The effect of nursing intervention on self-care self-efficacy and genes related to anxiety in patients with bone marrow transplantation

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ABSTRACT

Leukemia patients, after bone marrow transplantation, face many problems that hurt their self-efficacy in self-care. The present study aimed to determine the effect of health promotion strategies on the self-efficacy of patients undergoing bone marrow transplantation in self-care. The expression level of two genes affecting anxiety (i.e., 5-hydroxytryptamine receptor 1A (5-HT1A) and Corticotropin Releasing Hormone Receptor 1 (CRHR1)) was also investigated. For this purpose, this semi-experimental study was conducted before and after in bone marrow transplant candidate patients. Sixty patients were randomly divided into test and control groups. The test group received training on health promotion strategies, and the control group was treated according to the department's routine. Then the self-efficacy of the two groups was compared before and thirty days after the intervention. Also, the expression level of two genes was done by real-time PCR. Data analysis was done using descriptive statistics and paired t-tests, independent t-tests, analysis of covariance, and chi-square in SPSS 11.5 software. The results showed that there was no significant difference between the demographic variables of the two groups. The self-efficacy of the test group in the general scale and dimensions of adaptability, decision-making, and stress reduction increased compared to the control group and themselves before the training (p>0.001). The difference in self-efficacy scores in all dimensions before the intervention was statistically significant (p<0.05). The genetic evaluations also confirmed the obtained results. According to the expression of 5-HT1A and CRHR1 genes, the level of these genes which directly relate to anxiety were significantly decreased after intervention in the test group. In general, teaching health promotion strategies to bone marrow transplant patients can increase the confidence of these patients in taking care of themselves in the treatment process, which will ultimately lead to more survival and a higher quality of life in these patients.

Introduction

Bone marrow transplantation has turned from a controversial research method into a standard treatment for treating blood malignancies, solid tumors, immunodeficiency diseases, and metabolic disorders (1). Although bone marrow transplantation increases the life span of children and adults, this treatment affects the quality of life by increasing physical, mental, and social stress for the patient and his family (2). Nearly fifteen thousand people worldwide are treated with bone marrow transplants yearly. The process of illness and treatment in cancer patients brings complications such as defects in sexual function, a decrease in life satisfaction, a decrease in adaptability and self-confidence, and an increase in emotional tension, anxiety, depression, and mental disorders, which cause a decrease in self-care behaviors and directly and indirectly, affect self-efficacy in these patients (1-3). The concept of self-efficacy was first introduced by Bandura, which is "the ability to perform a specific activity and the expectation of having the ability to perform a specific behavior successfully" (4).

Research has shown that self-efficacy can predict a person's performance and change due to learning, experience, and feedback. The amount of changes in self-efficacy is directly related to a person's behavior (5). At the same time, many factors, such as personal knowledge, physical condition, self-confidence, interpersonal environment, available time, the complexity of tasks, and stress, can affect self-efficacy and the resulting behavior (1). The results of the studies show that self-efficacy and self-care behaviors are the primary keys to transplant results and survival after that, and with more remarkable adaptation, reduction of physical and mental symptoms, an increase of self-care behaviors, increasing the enjoyment of life and improving the quality of life are associated (6). Interventions to increase the sense of self-efficacy can positively increase self-efficacy in cancer patients so that people with high self-efficacy have more stability and self-confidence than people with low self-efficacy. They will have low self-efficacy in dealing with difficult situations (5).

Also, studies show that there is a negative relationship between the presence of psychological symptoms in the patient and the enjoyment of life during treatment, so patients with depressed mood, lack of social support, and anxiety before bone marrow transplantation have a lower chance of survival than patients without these symptoms; While factors such as adaptation methods, the chances of survival after transplantation in this Patients increase (7, 8). The study's results by Syrjala et al. (9) showed a correlation between self-efficacy and pain after bone marrow

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transplantation. So the increase in self-efficacy can lead to improved behaviors that promote health and quality of life (10). Kurlowicz (11) has reported that increasing the perception of self-efficacy in elderly patients undergoing hip replacement surgery can increase the functional abilities of these patients and reduce post-operative depression, which is one of the factors affecting self-efficacy. The results of the research of Broers et al. (12) also showed that bone marrow transplantation hurts the self-efficacy and quality of life of patients. Also, another study on cancer patients has shown that their self-efficacy decreases over time and affects their quality of life. Therefore, it can be predicted that the process of bone marrow transplant treatment strongly affects the patients' self-efficacy, and the implementation of therapeutic and educational interventions, such as teaching health promotion strategies, may positively affect the treatment results (13). Lev (14), designed a tool to measure a person's confidence in self-efficacy in self-care and the use of health promotion strategies. During several studies, he used this tool to measure the self-efficacy of cancer and hemodialysis patients.

