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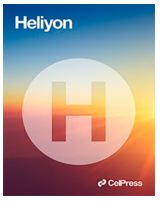

Research article

Influence of on emotions and behavior of adolescents with major depressive disorder

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ABSTRACT

Background: Major depressive disorder in adolescents is characterized by high prevalence rate, high recurrence rate, high suicide rate and high disability rate. However, the recognition rate and cure rate are low, and the disease has a very bad influence on the family and society. The lack of psychiatrists and psychotherapists in villages and small towns makes it difficult to get timely and professional intervention and treatment for adolescent with major depressive disorder.
Methods: A total of 84 adolescents with major depressive disorder who received treatment in the department of psychosomatic medicine of the Second Affiliated Hospital of Nanchang University participated in this survey, and they were divided into the control group and the intervention group by random number table. Adolescent Non-suicidal Self-injury Assessment Questionnaire (ANSSIAQ), Self-rating Questionnaire for Adolescent Problematic Mobile Phone Use (SQAPMPU), Screen for Child Anxiety Related Emotional Disorders (SCARED) and Depression Self-Rating Scale for Childhood (DSRS) were used to investigate the negative emotions and behavior of adolescents with major depressive disorder at baseline and intervention for 12 weeks.
Results: There were no significant differences in the baseline information of adolescents (sex ratio, age, education level), including the total score of SCARED, DSRS and SQAPMPU, the total mean score of ANSSIAQ between the two groups ($P > 0.05$). After 12-week intervention, the score of SCARED, DSRS and SQAPMPU, the total mean score of ANSSIAQ in both groups were lower than that of the baseline, and the score of the intervention group showed a more obvious downward trend ($P < 0.05$).
Conclusions: In-person and remote Satir family therapy not only effectively reduced the anxiety and depression level among participants, but also validly reduced their non-suicidal self-injury behavior and mobile phone use behavior. The results verified that the model we adopted can be well applied for the out-patient management of adolescents with major depressive disorder, especially in villages and small towns.

1. Introduction

In China, it is common for adolescents to experience depressive symptoms, with the prevalence ranging from 4% to 41% [1,2], they often generated behavioural changes such as mobile phone dependence and non-suicidal self-injury [], which affects their mental

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health and physical health and even endangers their lives [3]; Weavers B et al., 2021). Currently, the diagnosis and standardized treatment for depressive disorder presents a very low response rate, and most of them do not receive timely and standardized treatment, especially in villages and small towns. The treatment of adolescents with depressive disorder should adhere to the principle of equal emphasis on antidepressants and psychotherapy [4]. It shows that psychotherapy is also an indispensable treatment. And previous studies have shown that parenting style, parent-child relationship and parental incarceration were related to depressive disorder among adolescents [5,6]. Thus, it can be seen that family therapy can be used to treat adolescents with depressive disorder, it has been verified in previous studies [7,8].

Satir family theropy emphasizes humanism as the basis, it can let the patients' thoughts and behavior changed by multi-angle including individual and family and society [9,10]. At present, China has a shortage of psychiatrists and psychotherapists, especially in villages and small towns [11]. This makes it difficult for them to receive timely and professional intervention and treatment. Whereas psychotherapy is highly culturally applicable and regional [12], to date, there are no reports of Satir family theropy for Chinese adolescents with depressive disorder within villages and small towns. This study explored in-person and remote Satir family theropy applied to adolescents with these characteristics, the details are now reported as follows.

2. Methods

2.1. Study design

This is a prospective study. We confirm that all methods were carried out in accordance with the relevant guidelines and regulations of the Helsinki Declaration. Before the study began, adolescents and their parents signed an informed consent form to participate in the study and agreed to publish the study results. All participants were randomly divided into the control group and the intervention group on a 1:1 ratio by random number table, neither the participants nor the psychotherapists knew who were the intervention group or the control group. Each adolescent would be assigned a randomization number, which would not be reassigned if the adolescent withdrew from the study. Each group was composed of 42 adolescents. The control group received sertraline hydrochloride tablets 100 mg/d and the routine health education, while the intervention group received sertraline hydrochloride tablets 100 mg/d and in-person and remote Satir family therapy on the basis of the control group. All adolescents were given continuous intervention for 12 weeks. The primary outcome measures were SCARED and DSRS, a widely used tool for assessing anxiety and depression in adolescents. The secondary outcome measures were ANSSIAQ and SQAPMPU.

