

Effects of Progressive Muscle Relaxation Technique on Severity of Restless Legs Syndrome Among Patients on Maintenance Hemodialysis

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Abstract

Background: Restless legs syndrome (RLS), is one of several complications that patients on hemodialysis suffer from, it is a neurological sensory motor disorder, causing sleep disturbances, and other problems, which lead to daily functioning impairment. Progressive muscle relaxation is one of the complementary therapies that have been shown to provide benefits, including relieved restless legs syndrome, reducing patients' stress, pain and anxiety. **Aim of the study** was to evaluate the effects of progressive muscle relaxation on the severity of restless legs syndrome among patients on maintenance hemodialysis. **Research design:** A quasi experimental (time series) research design was utilized, included control comparison group. **Setting:** The research was carried out at the hemodialysis unit, Al - Moassat Alexandria University Hospital. **Subjects:** A purposive sample of 60 adult patients, diagnosed with end stage renal failure on maintenance hemodialysis, and suffering from restless legs syndrome were selected. They were equally divided into two groups of 30 patients. **Tools of data collection:** Three tools were used for data collection; Hemodialysis patients Structured Interview Schedule (tool I), International Restless Legs Syndrome Severity Rating Scale (tool II), and Restless Leg Syndrome Assessment Sheet (tool III). **Results:** The severity of restless legs syndrome significantly decreased in the study group, with a percent reduction of 38.89% at the 6th session and 61.11% at the 12th session, such decrease was not found among the control group patients. In addition to, there was a percent reduction and improvement of sleep pattern, physical activities, emotional well-being and social activities among the study group patients after completion of 12th PMR session (46.67 %, 57.78 %, 63.33 %, 55.56 % respectively). **Conclusion:** Progressive muscle relaxation technique had high statistical significant positive effects on severity of restless legs syndrome, improving sleep pattern, physical activity, emotional well-being and social activities. **Recommendations:** Progressive muscle relaxation must be implemented in the therapeutic routine management to help alleviate the severity of restless legs syndrome symptoms among patients on maintenance hemodialysis.

Keywords: Progressive Muscle Relaxation, Restless Legs Syndrome, Maintenance Hemodialysis.

Introduction:

Hemodialysis (HD) is the most prevalent renal replacement therapy for end-stage renal disease (ESRD). Although enhanced dialysis techniques have resulted in longer survival in patients with ESRD in recent years, these patients suffer from several complications and a heavy burden of symptoms that result from either ESRD or HD treatment, such as restless legs syndrome (RLS), depression, insomnia, and fatigue (Song et al., 2018).

Restless legs syndrome (RLS) is a sensory motor disturbance with features of both neurologic and sleep disorders. The patients complain of strong, irresistible urge to move the legs, often accompanied by uncomfortable

sensations deeply in the legs. The urge typically begins or worsens during periods of inactivity (e.g., lying down or sitting) and are relieved by movement. The pattern of movement is involuntary dorsiflexion of foot and lower leg, that lasts 2 to 5 seconds. Symptoms occur in the evening or at night and can progressively worsen across the night but tend to resolve spontaneously by early hours of the morning (Trenkwalder et al., 2016). The prevalence of RLS in patients on hemodialysis is reported to be between 20% and 80%. (Amrollahi et al., 2022).

The pathophysiology of RLS is still unclear, and may be uremia as well as iron deficiency in its genesis. It is considered as a peripheral disease, but studies of dopamine

metabolism in the brain increase the possibility for central nervous system origin, more specifically because of the organic deficit of hypothalamic dopaminergic cells, that are the source of dopamine throughout the spinal cord (**Antelmi et al., 2022**). The RLS is identified in two forms of primary and secondary. Primary RLS occurs in patients with positive family history who are usually older than 45 years. While, secondary RLS can be happened in patients with uremia, pregnancy, iron deficiency state, rheumatoid arthritis, diabetes mellitus (DM) type 2 and some neuropathies. Nevertheless, factors that affect the severity of RLS include hypertension, female sex, increased body weight, length of hemodialysis, age, and DM (**Wijemanne & Ondo, 2017**).

This syndrome, which develops over time among patients on HD, has negative effects as, avoiding social activities, and patients often experience psychiatric problems such as depression, anxiety disorders, and chronic sleep disorders. Therefore, RLS significantly affects daily life and coping (**Didato et al., 2020**).

The treatment of this syndrome includes both pharmaceutical and non-pharmaceutical therapies. The guidelines suggest dopaminergic therapy (levodopa or dopamine receptor agonists: pramipexol, ropinirole, pergolide or cabergoline) as the first-line pharmacological treatment for RLS in the general population; limited evidence is available on the effects of these drugs in patients with renal failure and repeated adverse effects of levodopa have been seen mainly with continuous use, that restrict its usage significantly. Therefore, an alternative intervention using non-pharmacological approach is urgently required. Relaxation technique is a promising and highly efficacious approach for symptom management (**Azimpour et al., 2019; Salib et al., 2020**).

Progressive muscle relaxation (PMR) is one way to improve physical work capacity and reduce functional limitations, by tightening and relaxing some part of muscles through stimulation of the sympathetic and parasympathetic nervous system. The purpose of this technique is to make the person feel relaxed through active contraction and then relaxing certain muscle groups in a progressive state, and complete relaxation will be felt through 4 to 5 sessions of muscle relaxation. The PMR, therefore has a positive impact for

patients on HD, and is a form of nursing intervention; it is basics for many unpleasant emotional feelings as well as physical and mental illnesses (**Kumala et al., 2021**).

The technique of PMR provides a balance between the posterior and the anterior hypothalamic activities; thus, preventing the undesirable side effects of stress and anxiety, and improving sleep pattern and quality of life. Other desirable effects of PMR include, reducing the level of epinephrine and norepinephrine in the blood and heart rate, reducing oxygen consumption, regulating metabolic rate, lowering blood pressure, reducing muscle tension, preventing fatigue and restlessness, decreasing pain by increasing endorphin levels, and increasing coping with pain and stress (**Luberto et al., 2020**).

PMR technique represents an art of nurses, which should provide more and better therapeutic care for their patients, alongside nursing knowledge, and most importantly, this technique is an easy method to be practiced in most places, also it creates a deep relationship between the nurse and the patient (**Dias et al., 2019; Yazdani et al., 2017**). So, this puts a burden on nephrology nurses to acquaint the patients on hemodialysis with RLS; the importance and how to practice.