It has also been found that teaching health promotion strategies to patients increases patient and family satisfaction with the quality of care, improves the quality of life, increases self-efficacy, ensures continuity of care, reduces patient anxiety, reduces the incidence of disease complications, increases participation in care programs, increases the client's independence in performing daily activities, shortening the hospitalization time and reducing the costs (15). While some studies have shown that the use of health promotion strategies is one of the critical predictors of weight loss, adaptation to the disease and reduction of symptoms, improvement of treatment results, and survival after treatment, other studies have shown that despite education and use (16, 17). These strategies significantly improved the self-care behaviors of patients' physical activities, and adaptability skills were not observed. The application rate of these strategies was also different in both sexes (17). Despite the existing recommendations for teaching self-care strategies, few reports have been published in this field, especially in bone marrow transplant patients (18). Because there are still contradictions in the discussion of the effect of education on health promotion strategies and there is no similar study in this field on patients undergoing bone marrow transplantation, we decided to conduct a study to investigate the effect of promotion health strategies on the self-efficacy of self-care in patients undergoing bone marrow transplantation. Also, to ensure the obtained results and evaluate the effect of this method on the control of anxiety, the expression level of two genes related to anxiety, namely 5-hydroxytryptamine receptor 1A (5-HT1A) (19) and Corticotropin Releasing Hormone Receptor 1 (CRHR1) (20), was evaluated.

Materials and Methods

Data collection

The present study was an experimental study that was conducted on 60 bone marrow transplant candidates in two groups of 30 people, pre-test-post-test, in the bone marrow transplant center. The research population consisted of bone marrow transplant candidate patients who were referred to the bone marrow transplant center. The sample was selected consecutively and randomly assigned to two groups. The first sample was allocated to the test group by lottery. Then the rest were allocated to each of the two groups, considering the gender factor, until the number of patients in each group reached thirty.

The selection criteria of the samples included age over seventeen years, no hearing loss, and no visual, speech, or mental disorders. Also, if the patients were part of the health team personnel and also if they had received written training about transplants, they were excluded from the study

The research units were examined on two occasions before the transplant and thirty days after the transplant. The research tool included five questions about personal characteristics (age, gender, economic status, number of hospitalizations, and literacy level) and 29 questions about health promotion strategies. Strategies Used by People to Promote Health (SUPPH) is a standard tool designed by Lu to measure self-efficacy of self-care and has been used in research and clinical practice (14). This tool is self-reported, and the internal correlation of the tool is reported by calculating Cronbach's alpha (0.94). Also, the correlation coefficient of the scores obtained with the scores obtained from the health behavior scale was r=0.61 (Health Behavior Scale) (21). The questions of this questionnaire have five options on the Likert scale in the range of "I have complete confidence" (five points) to "I have very little confidence" (one point), and it includes four dimensions: adaptability, stress reduction, decision-making, and enjoyment of life. The questions of this questionnaire examine the level of confidence of the person in doing the things mentioned in the tool, and the total score is 145.

Data Analysis

After collecting information in the first round for each patient, the test group patients were trained in health promotion strategies for stress reduction, adaptability, and decision-making, enjoyment of life, activity, rest, nutrition, and medication use. This training program was implemented in one of the training classes of the transplant center for the patients of the test group individually and face-to-face with the cooperation of the research colleague, who was a member of the staff of the bone marrow transplant department and had received the necessary training for this work. Then the patient's questions were answered, and an educational booklet containing the explained material was given to them. Also, the phone number of the researcher was given to them so they could ask their questions when needed.

Patients in the control group benefited from routine care and education. Thirty days after the transplant, both groups were evaluated by the health promotion strategies questionnaire as before the transplant. Descriptive statistics and paired t-tests, independent t-tests, analysis of covariance, and chi-square were used to analyze the data, and the collected data were analyzed by SPSS 11.5 software.