2.2. Participants

In our study, 84 Chinese teenagers with major depressive disorders were treated in our hospital's psychosomatic medicine department. Inclusion criteria of adolescents were as follows: ①meeting criteria for a current episode of major depressive disorder according to DSM-5 as assessed through the Mini International Neuropsychiatric Interview for DSM-5 (MINI 7.0.2); ② age ranged from 14 to 18 years old; ③ first diagnosed as "Major depressive disorder"; ④ adolescents all had non-suicidal self-injury behavior; ⑤ all came from villages and small towns which were less than 10 square kilometers in the total area, a backward country far away from Nanchang; ⑥ all were willing to accept medical treatment; ⑦ adolescents and their parents signed an informed consent form. Exclusion criteria of adolescents were as follows: ① all who had strong suicidal thoughts or suicidal behaviors that had to be hospitalized; ② adolescents received training on major depressive disorders in the past. Inclusion criteria for parents: parents can use online medical software well; exclusion criteria of the parents: ① parents have a history of mental disorders or have been diagnosed as mental disorders by a specialist clinician; ② Parents have a family history of severe mental illness; ③ the parents refused to sign the informed consent; ④ parents received training on the major depressive disorders in the past; ⑤ parents asked to quit voluntarily during the process.

2.3. Trial outcomes

Adolescents were assessed with self-questionnaires by a psychotherapist before the intervention and at the end of the 12th week.

2.3.1. Primary outcomes

① Depression of adolescents: DSRS [13] was used to assess adolescents' depression in a recent week. The scale includes 18 items, and each item is set with 3 options of "no, occasionally, frequently". When determining the score, the 1st, 2nd, 4th, 7th, 8th, 9th, 11th, 12th, 13th and 16th items are reversed scored, and each item is scored according to "0–2 points", and the total score $\geq$15 points is considered as depression. The higher the score, the more serious the depression.

2.3.2. Secondary outcomes

① Anxiety of adolescents: SCARED [13] was used to evaluate adolescents' anxiety in the last three months. The scale contains 41 items. Each item is set with 3 options of "no, occasionally, frequently", and scored with "0–2 points". The total score $\geq$23 points is considered as anxiety. The higher the total score, the more anxious the patient is. ② Non-suicidal self-injury behavior: ANSSIAQ [14] was used to investigate the status of non-suicidal self-injury in adolescents. The scale consists of 2 dimensions and 12 items. Each item is set with 5 options of "none, occasionally, sometimes, often, always", and scored with "0–4 points" according to Likert level 5 scoring standard: never, occasionally, periodically, frequently, always. The total score of the questionnaire is the cumulative score of each

item, the total mean score is equal to the total score of the questionnaire divided by the number of items. The higher the total mean score, the more serious the non-suicidal self-injury behavior is. ③ Mobile phone use in adolescents: SQAPMPU [13] was used to explore the status of mobile phone use in adolescents. The questionnaire consists of 3 dimensions and 13 items, the three dimensions were withdrawal symptoms, phone craving behavior and psychosomatic influence. Each item is set with 5 options of "never, occasionally, periodically, frequently, always", and scored with "0–4 points" according to Likert level 5 scoring standard. The total score is the sum of 13 items. The higher the total score, the greater the dependence on mobile phones.