Significance of the study:

The RLS is quite common among patients who are on maintenance HD. Its prevalence has been reported to range from 6% to 80% in various studies (**Gheshlagh et al., 2017**). The RLS has many negative effects on sleep pattern, physical, emotional wellbeing and social activity among these patients. PMR is based on sound research findings with greater efficacy. The PMR is a simple, suitable, and inexpensive method to reduce severity of RLS and improves sleep pattern, physical, emotional and social status. Therefore, this study will build upon the science of complementary therapy, which may be useful to nursing and other health care professionals to decrease distress of RLS, as well as optimizing quality of care for hemodialysis patients. In addition, it is hoped that the findings of the current study will increase nurses' knowledge related to nonpharmacological management of RLS for patients on HD, which may be reflected positively on patient care (**Gade et al., 2013**).

Aim of the Study:

The present study aimed to evaluate the effects of progressive muscle relaxation technique on the severity of restless legs syndrome among patients on maintenance hemodialysis.

Hypotheses of study:

1. Patients on maintenance hemodialysis who receive progressive muscle relaxation technique, will exhibit lower severity of restless legs syndrome than those who don't receive it.
2. Patients on maintenance hemodialysis who receive progressive muscle relaxation technique, will exhibit improvement in sleep pattern, physical activity, emotional well-being and social activities than those who don't receive it.

Materials and Method:

Materials

Research design:

A quasi experimental (time series) research design was utilized, this design included control comparison group.

Setting:

The study was conducted at the Hemodialysis Unit at Al - Moassat Alexandria University Hospital. The unit consisted of two floors; each floor included six rooms with 45 beds. The university hospital is one of the largest medical sectors in Alexandria, and provide services to other governorates as, Beheira, and Marsa Matrouh.

Subjects:

The study subjects comprised a purposive sample of 60 adult patients on maintenance hemodialysis. The 60 patients were equally divided into 2 groups; control and study groups; 30 patients each.

- The control group (I); received the usual routine hospital care.
- The study group (II); received PMR technique.

Patients enrolled in this study according to the following criteria:

- Male and female adults ranging from 20- 65 years old.

- Able to communicate verbally and agree to participate in the study.
- On maintenance hemodialysis 3 times weekly.
- All the patients were diagnosed using International Restless Legs Syndrome Study Group (IRLSSG) scale. The presence of RLS was assessed using the minimum diagnostic criteria recommended by (IRLSSG), which consisted of four items: (1) an urge to move the legs, usually accompanied or caused by uncomfortable and unpleasant sensations in the legs; (2) the urge to move or unpleasant sensations begin or worsen during periods of rest or inactivity, such as lying or sitting; (3) the urge to move or unpleasant sensations are partially or totally relieved by movement, such as walking or stretching, at least as long as the activity continues; (4) the urge to move or unpleasant sensations are worse in the evening or night than during the day or only occurred in the evening or night.

Exclusion criteria:

- Peripheral neuropathy or vascular diseases of the lower limbs.
- Skin diseases including acute psoriasis or eczema.
- Recent fractures or lower limbs surgeries.
- Feet injuries including severe bruises, ulcers, open wounds or recent burns.
- Had no associated diseases such as; rheumatic arthritis; neurological disorders; cancer, tuberculosis, human immune deficiency syndrome (AIDS), chronic cardiac, vascular or hepatic illness.

The study sample size was estimated based on the Epi-Info 7 program using the following parameters:

- Target population = 200
- Expected frequency = 50%
- Acceptable error = 10%
- Confidence coefficient = 95%
- Sample size = 60

Tools for data collection:

Three tools were utilized for data collection.

Tool I: Hemodialysis patient Structured

Interview Schedule: This tool was used to assess the patient's demographic and clinical data. It was developed by the researcher based on relevant literature

(Saraji et al., 2017; Bahgat & Algendy 2019) and it included two parts:

Part I: Patient's demographic data: It included age, gender, marital status, educational level, occupation and area of residence.

Part II: Patient's clinical data: It included medical history and the number of dialysis years.

Tool II: International Restless Legs Syndrome Severity Rating Scale (IRLSSRS):

This scale developed by the International Restless Legs Syndrome Intervention Group (IRLSIG, 2003) which adapted and translated to Arabic Language, to assess severity of a patient's RLS symptoms. It consisted of ten questions; each question was rated from 0 (none) to 4 (very severe). The patient asked to rate his/ her restless legs in the last week, as rating leg/arm RLS discomfort, rate needed to move around because of RLS symptoms, relief of RLS getting from moving around, severity of sleep disturbance, tiredness or sleepiness from RLS symptoms, severity of RLS as a whole, how often get RLS symptoms, severity of RLS symptoms on an average day, severity of impact of RLS symptoms on ability to carry out work and mood disturbance. The total scores ranged from 0-40. Statistically, this score was translated to the corresponding RLS severity as follows:

- 0 indicated None RLS.
- 1 - 10 indicated mild RLS.
- 11- 20 indicated moderate RLS.
- 21 -30 indicated severe RLS.
- 31-40 indicated very severe RLS.

Tool III: Restless Legs Syndrome Assessment Sheet:

This tool was adapted from El-Deeb, et al., (2017), and translated to Arabic language, it was used to evaluate RLS effects on patient's physical and psychosocial functioning. It consisted of 25 items with 4 domains; sleep pattern, physical activities, emotional well-being and social activities. These items were assessed on a 4-points rating scale ranging from (0) = Not at all, (1) = somewhat, (2) = Much and (3) = Very much.

Sleep pattern domain, included 9 items related to time of RLS occurrence during a day or night sleep, sleep description, sleep quality, wake up during sleep because of leg cramps, number of wake up, trouble returning to sleep, time needed to return to sleep, decrease in sleeping hours because of leg discomfort and interference of sleep problems with daily functioning.

Physical activities domain, included 5 items related to limitations on sports or exercise, stair-climbing, walking, sitting & standing due to RLS.

Emotional well- being domain, included 6 items related to RLS effects on interest in doing activity, feeling depressed, angry, frustrated, low mood & fearful.

Social activities domain, included 5 items related to RLS effects on getting out from home, participating in social activities and household chores, ability to accomplish hard work & meeting people's demands.