Genetic evaluations

60 blood samples were taken from patients (both interfere and control groups). 100μl of whole blood was first placed in a 1.5 ml microtube to extract RNA from the blood. RNA extraction and cDNA synthesis were performed by RNX-Plus kit (Qiagen, South Korea) and a Vivantis cDNA synthesis kit (Malaysia). Specific primer pairs were designed to amplify the sequences of 5-hy-

Table 1. The Primer sequences of PAI-1 and GAPDH genes for the real-time PCR technique.

Gene	Primer Sequence (5'-3')	Product size	Annealing Temp.
GAPDH (Forward)	ATGGAGCAAAGGCTGGGGCT	121bp	60°C
GAPDH (Reverse)	ATCTTGAGGCTGTCATACTTCTC		
5-HT1A (Forward)	CTGTGACCTGTTTATCGCCCTG	200bp	62°C
5-HT1A (Reverse)	GTAGTCTATAGGGTCGGATTGC		
CRHR1 (Forward)	CGCTCTACTACCTCATCTCCTCC	101bp	63°C
CRHR1 (Reverse)	GTCCTGGGCGAAGTAGTTGG		

droxytryptamine receptor 1A (5-HT1A), Corticotropin Releasing Hormone Receptor 1 (CRHR1), and GAPDH (internal control) genes. The primers were designed using Gene Runner 5 and Primer Express 1.0.3 software. Table 1 shows the sequence of primers for the real-time PCR technique.

The final volume for each reaction was 20μl, including 100ng of Power SYBR® Green PCR Master, 1μl of cDNA, 10μl of Master Mix (Applied Biosystems, USA), 10mmol/μl of primers, and 6μl of nuclease-free water. Temperature protocol was performed as initial denaturation at 95°C for 3 minutes. Subsequently, 45 cycles were performed as denaturation at 95°C for 5 seconds and annealing at 60-63°C for 30 seconds. Reproduction analysis and melting curve were performed using Applied Biosystems 7500. Then gene expression diagram was drawn using Prism 5 GraphPad software.

Statistical analysis

The obtained information was expressed in Mean ± SD, frequency, and percentage. The statistical program used was SPSS. Quantitative variables were compared using a t-test or a Mann-Whitney U test. The comparison of qualitative variables was made by Contingency Tables using the Chi-square test or Fisher's exact test according to the conditions. Repeated Measures analysis compared quantitative parameter changes between the two groups. In all cases studied, the results were statistically significant if they had a $p \leq 0.05$. Also, genetic data analysis was performed based on threshold cycle comparison (Ct). The ΔCT was calculated by the Ct difference obtained from the tested samples. Then, it was calculated using the formula $2^{-\Delta\Delta CT}$.

Results

The average age of the research samples in the test group was 41.20 (SD=12.86) and in the control group, was 44.46 (SD=9.75) years, so in the test and control groups, 36.7% and 46%, respectively. 7% of the samples were in the age group of 31 to 45 years. Fifty percent of the samples in each group were male, and fifty percent were female. Sixty percent of the test group and 43.3% of the control group were married. Fifty percent of the test group and 43.3% of the control group had diplomas and university education, respectively. 23.3% of the test group and 30% of the control group were workers, 40% of the test group and 46.7% of the control group had Low economy, and forty percent of both groups were hospitalized two to three times for diagnosis and treatment of this disease.

The comparison of the average scores of total self-efficacy and its dimensions before the intervention in the two groups did not show any significant difference; However, the comparison of the average scores of total self-efficacy as well as the dimensions of adaptability, decision-making, and stress reduction showed a significant difference between the two groups after the intervention, while no significant difference was observed in the enjoyment of life dimension between the two groups (p=0. 247) (Table 2).

After the intervention, the scores of the test group increased in the three dimensions of adaptability, decision-making, stress reduction, and the total score of self-efficacy, which was significantly increased in the paired t-test. Still, no significant difference was observed in the dimension of enjoying life. In the control group, the paired t-test showed that there was no significant difference (p>0.05) in the four dimensions and the total score of self-efficacy (Table 2).

Table 3 shows the scores of the two groups after the intervention and indicates that the difference in the scores of the two groups was significant in all dimensions. Also, analysis of covariance was used to remove the effect of background variables such as gender, economic status, marital status, occupation, literacy level, and the number of hospitalizations, and it showed that the effect of education is significant by removing the effect of these variables (p=0.001).