2.4. Interventions

The control group took part in an interview that served to reinforce their understanding of the importance of their contribution to the research at the beginning of the Satir family therapy treatment, and received 100 mg/d of sertraline hydrochloride tablets combined with routine health education. After enrollment, Sertraline hydrochloride was titrated slowly to 100mg/d, starting with 25 mg and increasing in unit of 25 mg every 4 days, and the attending physician and psychotherapist conducted the routine health education for them, once a week, for 15 min each time. In addition, the patient also visited their primary care physician once a month at the outpatient clinic. During the return visit, routine health education was conducted in the outpatient clinic for 15–30 min each time, including: (1) recording the baseline information of the patient; (2) explaining the clinical symptoms, treatment principles, common drug side effects, drug response time, matters needing attention in outpatient diagnosis and treatment for adolescents and their parents. The intervention group received the in-person and remote Satir family therapy on the basis of the control group, each participating family was given individualized interventions based on a basic framework. First, the Satir Model group was established, including one state psychotherapist who had accepted hundreds of hours of professional training. All team members volunteered to participate in the project. The intervention plan was developed after discussion by all the above-mentioned personnel. The project leader trained team members in the related knowledge. The chief physicians were responsible for the overall supervision of the project implementation process. Psychotherapists formulated the specific operation content and mode of intervention based on the Satir model and put it into practice. The attending doctors were responsible for diagnosing the disease and following the medication regimen. The intervention duration was 12 weeks, and in-person and remote Satir family therapy for adolescents and their parents of the intervention group delivered in 12 sessions, 60–120 min each time, once a week for 12 weeks. Individual interviews at the beginning of the Satir family therapy treatment served to reinforce the rationale of the research, highlighted the importance of practice and addressed potential barriers to engagement.

The first intervention and the last intervention were completed through face-to-face family therapy in the psychological treatment room of our hospital. The intervention from the 2nd to the 11th week was completed by video intervention via the APP of the Internet medical platform. At the beginning of each intervention, the psychotherapist asked about homework completion. At the end of the intervention, adolescents and their parents were asked to summarize the intervention, identify the problems they found, and propose their next plan. At the same time, psychotherapists assigned homework for family problems. The study flowchart of this project is shown in Fig. 1, and the specific treatment content and objectives are shown in Table 1 (Ming T et al., 2020).

2.5. Statistical methods

2.5.1. Sample size

PASS11 was used to calculate the sample size of the study, and the mean of the SCARED scores in the control group was estimated to

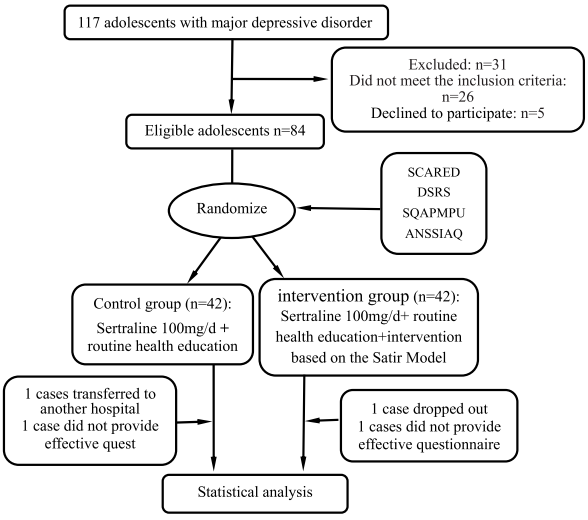

Fig. 1. The study flowchart of this project.

Table 1
Contents and objectives of the Satir Model therapy.