Method:

1. Approval:

- Written approval from the Research Ethics Committee of Faculty of Nursing, Alexandria University was obtained.
- Official letters were submitted from the Faculty of Nursing, Alexandria University to the director and head of the department of the selected hospital setting in order to obtain their approval to carry out the study after explaining its aim.

2. Tools:

- Tool I was developed based on a review of related literatures. Tool II and III were adapted and translated to Arabic by the researchers.
- Tools content validity, completeness and clarity of items, were tested by five expert professors in the field of Medical -Surgical Nursing, Faculty of Nursing Alexandria University and Nephrology medicine, Faculty of Medicine - Alexandria University, and necessary modifications, correction and clarification of the items were introduced thereafter.
- Reliability to the tools was tested by using the Cronbach's Alpha Statistical Test for Tool I, it was 0.90. Tool II and III were

validated and found to have high levels of internal consistency, inter-examiner reliability, and test retest reliability; they were 0.89 and 0.88 respectively.

3. Pilot study:

- A pilot study was initially carried out on 10% of study sample (6 patients), prior to the actual data collection phase, to check clarity, feasibility and applicability of the tools and determine obstacles that might be encountered during period of data collection, and needed modifications were introduced. Pilot study subjects were excluded from the study thereafter.

4. Collection of data:

- Data were collected over a period of four months, starting from the beginning of August 2021 to the end of November 2021.
- Patients meeting the inclusion criteria were enrolled using a purposive sampling technique and equally divided into control and study groups, as follow:
 - Control group (I): received the usual hospital routine care.
 - Study group (II): received PMR technique. Those patients were instructed to perform the taught PMR technique, throughout their scheduled hemodialysis sessions, twenty minutes/twice daily for 4 consecutive weeks.
- Data were collected initially from the control group followed by the study group, to prevent any influence on knowledge and practices. In order to address the effect of PMR technique on RLS; data were collected through the following phases:

I. Assessment phase:

- Patients in the control and study groups were interviewed individually and in privacy, to assure confidentiality of information.
- The researchers introduced themselves to the patients and explained the purpose of the study.
- During interview, tool I was used to obtain patient's demographic and clinical data and initial assessment was done using tool (II) and tool (III).
- The individual assessment session took from 25-30 minutes.

II. Planning phase:

- Patients in the study group received educational pamphlets with pictures illustrating and representing benefits and steps of PMR technique.
- The surrounding environment and the study group patients were prepared. The *environment* prepared to be quiet and free from any distraction as visitors & accompanying persons, well ventilated, cool, softly lighted, well cleaned and curtains were used to keep privacy. In addition, comfortable beds with firm mattress and clean without wrinkled linen were ensured. *The study group patients* were welcomed and asked to evacuate the urinary bladder, lose any tight clothing, and lie down or sit in a comfortable position with legs uncrossed, patients asked to be preferably lightly close eyes, focus on a spot, clear thoughts and focus on breath.

III. Implementation phase:

- The teaching methods included, demonstration, re-demonstration, using audiovisual material, colored pamphlets and power point presentation.
- PMR was continued for 12 sessions; it was done three times in the week, (every other day), for four weeks, with a total 12 sessions per patient. Every session took approximately 15 to 20 minutes according to the activities performed in each session, and the attention span of the patient.
- Application of PMR for the study group patients was conducted and applied individually to every patient, during HD session (morning / evening shifts), according to the following **PMR technique**:
 - Patient were asked to take deep breathing and inhale deeply through the nose and to feel the abdomen rises as he/she fills his/her body with air. Then slowly exhale out through the mouth, the navel pulling in toward the spine as the patient expels air out. Repeat 3-5 cycles of deep breathing (as patient tolerance).
 - Patient were asked to tense and release muscles. Starting with face muscles group, including (forehead, eyes, & mouth); patients were asked to wrinkle forehead through raising the eye brows as high as

possible & frown nose, close eyes very tightly, and for mouth (pursed the lips or open the mouth as wide as patient can as when yawning). Patients then were asked to tense these muscles for 5-7 seconds, and then release gradually while counting for 10 seconds.

- Continue to tense and then release each muscle group. Arm muscles include; "Hands, forearm & upper arms". Patients were asked to (Clench the fist hands, move on to biceps by drawing the forearm up towards shoulder, slowly bend the elbow by using a strong five-second contraction, then slowly release while counting for 10 & repeat on the left arm. Notice the sensation, feel the tension leaving and replaced by warmth in the hand.
- For shoulder and neck muscles, patients were asked to (Shrug the shoulders lightly up towards the ears as high as possible, slowly turn head until feeling a gentle stretch, hold them for five seconds, and then let them drop down as far as possible.
- For abdominal muscles, patients were taught to (Suck & hold the abdomen for 5-7 seconds as far as possible, with supporting with hands or through breathing in deeply, filling up the lungs and chest with air, and slowly release while counting for 10 seconds.
- For muscles of legs, (the hip, leg & foot) and buttocks, patients were instructed to (tense the buttocks by pulling it together, hold for 5-7 seconds and then slowly release while counting for 10. Also, patients were asked to, tense the muscles of legs, Lift the leg off the ground or bed, straighten the knees and pull the toes upwards to stretch the calf muscle, curl the toes downwards, hold them for 5 seconds and then, slowly release while counting for 10 seconds. The same steps were utilized with the other leg.
- The patient were instructed to end the technique by taking a deep breath and noting how much calmer and relaxed he/she felt.
- Before starting every session, patients were asked questions about the parts discussed in the previous meeting to ascertain their level of understanding and forgetfulness or

unclear points to be emphasized. A summary of the previous session was provided to patient to refresh their memories and ensure implementation of learned sessions.

- Re-demonstrations according to patient's needs. Also, wrong technical practice was corrected. Upon completion of the explanation, patients were asked to re-demonstrate PMR technique until he/she can master it.
- The study group participants were asked to continue practice of PMR at home for twenty minutes, at least twice daily, for four consecutive weeks. Continuation of following the technique was confirmed through phone calls.
- Patients was also requested to record PMR session's date and time on a printed follow-up sheet; with the assistance of the family, if the participant was illiterate. Follow-up sheets were checked prior to each dialysis sessions weekly for the four study weeks.

IV. Evaluation phase:

- **Control group** patients were evaluated 3 times, at the same specified times of evaluation for the study group patients, using tools II and III.
- **Study group** patients were evaluated 3 times, initially before implementation of PMR, secondly at the 2nd week (6 sessions), and thirdly at the fourth week (12 sessions) after implementation of PMR using tools II and III.
- Comparisons were done between two groups to identify the effectiveness of the of PMR severity on RLS among patients on hemodialysis.