The genetic evaluations also confirmed the obtained results. According to the expression of the 5-HT1A gene, the level of this gene which directly relates to anxiety was significantly decreased after intervention in the test group (p=0.01)(Figure 1).

Also, expression of the CRHR1 gene showed a signifi-

Table 2. Comparison of self-efficacy in two groups, before and after the intervention.

Scale	Test Group (Mean ± SD)			Test Group (Mean ± SD)		
	Before	After	P-value	Before	After	P-value
Compatibility	13.86 ± 3.63	16.36 ± 2.99	0.001	13.70 ± 2.85	13.73 ± 2.83	0.326
Decision making	10.06 ± 2.72	11.60 ± 2.06	0.001	9.86 ± 2.71	9.16 ± 1.62	0.085
Stress reduction	17.83 ± 5.36	22.23 ± 3.22	0.001	18.00 ± 4.56	18.20 ± 4.39	0.161
Life enjoyment	39.60 ± 9.51	40.96 ± 8.72	0.160	39.23 ± 7.29	38.60 ± 6.83	0.134
Total self-efficacy	81.36 ± 18.59	91.23 ± 14.62	0.002	80.80 ± 14.47	79.7 ± 12.85	0.105

Table 3. Mean and standard deviation of changes in self-efficacy scores in two groups after the intervention.

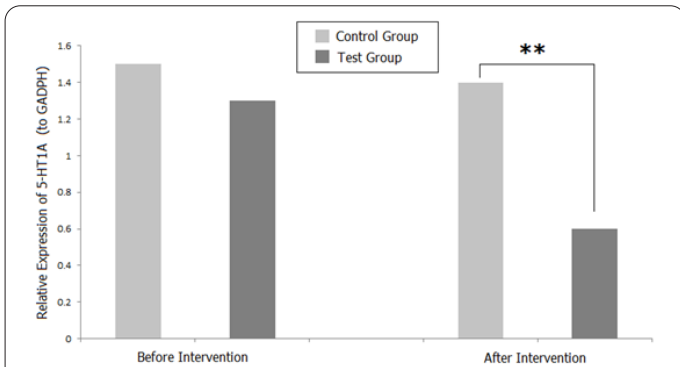| Scale	Test Group		Control Group		P value
	Mean	Standard Deviation	Mean	Standard Deviation	
Compatibility	-2.50	2.44	-0.9	1.60	0.004
Decision making	-1.53	1.94	0.23	1.71	0.001
Stress reduction	-4.53	3.02	-1.93	2.13	0.001
Life enjoyment	-6.26	6.13	-2.33	3.88	0.004
Total self-efficacy	14.83	10.32	-4.93	9.38	0.001

Figure 1. The relative expression of the 5-HT1A gene in both test and control groups before and after the intervention.
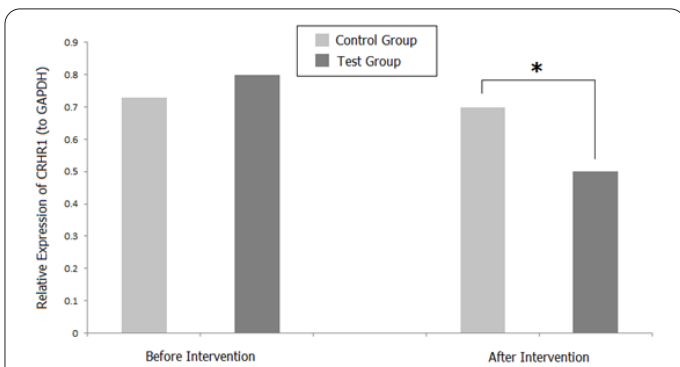

Figure 2. The relative expression of the CRHR1 gene in both test and control groups before and after the intervention.

cant reduction in the test group after intervention (Figure 2).

Discussion

The study results showed that teaching health promotion strategies improves self-care self-efficacy in patients undergoing bone marrow transplantation. The results of the studies show that the training increases self-efficacy, improves functional activity and reduces the number of visits to the hospital, increases the confidence of diabetic patients about the disease and blood sugar control, and reduces stress. The results of the present study are consistent with the study of Carson et al. (22). Kara et al. (23) also found that teaching self-care strategies can reduce the frequency of respiratory problems in patients with the chronic obstructive pulmonary disease by increasing self-efficacy. Also, other studies have shown that if rehabilitation programs for patients with chronic obstructive diseases are combined with education, it can effectively improve their long-term self-efficacy.