Objectives	Intervention method and contents
Intervention for adolescents	Assist young people in the intervention group to identify themselves and gain family support and positive energy.
Recognize self-resources and improve self-esteem	Assess the negative emotions of adolescents, find out the potential causes, and guide them to recognize their own resources and the destruction of resources caused by negative emotions, and help them to understand how to cherish their own resources, realize their own nature, and improve self-esteem.
Perceive the self-need and inner "iceberg"	Guide adolescents to a deeper understanding of what they think, feel and act from a horizontal and vertical perspective. For example, what do I hear and see? What interpretation do I make? How do I feel about this interpretation? How do I feel about my feelings? What defense mechanisms do I use? What rules do I apply for evaluation?
Six component analysis of family problems	Help adolescents analyze family conflicts that cause negative emotions and their own and their parents' journeys during family conflicts. Support adolescents remove residual shadows left by previous family conflicts, transform adolescents' interpretation of information about experienced events, and then guide adolescents to adopt positive defense mechanisms and rules to reduce family conflicts.
Change the survival stance, establish a new mode of family communication	Guide adolescents to clearly distinguish their external behavior from internal desire, realize their survival stance that they adopted in the past survival postures they have used in the past (such as consistent communication, hyper-rational communication, placater communication, blame communication, interrupting communication); Help them with major depressive disorder in a rational and effective way to transform inconsistent communication into consistent communication by using changing tools such as sculpture, metaphor, mandala, meditation, temperature reading.
Repairing Family relationships	Allow adolescents with major depressive disorder to choose their favorite items and use them as an intermediary to perceive each other's feelings instead of their parents, resolve family conflicts and repair family relations by effective communication to achieve the purpose of strengthening the psychological connection, and ultimately to obtain the positive energy of family support brought by the kinship connection.
Intervention for parents of adolescents	Help parents in the intervention group identify themselves, help their teenagers properly, and improve family relationships.
Discover self-need and inner "iceberg"	Guide the adolescents'parents to a deeper understanding of what they think, feel, and act from a horizontal and vertical perspective.
Change the living attitude, establish a new mode of family communication	Guide their parents to clearly distinguish their external behavior and internal desire, recognize to know their survival stance that they adopted in the past (such as consistent communication, hyper-rational communication, placater communication, blame communication, interrupting communication); Help adolescents with major depressive disorder in a reasonable and effective way to transform inconsistent communication into consistent communication by using changing tools such as sculpture, metaphor, mandala, meditation, temperature reading.
Parents help adolescents improve their motivation for change	Parents change their didactic and nagging family communication style, motivate their teenagers to change their behavior through scientific methods, improve parent-child relationships, and make their teenagers accept family education about negative emotions.
Family harmony skills	Parents are guided to understand their own and their adolescents' psychological needs and inner iceberg, analyze the relationship between family conflicts and major depressive disorders of adolescents, learn consistent communication techniques in order to prevent and resolve conflicts with their adolescents and strengthen the bonding with their adolescents.
Growth skills for family relationship	Parents are guided to understand the relationship between the quality of family relationships and major depressive disorders of adolescents, recognize the importance of love and attachment, tap into the sore spots of the parent-child relationship, and learn the dialogue style of emotional engagement and connection.

be 50 ± 10, and the SCARED scores could be reduced to 30 ± 10 in the intervention group after receiving the intervention. Setting $\alpha = 0.05$ (two-sided) and $\beta = 0.10$, the results showed that the number of people in both the control and intervention group should be no less than 23. Therefore, more than 23 participants were planned to be included in each group in this study.

2.5.2. Statistical analysis

In this study, SPSS 23.0 was used for statistical analysis. The measurement data conforming to normal distribution were represented by ($\overline{x} \pm s$), *t*-test was used for comparison between the two groups. The measurement data that did not conform to the normal distribution were described by median and rank sum test was used for comparison between groups. The count data were expressed as case numbers, and χ^2 tests were used for comparison between groups. $P < 0.05$ was considered as a statistically significant difference.

2.6. Ethics approval and consent to participate

The experimental protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Biomedical Research Ethics Committee of the Second Affiliated Hospital of Nanchang University: Research and Clinical Review [2020] No. (116). Written informed consent was obtained from adolescents and their parents.

3. Results

3.1. Comparison of the baseline data

A total of 84 adolescents participated in this study. 40 cases in each group completed the program separately. There was no significant difference in the baseline data between the two groups (gender ratio, age, education level) ($P > 0.05$). A description of the baseline demographics of the participants was included in Table 2.

3.2. Comparison of SCARED and DSRS scores

After 12-week intervention, the SCARED and DSRS score of the two groups was lower than that before intervention ($P < 0.05$), SCARED and DSRS score of the intervention group was lower than that of the control group ($P < 0.05$). The specific data are shown in Table 3.

3.3. The total mean score comparison of ANSSIAQ

After 12-week intervention, the total mean score of ANSSIAQ in the two groups was lower after 12-week intervention than that before intervention ($P < 0.05$). The total mean score of ANSSIAQ in the intervention group was lower than those of the control group ($P < 0.05$). The specific data are shown in Table 4.

3.4. All dimension scores and total score comparison of SQAPMPU

After 12-week intervention, the withdrawal symptoms, phone craving behavior, psychosomatic influence and total score of two groups were lower than that before intervention ($P < 0.05$), all dimension scores of SQAPMPU and total score of the intervention group were lower than that of the control group ($P < 0.05$). The specific data are shown in Table 5.