Ethical considerations:

- Research proposal was approved from the Research Ethical Committee at the Faculty of Nursing, Alexandria University.
- Approval to carry out the study was obtained from administrative office of the study setting.
- After official permission was obtained, the aim of the study was explained to the participants. Verbal consents were obtained from each patient to participate in the study, after clarifying the aim and procedures of the study.

- Participants were informed about their right to refuse participation and to withdraw at any time without any consequences.
- Confidentiality of data was ensured.
- Patients' privacy was respected.

Statistical analysis of the data:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Shapiro test was used to verify the normality of distribution. Quantitative data were described using mean and standard deviation. Significance of the obtained results was judged at the 5% level.

The following statistical analysis measures were used:

- 1- Chi-square test:** For categorical variables, to compare between different groups
- 2- Fisher's Exact or Monte Carlo correction**

Correction for chi-square when more than 20% of the cells have expected count less than 5

3 - Friedman test

For abnormally distributed quantitative variables, to compare between more than two periods or stages and **After Hoc Test (Dunn's)** for pairwise comparisons.

Results:

Table (1): shows percentage distribution of the control and study group patients according to their demographic characteristics and clinical data, more than one third of the patients in both control and study groups (43.3% and 40%) respectively were between 50 to 60 years old. Females were more prevalent in around two thirds (66.7%) of both groups. Additionally, 43.3% and 40% respectively of patients in both groups were housewives, and 90 % and 86.7% respectively of them were from urban areas.

About two thirds of the studied patients in the control and study groups (60% and 66.7%) respectively were married. Secondary level of education was prevailing among more than one third of patients in the control and study groups (46.7% and 33.3%) respectively.

In relation to the medical history of studied patients in both groups, more than one third of them (40% & 40%) respectively were suffering from hypertension. Duration of hemodialysis was more than 9 years in around two thirds (66.7%) of the control group and slightly more than half (53.3%) of the study group. No significant differences in demographic characteristics and clinical data between the both groups were found ($p \leq 0.05$).

Table (2): displays percentage distribution of the control and study group patients regarding restless legs syndrome severity pre and post application of progressive muscle relaxation technique. This table reveals that there were no statistical significant differences between both groups regarding RLS severity pre application of the PMR technique sessions, and nearly all patients were suffering from moderate and severe RLS. High statistical significant differences related to all RLS rating scale items were decreased among the study group patients post application of PMR technique, (where all Ps were <0.001).

In addition, this table depicts that the RLS severity significantly decreased, post application of PMR technique with percent reduction (38.89%) at 6th session and 61.11% at 12th session. At the same time, such decrease was not found among the control group patients.

Table (4): shows percentage distribution of the control and study group patients regarding effect of restless legs syndrome on sleep pattern pre and post application of progressive muscle relaxation.

It was noticed that about two thirds (66.7% and 63.3%) of the control and study group patients complained from very poor sleep pattern in the first assessment (pre application). While, more than three quarters (83.3%) of the study group patients, reported having good sleep pattern at the 12th session post application of PMR technique. A statistical significant differences ($p < 0.001^*$) found between both groups regarding effect of RLS on sleep pattern at the 12th session.

Eventually, the same table summarized that the overall effect of the RLS on sleep pattern in the first assessment, indicated that majority (90.0%) of the control group patients

and all (100.0%) the study group patients were affected "Very much" by RLS. In addition, there was no statistical significant difference ($p < 0.237$) between the control and study group patients. Whereas, at the 12th session, the most (80.0%) of the control group patients reported they were affected "Very Much" by RLS compared to the most (80.0%) of the study group patients were "Somewhat" affected by RLS, with high statistical significant differences ($P < 0.001^*$) between both groups post application of PMR technique at 12th session. The percent reduction of RLS on sleep pattern shows that 46.67 % sleep pattern improvement, within the study group by the 12th sessions.

Table (4): illustrates percentage distribution of the control and study group patients regarding effect of restless legs syndrome on physical activities pre and post application of progressive muscle relaxation.

It is noticed that there were no statistical significant differences among both groups in the first assessment (pre the application of PMR technique in all the subscales items related to the effect of RLS on sports, stair climbing, walking, sitting, and standing. Whereas, at the 12th session assessment (post application of PMR technique), statistical significant differences in the study group over the control group related to the effect of RLS on overall physical activities items ($p < 0.001$) were found. The percent reduction of the effect of RLS on physical activities shows that 57.78 % of physical activities improved among the study group patients post the application PMR technique at 12th session.

Table (5): shows percentage distribution of the control and study group patients regarding effect of restless legs syndrome on emotional well- being pre and post application of progressive muscle relaxation.

It is revealed that, in the first assessment, there was a highest percentage effect of RLS on all the sub items of emotional well- being in the control and study group patients pre the application of PMR technique (70.0% & 86% respectively) had very much effect, and there was no statistically significant difference among them ($p = 0.237$).

While, at the 12th session assessment (post the application of PMR technique) more than two thirds (70.0%) of the control group patients were found still having "very much effect", compared to nearly two thirds (60.0%) of the study group patients were improved to "somewhat effect", with statistical significant differences ($p < 0.001$). Furthermore, the percent reduction of RLS on emotional well- being indicated that 63.33 % of the emotional well-being improved among the study group patients post application of PMR technique at 12th session.

Table (6): represents percentage distribution of the control and study group patients regarding effect of restless legs syndrome on social activities pre and post application of progressive muscle relaxation.

It is observed that there were no statistical significant differences between the control and study group patients in the first assessment in relation to overall subscale items ($p = 0.060$).

Whereas, at the 12th session assessment (post application of PMR technique) about two thirds (63.3.0%) of the control group patients were found still having "very much effect" of RLS on social activities, compared to more than two thirds (73.3%) of the study group patients demonstrated "somewhat effect" of the overall RLS subscales items of social activities. Statistical significant difference were evident in the study group patients over the control group, related to effect of RLS on over all subscales items of social activities ($P < 0.001^*$)

Additionally, the percent reduction of overall RLS effects on social activities represented 55.56 % of the social activities among the study group patients post the application of 12th session PMR technique, which indicated the positive effect of PMR in improving social activities among patient with RLS.