The findings of the study by Haas et al. (24) have also confirmed our results. Also, studies show that the use of adaptation strategies has reduced stress and its symptoms in patients, and patients who have undergone educational programs in the field of stress reduction have a better adaptation to their disease and a higher quality of life (25, 26). According to the results of the study, it can be stated that health promotion strategies can affect the self-efficacy of bone marrow transplant patients in terms of their confidence in their ability to perform self-care behaviors, and this shows the importance of educational interventions to increase self-efficacy in these patients and it can be predicted that by increasing the self-efficacy of patients in self-care, the results of treatment will improve. The costs of hospitalization and treatment for patients will decrease.

The training in health promotion strategies has increased the self-efficacy of self-care in bone marrow transplant patients. Still, this training has not been able to have a noticeable effect on the dimension of life enjoyment, which is one of the dimensions of self-care self-efficacy. The present research results in the dimension of enjoyment of life are consistent with the results of Low (27). It can be said that the patient's understanding of the quality of life and enjoyment of it can be influenced by many factors such as the economic status, cultural conditions of the people, and the progress or lack of progress of the disease (28) and according to the results of the present study which showed Most of the patients undergoing bone marrow transplantation have low economic status, and on the other hand, the process of bone marrow transplantation and the treatments performed to reduce the side effects of the transplant, such as the purchase of immune system suppressing drugs, which take a large amount of the family's income, can cause problems. It has increased the number of patients, which may hurt their quality of life and enjoyment. At the same time, because comparing the scores of the two groups in this area showed a statistically significant difference, further research is suggested to investigate the effect of strategies on this area (29).

In general, teaching health promotion strategies as a low-cost and simple method can positively affect the self-efficacy of self-care and physical and mental health and quality of life of people. It is suggested that the investigation of these patients in terms of self-efficacy of self-care using the tools used in this research should be part of the work program of nurses in bone marrow transplant departments. Also, since the quality of life of these patients was not investigated in this study, secondary research can be done in the field of investigating the quality of life and the factors affecting it. Considering the present study, due to various reasons such as time limitations, dissemination of information among the samples, and the small number of samples, the effect of the educational intervention of health promotion strategies were evaluated in the short term. Therefore, a secondary analysis is suggested. Regar-

ding the effect of the educational intervention of health promotion strategies on self-efficacy in the studied patients in the long term (about six months after the intervention), it should also be done to determine to what extent such interventions are sustainable.

References

1. Sertbaş G, Ok E, Unver V. Effects of creative arts intervention on anxiety, depression and sleep quality among bone marrow transplantation patients during protective isolation. Cancer Nurs 2023; 46(1): E1-E10.

2. Di Giuseppe G, Thacker N, Schechter T, Pole JD. Anxiety, depression, and mental health-related quality of life in survivors of pediatric allogeneic hematopoietic stem cell transplantation: a systematic review. Bone Marrow Transplant 2020; 55(7): 1240-1254.

3. Azeez SH, Jafar SN, Aziziaram Z, Fang L, Mawlood AH, Ercisli MF. Insulin-producing cells from bone marrow stem cells versus injectable insulin for the treatment of rats with type I diabetes. Cell Mol Biomed Rep 2021; 1(1): 42-51.

4. Ammentorp J, Sabroe S, Kofoed P-E, Mainz J. The effect of training in communication skills on medical doctors' and nurses' self-efficacy: A randomized controlled trial. Patient Educ Couns 2007; 66(3): 270-277.

5. Copeland AC, Tan X, Nash RP et al. Collaborative care for depression and anxiety in the bone marrow transplant population: A pilot feasibility study. Psycho Oncol 2021; 30(1): 118-122.

6. Mousavi S, Abazari F, Azizzadeh Foroozi M, Dehghan M, Karami Robati F. Comparison of the Effect of Face to Face Education and Video Training on the Anxiety of Patients Referring to Bone Marrow Transplantation in Afzalipour Hospital in Kerman: A Randomized Clinical Trial. J Rafsanjan Univ Med Sci Health 2020; 19(6): 579-590.