4. Discussion

In China, the Satir Model is in its infancy [15]. At present, the Satir model mainly focuses on healthy people and is in the form of group intervention. Lots of research on the therapeutic effect of the Satir Model reported the social psychology fields, including improving the university students' interpersonal relationships [16], promoting university students' academic performance [17], improving meaning in life of college students [18]. In recent years, scholars have applied the model to patients with physical diseases such as colorectal cancer [19]. So far, however, there are no reports that scholars have implemented the Satir model therapy on adolescents with major depressive disorder. Therefore, the author tried to use the Satir Model therapy to intervene in adolescents with major depressive disorders in villages and small towns in order to find a specific scheme of psychological intervention to meet the needs of those and fill the gap in this field of China.

Previous study have shown that cognitive-behavioural therapy based on the Internet over the phone for depressed postnatal women is a viable alternative to face-to-face treatment [20]. This shows that therapy based on the Internet over the phone is clinically effective and that patient compliance with treatment is good. Remote video therapy is superior to telephone psychotherapy in many ways. So far, no research has been carried out on the effectiveness of remote video therapy in adolescents with diagnosed depressive disorder, especially in villages and small towns. So the authors boldly hypothesized that in-person and remote Satir family theropy was also applicable to adolescents with depressive disorder, then verified that all observed indicators in both groups were lower after 12-week intervention than that of the baseline, the decrease was more pronounced in the intervention group. The findings were similar to previous studies [16]. The results of Geke Romijn et al., showed that blended cognitive-behavioural therapy appeared an alternative option for treating patients with anxiety disorders [21,22]. The conclusion of this study also confirmed the authors' hypothesis hypothesis that in-person and remote Satir family theropy was also applicable to adolescents with depressive disorder. The results may be related to the following factors: (1) In the process of in-person and remote Satir family therapy, psychotherapists weakened the concept of depressive disorders, they effectively reduced their stigma, paid attention to the people-oriented, guided adolescents and their parents to analyze their own internal processing of perception, change the way of thinking, realize that the problem itself is not a problem and how to deal with these problems is the problem. In daily life, patients can see things with a more peaceful mind, their

Table 2
Comparison of the baseline data between the two groups.

Characteristic	Control group	Intervention group	t/χ^2	P
Gender (male/female)	20/20	18/22	0.201	0.654
Age	15.85 ± 1.00	15.60 ± 0.98	1.127	0.263
Education level (illiteracy/junior high school/senior high school or technical secondary school/ university degree or above)	0/23/15/2	1/25/14/0	2.699	0.571

Table 3
Comparison of SCARED and DSRS score between the two groups ($\overline{x} \pm s$, scores).

Groups	Cases	SCARED scores				DSRS scores			
		Before the intervention	After the intervention	*t*	*P*	Before the intervention	After the intervention	*t*	*P*
Control group	40	53.30 ± 13.36	37.52 ± 8.27	14.898	0.000	25.02 ± 4.69	16.95 ± 2.26	11.847	0.000
Intervention group	40	53.22 ± 15.04	32.22 ± 7.44	14.386	0.000	24.28 ± 4.79	14.08 ± 1.85	15.115	0.000
T		0.024	3.012			0.708	6.226		
P		0.981	0.003			0.481	0.000		

Table 4
The total mean score comparison of ANSSIAQ between the two groups ($\overline{x} \pm s$, scores).

Groups	Cases	Before the intervention	After the intervention	*t*	*P*
Control group	40	1.26 ± 0.60	0.97 ± 0.35	6.019	0.000
Intervention group	40	1.27 ± 0.56	0.76 ± 0.24	7.819	0.000
T		0.113	3.119		
P		0.911	0.003		