Table (1): Percentage of the control and study group patients according to their demographic characteristics and clinical data (n= 60).

| Patients demographic characteristics and clinical data | Control group (n = 30) | | Study group (n = 30) | | χ^2 | P |
|--|------------------------|------|----------------------|------|----------|---------|
| | No. | % | No. | % | | |
| Patients demographic Characteristics | | | | | | |
| 1. Age in years: | | | | | | |
| 20- | 0 | 0.0 | 4 | 13.3 | 5.124 | = 0.159 |
| 30- | 8 | 26.7 | 4 | 13.3 | | |
| 40- | 9 | 30.0 | 10 | 33.4 | | |
| 50-60 | 13 | 43.3 | 12 | 40.0 | | |
| 2. Gender: | | | | | | |
| Male | 10 | 33.3 | 10 | 33.3 | 0.000 | 1.000 |
| Female | 20 | 66.7 | 20 | 66.7 | | |
| 3. Occupation: | | | | | | |
| Manual work | 4 | 13.3 | 6 | 20.0 | 2.570 | = 0.644 |
| Professional work | 3 | 10.0 | 2 | 6.7 | | |
| Retired | 4 | 13.3 | 3 | 10.0 | | |
| House wife | 13 | 43.4 | 12 | 40.0 | | |
| Not work | 6 | 20.0 | 7 | 23.3 | | |
| | | | | | | |
| 4. Area of residence: | | | | | | |
| Urban | 27 | 90.0 | 26 | 86.7 | 0.162 | = 1.000 |
| Rural | 3 | 10.0 | 4 | 13.3 | | |
| 5. Marital status: | | | | | | |
| Single | 6 | 20.0 | 6 | 20.0 | 2.954 | = 0.414 |
| Married | 18 | 60.0 | 20 | 66.7 | | |
| Divorced | 3 | 10.0 | 0 | 0.0 | | |
| Widow | 3 | 10.0 | 4 | 13.3 | | |
| 6. Level of education: | | | | | | |
| Illiterate | 4 | 13.3 | 6 | 20.0 | 2.580 | = 0.678 |
| Preparatory | 3 | 10.0 | 2 | 6.7 | | |
| Primary | 3 | 10.0 | 2 | 6.7 | | |
| Secondary | 14 | 46.7 | 10 | 33.3 | | |
| University | 6 | 20.0 | 10 | 33.3 | | |
| Clinical Data | | | | | | |
| 7. Medical history: | | | | | | |
| None | 9 | 30.0 | 6 | 20.0 | 1.856 | = 0.666 |
| Diabetes mellitus | 3 | 10.0 | 2 | 6.7 | | |
| Hypertension | 12 | 40.0 | 12 | 40.0 | | |
| Diabetes mellitus & Hypertension | 6 | 20.0 | 10 | 33.3 | | |
| 8. Duration of hemodialysis in years: | | | | | | |
| <1 year | 4 | 13.3 | 4 | 13.3 | 1.481 | = 0.530 |
| 3< 6 years | 6 | 20.0 | 10 | 33.3 | | |
| >9years | 20 | 66.7 | 16 | 53.4 | | |

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at $p \leq 0.05$
p: p value for comparing between the studied groups

Table (2): Percentage distribution of the control and study group patients regarding restless legs syndrome severity pre and post application of progressive muscle relaxation technique(n= 60).

| Restless Legs Syndrome severity | Control group(n = 30) | | | | | | Study group (n = 30) | | | | | | $\chi^2(p)$ Pre application | $\chi^2(p)$ 6 th session post application | $\chi^2(p)$ 12 th session post application |
|--|-----------------------|-------|--|-------|---|------|----------------------|------|--|------|---|------|-----------------------------|--|---|
| | Pre application | | 6 th session post application | | 12 th session post application | | Pre application | | 6 th session post application | | 12 th session post application | | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | | | |
| 1. Rate the RLS discomfort in your legs or arms. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 3.360 (0.067) | 20.964* (<0.001*) | 72.096* (0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 28 | 93.3 | | | |
| Moderate | 21 | 70.0 | 20 | 66.7 | 21 | 70.0 | 14 | 46.7 | 20 | 66.7 | 0 | 0.0 | | | |
| Severe | 9 | 30.0 | 10 | 33.3 | 9 | 30.0 | 16 | 53.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 2. Rate the need to move around because of your RLS symptoms. | | | | | | | | | | | | | | | |
| None | 3 | 10.0 | 3 | 10.0 | 5 | 16.6 | 2 | 6.7 | 4 | 13.3 | 6 | 20.0 | 4.855 (0.175) | 10.084* (0.015*) | 46.364* (<0.001*) |
| Mild | 3 | 10.0 | 3 | 10.0 | 4 | 13.5 | 2 | 6.7 | 10 | 33.3 | 24 | 80.0 | | | |
| Moderate | 18 | 60.0 | 18 | 60.0 | 16 | 53.3 | 12 | 40.0 | 16 | 53.4 | 0 | 0.0 | | | |
| Severe | 6 | 20.0 | 6 | 20.0 | 5 | 16.6 | 14 | 46.6 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 3. Relief of RLS getting from moving around. | | | | | | | | | | | | | | | |
| None | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 4 | 13.3 | 6 | 20.0 | 4.795 (0.200) | 7.353 (=0.060) | 20.836* (<0.001*) |
| Mild | 12 | 40.0 | 12 | 40.0 | 12 | 40.0 | 8 | 26.7 | 12 | 40.0 | 24 | 80.0 | | | |
| Moderate | 9 | 30.0 | 9 | 30.0 | 9 | 30.0 | 6 | 20.0 | 14 | 46.7 | 0 | 0.0 | | | |
| Severe | 6 | 20.0 | 6 | 20.0 | 6 | 20.0 | 14 | 46.6 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 4. Severity of sleep disturbance from RLS symptoms. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 10 | 33.3 | 0.472 (0.842) | 34.375* (<0.001*) | 56.025* (<0.001*) |
| Mild | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 8 | 26.7 | 20 | 66.7 | | | |
| Moderate | 9 | 30.0 | 7 | 23.3 | 7 | 23.3 | 6 | 20.0 | 20 | 66.7 | 0 | 0.0 | | | |
| Severe | 18 | 60.0 | 20 | 66.7 | 20 | 66.7 | 22 | 73.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 5. Severity of tiredness or sleepiness from RLS symptoms. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 10 | 33.3 | 0.472 (0.844) | 42.443* (<0.001*) | 62.260* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 18 | 60.0 | | | |
| Moderate | 7 | 23.3 | 7 | 23.3 | 7 | 23.3 | 6 | 20.0 | 22 | 73.3 | 2 | 6.7 | | | |
| Severe | 19 | 63.33 | 20 | 66.7 | 20 | 66.7 | 22 | 73.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 4 | 13.3 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 0 | 0.0 | 0 | 0.0 | | | |
| 6. Severity of RLS as a whole. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 0.734 (=0.733) | 31.706* (<0.001*) | 53.143* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 8 | 26.7 | 18 | 60.0 | | | |
| Moderate | 12 | 40.0 | 12 | 40.0 | 12 | 40.0 | 10 | 33.3 | 22 | 73.3 | 2 | 6.7 | | | |
| Severe | 15 | 50.0 | 15 | 50.0 | 15 | 50.0 | 18 | 60.0 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 0 | 0.0 | 0 | 0.0 | | | |
| 7. Rate of RLS symptoms. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 12 | 40.0 | 4.323 (=0.119) | 24.429* (<0.001*) | 60.000* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 18 | 60.0 | | | |
| Moderate | 15 | 50.0 | 14 | 46.66 | 15 | 50.0 | 8 | 26.7 | 24 | 80.0 | 0 | 0.0 | | | |
| Severe | 12 | 40.0 | 13 | 43.34 | 12 | 40.0 | 20 | 66.7 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.6 | 0 | 0.0 | 0 | 0.0 | | | |
| 8. Severity of RLS symptoms on an average day. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 3.774 (0.052) | 28.485* (<0.001*) | 55.359* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 20 | 66.7 | | | |
| Moderate | 13 | 43.3 | 13 | 43.3 | 13 | 43.3 | 6 | 20.0 | 20 | 66.7 | 4 | 13.3 | | | |
| Severe | 17 | 56.7 | 17 | 56.7 | 17 | 56.7 | 24 | 80.0 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 9. Impacting RLS symptoms on ability to carry out a work. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 0.218 (=1.000) | 49.565* (<0.001*) | 62.067* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 14 | 46.7 | | | |
| Moderate | 4 | 13.33 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 20 | 66.7 | 6 | 20.0 | | | |
| Severe | 26 | 86.66 | 27 | 90.0 | 27 | 90.0 | 28 | 93.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | |
| 10. Impact of RLS symptoms on mood disturbance. | | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 8 | 26.7 | 2.308 (=0.254) | 46.116* (p<0.001*) | 60.218* (<0.001*) |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4 | 13.3 | 18 | 60.0 | | | |
| Moderate | 6 | 20.0 | 5 | 16.66 | 6 | 20.0 | 2 | 6.7 | 24 | 80.0 | 4 | 13.3 | | | |