7. Dielman T, Moss G, Harlan W, Campanelli P, Butchart A. Global and component measures of type A behavior as predictors of self-reports of psychological symptoms and life enjoyment. 1990.

8. Kim S, Jang H-J, Myung W et al. Heritability estimates of individual psychological distress symptoms from genetic variation. J Affect Disord 2019; 252: 413-420.

9. Syrjala KL, Chapko ME. Evidence for a biopsychosocial model of cancer treatment-related pain. Pain 1995; 61(1): 69-79.

10. Pequeno NPF, Cabral NLdA, Marchioni DM, Lima SCVC, Lyra CdO. Quality of life assessment instruments for adults: a systematic review of population-based studies. Health Qual Life Outcomes 2020; 18(1): 1-13.

11. Kurlowicz LH. Perceived self-efficacy, functional ability, and depressive symptoms in older elective surgery patients. Nurs Res 1998; 47(4): 219-226.

12. Broers S, Kaptein AA, Le Cessie S, Fibbe W, Hengeveld MW. Psychological functioning and quality of life following bone marrow transplantation: a 3-year follow-up study. J Psychosom Res 2000; 48(1): 11-21.

13. Kurt S, Sarıkaya NA. Self Efficiency And Symptom Control of Cancer Patients. 2022.

14. Lev EL. Bandura's theory of self-efficacy: applications to oncology. Scol Inq Nurs Pract 1997.

15. Fernandez ME, Ruiter RA, Markham CM, Kok G. Intervention mapping: theory-and evidence-based health promotion program planning: perspective and examples. Front Public Health 2019; 7: 209.

16. Bosch-Capblanch X, Abba K, Prictor M, Garner P. Contracts between patients and healthcare practitioners for improving patients' adherence to treatment, prevention and health promotion activities. Cochrane Database Syst Rev 2007; (2).

17. Lowenstein A, Foord-May L, Romano J. *Teaching strategies for health education and health promotion: working with patients, families, and communities*: Jones & Bartlett Publishers; 2009.

18. Fini IA, Adib-Hajbaghery M, Khachian A. The effect of health-promotion strategies education on self-care self-efficacy in patients with bone marrow transplantation. Iran J Crit Care Nurs 2011; 4(3): 109-116.

19. Marcinkiewcz CA, Bierlein-De La Rosa G, Dorrier CE et al. Sex-dependent modulation of anxiety and fear by 5-HT1A receptors in the bed nucleus of the stria terminalis. ACS Chem Neurosci 2019; 10(7): 3154-3166.

20. Eghtesad M, Elahdadi Salmani M, Lashkarbolouki T, Goudarzi I. Lateral Hypothalamus Corticotropin-releasing Hormone Receptor-1 Inhibition and Modulating Stress-induced Anxiety Behavior. Basic Clin Neurosci 2022; 13(3): 373-384.

21. Lev EL, Paul D, Owen SV. Age, self-efficacy, and change in patients' adjustment to cancer. Cancer Pract 1999; 7(4): 170-176.

22. Carson JAS, Gillham MB, Kirk LM, Reddy ST, Battles JB. Enhancing self-efficacy and patient care with cardiovascular nutrition eduction. Am J Prev Med 2002; 23(4): 296-302.

23. Kara M, Türkinaz A. Effect of education on self-efficacy of Turkish patients with chronic obstructive pulmonary disease. Patient Educ Couns 2004; 55(1): 114-120.

24. Haas BK. Focus on health promotion: self-efficacy in oncology nursing research and practice. Paper presented at: Oncology Nursing Forum, 2000.

25. Seiler A, Jenewein J. Resilience in cancer patients. Front Psychiatry 2019; 10: 208.

26. Alharbi H, Alshehry A. Perceived stress and coping strategies among ICU nurses in government tertiary hospitals in Saudi Arabia: a cross-sectional study. Ann Saudi Med 2019; 39(1): 48-55.

27. Lev EL, Owen SV. A measure of self-care self-efficacy. Res Nurs Health 1996; 19(5): 421-429.

28. Davidson JR, Hughes D, Blazer DG, George LK. Post-traumatic stress disorder in the community: an epidemiological study. Psychol Med 1991; 21(3): 713-721.

29. Nwuke C, Ibeh B, Antidiarrheal potential of methanol extract of Combretum dolichopetalum and its fractions in wistar albino rats, SPR, 2021;1(1): 11-23.