attitude towards events has changed, and their behavior patterns have also changed. And then negative emotions decreased, and non-suicidal self-injury behavior and mobile phone use became less frequent. (2) Psychotherapist skillfully applied the change tools, such as sculpture, metaphor, mandala, meditation, temperature reading. The limited and dysfunctional coping patterns of adolescents and their parents have changed what they learned from childhood. Adolescents and their parents found the advantages and disadvantages of self-communication, and then changed their survival attitude and sought consistent communication. Finally, adolescents with major depressive disorders had less family and life conflicts, less negative emotions, more positive coping styles to face life events, and less non-suicidal self-injury behavior decreased and mobile phone use less frequently. (3) During in-person and remote Satir family therapy in the treatment of adolescents with major depressive disorders, psychotherapists used their free time to provide online intervention for adolescents, which changed the passive role of psychotherapists in the offline psychological intervention process. The psychotherapist changed his passive role and changed from passive to active. The treatment compliance was improved and their negative emotions were significantly improved. (4) In the 12-week intervention process, psychotherapists, adolescents and their parents found out problems and explored new meanings, broke defensive habits, explored new options and engaged in a process of "readjusting-evaluating-adjusting". The psychotherapist established an interactive relationship with the patients and constantly optimized the patients' perspective and behavior style. Over time, adolescents' attitudes towards the event changed, and adolescents' behavior also changed. Non-suicidal self-injury behavior and cell phone use decreased, anxiety and depression were improved.

5. Limitation

This study still has some limitations that require great attention in explaining the findings of this study, and based on these limitations, there are still some aspects of this study that can be enhanced. In the first place, the study is that the time involved in the control group was 15–30 min per week but 60–120 min in the intervention group. Therefore, the better results in the intervention group could have been due to the fact that the intervention group spent more time with participants than the intervention group and in-person and remote Satir family therapy. In future studies, we will consider the influence of time on the outcome of psychological intervention in order to understand the effect of psychological intervention more comprehensively. Secondly, considering that family members may need better participation in the whole process of Satir family therapy, the exclusion of family history of mental disorders limits the generalizability of the study. Additionally, adolescents with major depressive disorder in the current study were from the same university affiliated hospital, which may not be representative of adolescents with major depressive disorder in other areas of China. Therefore, we hope that adolescents with major depressive disorder from other regions and other institutions can be included in the study to improve the representativeness of the sample. A definitive study would need a much larger sample size and cover a wide geographic area.

6. Conclusion

In summary, in-person and remote Satir family therapy in adolescents with major depressive disorders, which is especially suitable for patients with major depressive disorders in villages and small towns, can effectively improve the adolescents' anxiety and depression, reduce the frequency of non-suicidal suicide behavior and mobile phone use. The cost of manpower and material resources for patients on the way is reduced by the intervention platform on the Internet. Adolescents with major depressive disorders can obtain the guidance and help of professional psychological therapists more conveniently, especially in villages and small towns. It is of great clinical significance. However, there are still some limitations to this study. For example, there is no long-term follow-up of patients in this study. The long-term efficacy of the treatment is not known. Therefore, it is necessary to continuously optimize in-person and

Table 5
All dimension scores and total score comparison of SQAPMPU between the two groups ({{¯{x}{}\vphantom{¯}}}±s, scores).

Groups	Cases	Withdrawal symptoms				Phone craving behavior				Psychosomatic influence				Total score			
		Before the intervention	After the intervention	*t*	*P*	Before the intervention	After the intervention	*t*	*P*	Before the intervention	After the intervention	*t*	*P*	Before the intervention	After the intervention	*t*	*P*
Control group	40	17.32 ± 6.33	13.58 ± 4.03	8.956	0.000	7.10 ± 2.41	5.90 ± 1.65	7.856	0.000	11.90 ± 3.76	8.85 ± 2.33	7.457	0.000	35.32 ± 11.25	28.32 ± 6.85	9.257	0.000
Intervention group	40	17.85 ± 6.05	11.50 ± 2.39	8.974	0.000	7.20 ± 2.79	4.75 ± 1.03	6.777	0.000	11.50 ± 3.70	6.62 ± 1.39	9.155	0.000	36.55 ± 11.24	22.88 ± 3.60	10.210	0.000
T		0.379	2.802			0.172	3.745			0.719	5.192			0.487	4.455		
P		0.706	0.007			0.864	0.000			0.474	0.000			0.627	0.000		

remote specific intervention based on the Satir Model for patients with adolescents with major depressive disorder, necessitating further research, and observe its long-term efficacy in order to better provide high-quality medical services for patients with major depressive disorder. Ultimately, we will be able to find better treatment options and better care for patients with major depressive disorders.

Author contribution statement

Heli Lu: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Zewen Huang: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Lejun Zhang: Conceived and designed the experiments; Wrote the paper.

Xiaoqin Huang: Conceived and designed the experiments; Performed the experiments.

Xinyi Li: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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