| | | | | | | | | | | | | | | |
|---|----|------|----|-------|----|------|----|------|----|------|----|------|----------|-----------|
| Severe | 24 | 80.0 | 25 | 83.34 | 24 | 80.0 | 28 | 93.3 | 0 | 0.0 | 0 | 0.0 | | |
| Very severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | |
| Overall restless legs syndrome rating scale. | | | | | | | | | | | | | | |
| None | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | |
| Mild | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 26 | 86.7 | 0.878 | 45.438* |
| Moderate | 6 | 20.0 | 6 | 20.0 | 5 | 16.6 | 4 | 13.3 | 24 | 80.0 | 4 | 13.3 | (=0.673) | (<0.001*) |
| Severe | 20 | 66.7 | 21 | 70.0 | 19 | 63.4 | 24 | 80.0 | 0 | 0.0 | 0 | 0.0 | | 60.965* |
| Very severe | 4 | 13.3 | 3 | 10.0 | 6 | 20.0 | 2 | 6.7 | 0 | 0.0 | 0 | 0.0 | | (<0.001*) |
| p₀ | | | | - | | - | | | | | | | | <0.001* |
| The percent reduction | | | | - | | - | | | | | | | | 38.89 |
| | | | | | | | | | | | | | | 61.11 |

χ²: Chi square test MC: Monte Carlo FE: Fisher Exact p: p value for comparing between the studied groups p₀: p value for post Hoc Test (Dunn's) for Friedman test for comparing between pre and each other periods
 *: Statistically significant at p ≤ 0.05

Table (3): Percentage distribution of the control and study group patients regarding effect of restless legs syndrome on sleep pattern pre and post application of progressive muscle relaxation(n= 60).

