative symptoms and drug-induced Parkinson’s disease than those who were minimally physically active. This study also indicated that EPS was a major obstacle to physical activity in schizophrenia (Lee et al., 2018). Studies have shown that adults engage in a variety of gardening activities involving moderate to high levels of physical activity (Oh et al., 2018). Patients engage in various physical activities to promote their health during their gardening activities (Park et al., 2014).

Four different EPSs all involve abnormal involuntary movements of the limbs. For example, dystonia is an involuntary muscular contraction of the head, neck, trunk, and extremities (Courey, 2007). Tardive dyskinesia refers to choreic or stereotypic movements of the mouth, limbs, torso, or upper face (Dayalu and Chou, 2008). When engaged in gardening activities, patients must complete a lot of grasping movements, also involving lifting, pushing, pulling, digging, and other hand movements. At the same time, they will also

Table 2. Effects of the edible horticultural therapy (EHT) program on the positive-negative symptoms of schizophrenic patients as evaluated using the Positive and Negative Syndromes Scale (PANSS).

		EHT group (n = 20)	Control group (n = 20)	Significance
Variable		Mean (SD)	Mean (SD)	
Positive	Pretest	20.95 (3.203)	19.20 (3.578)	0.111 ^{NS}
	Posttest	15.55 (3.734)	18.75 (3.323)	0.007***
	D-value	-5.4	-0.45	
	Significance	<0.001***	0.154 ^{NS}	
Negative	Pretest	21.35 (3.660)	19.05 (4.310)	0.077 ^{NS}
	Posttest	15.60 (4.728)	18.40 (3.705)	0.007***
	D-value	-5.75	-1.01	
	Significance	<0.001***	0.164 ^{NS}	
General	Pretest	43.75 (4.767)	42.15 (3.897)	0.252 ^{NS}
	Posttest	32.85 (6.588)	41.35 (4.614)	<0.001***
	D-value	-10.8	-0.8	
	Significance	<0.001***	0.339 ^{NS}	
Total	Pretest	86.05 (9.417)	80.40 (8.929)	0.059 ^{NS}
	Posttest	64.00 (14.275)	78.50 (8.605)	<0.001***
	D-value	-22.05	-1.9	
	Significance	<0.001***	0.127 ^{NS}	

The paired *t* test was used to compare pre- and posttest means in each group.

The independent-sample *t* test was used to analyze the data between the two groups.

NS, *, **, ***Nonsignificant or significant at $P \leq 0.05, 0.01, \text{ or } 0.001$, respectively.

Table 4. Effects of the edible horticultural therapy (EHT) program on life satisfaction of schizophrenic patients in the EHT group as evaluated using the Life Satisfaction Index A scale (LSIA).

		EHT group (n = 20)
Variable		Mean (SD)
LSIA	Pretest	20.70 (8.664)
	Posttest	25.60 (6.378)
	D-value	+4.9
	Significance	0.009**

The paired *t* test was used to compare pre- and posttest means.

NS, *, **, ***Nonsignificant or significant at $P \leq 0.05, 0.01, \text{ or } 0.001$, respectively.

be required to do some physical gardening work, such as climbing steps, slopes, walking or moving, bending, lifting, and carrying on various surfaces. All of these activities are effective in improving limb function (Lee et al., 2018). Studies have found that these practices can also prevent injuries to muscles and bones and might afford pain relief (Söderback et al., 2004).

Horticultural therapy may be a useful and cost-effective auxiliary treatment. Horticultural therapy cannot only improve patients' symptoms during hospitalization, but can also be retained as a recreational activity or as a new recreational interest and can be continued after discharge. In the communication session of the sixth session of the EHT program, seven patients mentioned that they would continue to engage in gardening after their recovery.

In contrast to horticultural therapy, which uses a variety of different plants, EHT mainly uses vegetables. Vegetables have a short life cycle. Patients can experience the whole life cycle of plants from sowing to harvesting during the EHT program; tasting the fruits of their labor and skills for cultivating may lead to improved confidence and achievement of goals, so that patients can improve their self-efficacy (Zhu et al., 2016). In addition, during the EHT program, patients can learn about vegetables and improve their dietary structure (Libman, 2007). EHT may be an integrated approach to promote a healthful diet, physical activity, and psychosocial well-being. Further research is needed to examine how the various aspects of horticultural therapy work.

Considering the safety of the experiment and the particularity of the experiment period, the total number of participants in this study was small. In the following research, the sample size should be further increased. The EHT program implemented in six sessions can be considered a short-term program. Some studies have evaluated the impact of programs with more training and that lasted longer (Son et al., 2004). Future research may consider setting up more sessions to assess the potential of EHT as long-term adjunctive therapy for schizophrenia.

Conclusions

Our study shows that EHT can improve psychopathological symptoms in patients with psychopathology, which is consistent with previous findings. Furthermore, we found that EHT has the potential to improve EPSs, providing new evidence for the addition of healing gardens in psychiatric hospitals. More research is needed on the effect of EHT on the recovery of patients with schizophrenia so that we can examine its potential benefits for the recovery of patients.

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