| Restless leg syndrome effect on sleep pattern | Control group (n = 30) | | | | | | Study group (n = 30) | | | | | | χ ² (p) Pre application | χ ² (p) 6 th session post application | χ ² (p) 12 th session post application | |
|--|------------------------|--|-----|---|-----|-----------------|--|-------|---|------|-----|-------|------------------------------------|---|--|--|
| | Pre application | 6 th session post application | | 12 th session post application | | Pre application | 6 th session post application | | 12 th session post application | | | | | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | | | | |
| Restless leg syndrome occurring (time) | | | | | | | | | | | | | | | | |
| During the day nap. | 1 | 3.3 | 2 | 6.7 | 3 | 10.0 | 2 | 6.7 | 2 | 6.7 | 0 | 0.0 | 0.862 (=0.870) | 4.049* (<0.001*) | 5.992* (=0.023) | |
| During sleep at night. | 9 | 30.0 | 10 | 33.3 | 23 | 76.6 | 10 | 33.3 | 26 | 86.7 | 30 | 100.0 | | | | |
| Day and night. | 20 | 66.7 | 18 | 60.0 | 4 | 13.3 | 18 | 60.0 | 2 | 6.7 | 0 | 0.0 | | | | |
| You describe your sleep as: | | | | | | | | | | | | | | | | |
| Deep | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 0 | 0.0 | 12 | 40.0 | 30 | 100.0 | --- | 15.000* (<0.001*) | 60.000* (<0.001*) | |
| Not deep | 30 | 100.0 | 30 | 100.0 | 28 | 93.3 | 30 | 100.0 | 18 | 60.0 | 0 | 0.0 | | | | |
| How would you rate your sleep? | | | | | | | | | | | | | | | | |
| Very good | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3.583 (=0.835) | 35.619* (<0.001*) | 71.922* (<0.001*) | |
| Good | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 25 | 83.3 | | | | |
| Adequate | 7 | 23.3 | 7 | 23.3 | 7 | 23.3 | 7 | 23.3 | 24 | 80.0 | 3 | 10.0 | | | | |
| Poor | 3 | 10.0 | 5 | 16.6 | 3 | 10.0 | 4 | 13.3 | 4 | 13.3 | 2 | 6.7 | | | | |
| Very poor | 20 | 66.7 | 18 | 60.0 | 20 | 66.7 | 19 | 63.3 | 0 | 0.0 | 0 | 0.0 | | | | |
| Do you wake up during your sleep due to restless leg syndrome? | | | | | | | | | | | | | | | | |
| No | 0 | 0.0 | 3 | 10.0 | 7 | 23.3 | 0 | 0.0 | 14 | 46.7 | 28 | 93.3 | --- | 18.261* (<0.001*) | 52.500* (<0.001*) | |
| Yes | 30 | 100.0 | 27 | 90.0 | 23 | 76.6 | 30 | 100.0 | 16 | 53.3 | 2 | 6.7 | | | | |
| If yes answer on the following question: How many times per night on an average? | | | | | | | | | | | | | | | | |
| Zero | 0 | 0.0 | 0 | 0.0 | 7 | 23.3 | 0 | 0.0 | 0 | 0.0 | 28 | 93.3 | --- | 52.500* (<0.001*) | 74.019* (<0.001*) | |
| One time | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 28 | 93.3 | 2 | 6.7 | | | | |
| Two or three time | 30 | 100.0 | 30 | 100.0 | 23 | 76.6 | 30 | 100.0 | 2 | 6.7 | 0 | 0.0 | | | | |
| More than three times | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| If awakened, do you have trouble returning to sleep? | | | | | | | | | | | | | | | | |
| No | 1 | 3.3 | 0 | 0.0 | 7 | 23.3 | 0 | 0.0 | 14 | 46.7 | 28 | 93.3 | 1.017 (=1.000) | 18.261* (<0.001*) | 34.737* (<0.001*) | |
| Yes | 29 | 96.7 | 30 | 100.0 | 23 | 76.6 | 30 | 100.0 | 16 | 53.3 | 2 | 6.7 | | | | |
| How much time trying to get back to sleep? | | | | | | | | | | | | | | | | |
| Zero | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 22 | 73.3 | 5.874 (=0.124) | 43.277* (<0.001*) | 61.386* (<0.001*) | |
| Less than 30 minutes | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 26 | 92.9 | 8 | 26.7 | | | | |
| 30min to 1 /hrs | 26 | 86.6 | 24 | 80.0 | 24 | 80.0 | 25 | 83.3 | 2 | 7.1 | 0 | 0.0 | | | | |
| More than 1 /hrs | 1 | 3.3 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 0 | 0.0 | 0 | 0.0 | | | | |
| Your sleeping hours decreased because of restless leg syndrome? | | | | | | | | | | | | | | | | |
| No | 0 | 0.0 | 2 | 6.6 | 0 | 0.0 | 0 | 0.0 | 4 | 13.3 | 24 | 80.0 | --- | 4.286 (=0.112) | 40.000* (<0.001*) | |
| Yes | 30 | 100.0 | 28 | 93.3 | 30 | 100.0 | 30 | 100.0 | 26 | 86.7 | 6 | 20.0 | | | | |
| To what extent do you consider your sleep problem interferes with your daily functioning? | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 4.083 (=0.253) | 44.899* (<0.001*) | 69.468* (<0.001*) | |
| A little | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 24 | 80.0 | | | | |
| Some what | 6 | 20.0 | 6 | 20.0 | 8 | 26.6 | 4 | 13.3 | 24 | 80.0 | 0 | 0.0 | | | | |
| Much | 18 | 60.0 | 18 | 60.0 | 16 | 53.3 | 18 | 60.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Very much | 6 | 20.0 | 6 | 20.0 | 6 | 20.0 | 8 | 26.7 | 0 | 0.0 | 0 | 0.0 | | | | |
| Overall Restless leg syndrome effect on Sleep pattern. | | | | | | | | | | | | | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 3 | 10.0 | 0 | 0.0 | 4 | 13.3 | 24 | 80.0 | 3.158 (=0.237) | 57.358 (<0.001*) | 49.714 (<0.001*) | |
| Much | 3 | 10.0 | 5 | 16.4 | 3 | 10.0 | 0 | 0.0 | 26 | 86.7 | 4 | 13.4 | | | | |
| Very much | 27 | 90.0 | 25 | 83.3 | 24 | 80.0 | 30 | 100.0 | 0 | 0.0 | 2 | 6.6 | | | | |
| p₀ | | | | - | | - | | | | | | | | <0.001* | | |
| The percent reduction | | | | - | | - | | | | | | | | 37.78 | | |
| | | | | | | | | | | | | | | 46.67 | | |

χ²: Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at p ≤ 0.05
 p: p value for comparing between the studied groups
 p₀: p value for post Hoc Test (Dunn's) for Friedman test for comparing between pre and each other periods.

Table (4): Percentage distribution of the control and study group patients regarding effect of restless legs syndrome on physical activities pre and post application of progressive muscle relaxation(n= 60).

| Restless leg syndrome effect on physical activities | Control group(n = 30) | | | | | | Study group (n = 30) | | | | | | $\chi^2(p)$ Pre application | $\chi^2(p)$ 6 th session post application | $\chi^2(p)$ 12 th session post application | |
|---|-----------------------|-------|--|-------------|---|-------|----------------------|-------|--|--------------|---|------|-----------------------------|--|---|--|
| | Pre application | | 6 th session post application | | 12 th session post application | | Pre application | | 6 th session post application | | 12 th session post application | | | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | | | | |
| Sports or exercise: | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0.0 | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 20 | 83.3 | --- | 73.444* (<0.001*) | 60.000* (<0.001*) | |
| Much | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 24 | 80.0 | 10 | 16.7 | | | | |
| Very much | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Climbing stair: | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 20 | 83.3 | --- | 73.444* (<0.001*) | 60.000* (<0.001*) | |
| Much | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 24 | 80.0 | 10 | 16.7 | | | | |
| Very much | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Walking: | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 20 | 83.3 | --- | 73.444* (<0.001*) | 60.000* (<0.001*) | |
| Much | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 24 | 80.0 | 10 | 16.7 | | | | |
| Very much | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Sitting: | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 10 | 33.3 | 24 | 80.0 | 0.000 (1.000) | 41.538* (<0.001*) | 48.000* (<0.001*) | |
| Much | 6 | 20.0 | 6 | 20.0 | 6 | 20.0 | 6 | 20.0 | 20 | 66.7 | 6 | 20.0 | | | | |
| Very much | 24 | 80.0 | 24 | 80.0 | 24 | 80.0 | 24 | 80.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Standing: | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 20 | 83.3 | --- | 73.444* (<0.001*) | 60.000* (<0.001*) | |
| Much | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 24 | 80.0 | 10 | 16.7 | | | | |
| Very much | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 30 | 100.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Overall Restless leg syndrome effect on Physical activities: | | | | | | | | | | | | | | | | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 22 | 73.3 | | | | |
| Much | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 0 | 0.0 | 24 | 80.0 | 8 | 26.7 | --- | 73.444 (<0.001*) | 53.600 (<0.001*) | |
| Very much | 30 | 100.0 | 0 | 30.0 | 28 | 93.3 | 30 | 100.0 | 0.00 | 0.0 | 0 | 0.0 | | | | |
| p₀ | | | - | - | | | | | <0.001* | <0.001* | | | | | | |
| The percent reduction | | | 0.0 | 2.22 | | | | | 40.00 | 57.78 | | | | | | |

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at $p \leq 0.05$

p: p value for comparing between the studied groups

p₀: p value for post Hoc Test (Dunn's) for Friedman test for comparing between pre and each other periods

Table (5): Percentage distribution of the control and study group patients regarding effect of restless legs syndrome on emotional well- being pre and post application of progressive muscle relaxation (n= 60).

| Restless leg syndrome effect on emotional well- being | Control group (n = 30) | | | | | | Study group (n = 30) | | | | | | $\chi^2(p)$ Pre application | $\chi^2(p)$ 6 th session post application | $\chi^2(p)$ 12 th session post application |
|---|------------------------|------|--|------|---|------|----------------------|------|--|------|---|--------------|-----------------------------|--|---|
| | Pre application | | 6 th session post application | | 12 th session post application | | Pre application | | 6 th session post application | | 12 th session post application | | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | | | |
| Little interest or pleasure in doing any work or activity. | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4.356 (0.237) | 35.132* (<0.001*) | 73.172* (<0.001*) |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 8 | 6.7 | 30 | 100.0 | | | |
| Much | 11 | 36.7 | 11 | 36.7 | 9 | 30.0 | 10 | 33.3 | 22 | 93.3 | 0 | 0.0 | | | |
| Very much | 19 | 63.3 | 19 | 63.3 | 21 | 70.0 | 20 | 66.7 | 0 | 0.0 | 0 | 0.0 | | | |
| Feeling depressed. | | | | | | | | | | | | | | | |
| Not at all | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 4 | 13.3 | 0 | 0.0 | 5.489 (=0.052) | 39.518* (<0.001*) | 55.488* (<0.001*) |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 24 | 80.0 | | | |
| Much | 6 | 20.0 | 6 | 20.0 | 8 | 26.7 | 2 | 6.7 | 20 | 66.7 | 6 | 20.0 | | | |
| Very much | 21 | 70.0 | 21 | 70.0 | 19 | 63.3 | 28 | 93.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Feeling angry. | | | | | | | | | | | | | | | |
| Not at all | 15 | 50.0 | 15 | 50.0 | 15 | 50.0 | 8 | 26.7 | 14 | 46.7 | 18 | 60.0 | 5.389 (0.068) | 8.815* (=0.023*) | 29.837* (<0.001*) |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.6 | 12 | 40.0 | | | |
| Much | 9 | 30.0 | 9 | 30.0 | 7 | 23.3 | 8 | 26.7 | 14 | 46.7 | 0 | 0.0 | | | |
| Very much | 6 | 20.0 | 6 | 20.0 | 8 | 26.7 | 14 | 46.6 | 0 | 0.0 | 0 | 0.0 | | | |
| Feeling of frustration or hopeless. | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 12 | 40.0 | 3.874 (=0.124) | 49.242* (<0.001*) | 58.842* (<0.001*) |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 4 | 13.3 | 12 | 40.0 | | | |
| Much | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 3 | 10.0 | 20 | 66.7 | 6 | 20.0 | | | |
| Very much | 24 | 80.0 | 24 | 80.0 | 27 | 90.0 | 25 | 83.3 | 0 | 0.0 | 0 | 0.0 | | | |
| Low mood. | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4 | 13.3 | 10 | 33.3 | 3.177 (=0.197) | 47.646* (<0.001*) | 56.266* (<0.001*) |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 6 | 20.0 | 20 | 66.7 | | | |
| Much | 3 | 10.0 | 3 | 10.0 | 5 | 16.7 | 2 | 6.7 | 20 | 66.7 | 0 | 0.0 | | | |
| Very much | 24 | 80.0 | 24 | 80.0 | 22 | 73.3 | 28 | 93.3 | 0 | 0.0 | 0 | 0.0 | | | |
| 6.Often felt tearful. | | | | | | | | | | | | | | | |
| Not at all | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 2 | 6.7 | 8 | 26.7 | 18 | 60.0 | 3.602 (=0.329) | 32.769* (<0.001*) | 44.430* (<0.001*) |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 4 | 13.3 | 12 | 40.0 | | | |
| Much | 5 | 16.7 | 5 | 16.7 | 5 | 16.7 | 4 | 13.3 | 18 | 60.0 | 0 | 0.0 | | | |
| Very much | 19 | 63.3 | 19 | 63.3 | 19 | 63.3 | 24 | 80.0 | 0 | 0.0 | 0 | 0.0 | | | |
| Overall Restless leg syndrome effect on Emotional well- being. | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.00 | 0 | 0.00 | 0 | 0.0 | 0 | 0.0 | 6 | 20.0 | 6 | 20.0 | 3.547 (=0.237) | 38.670* (<0.001*) | 42.954* (<0.001*) |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 6 | 20.0 | 18 | 60.0 | | | |
| Much | 6 | 20.0 | 6 | 20.0 | 6 | 20.0 | 4 | 14.0 | 18 | 60.0 | 6 | 20.0 | | | |
| Very much | 21 | 70.0 | 21 | 70.0 | 21 | 70.0 | 26 | 86.0 | 0 | 0.0 | 0 | 0.0 | | | |
| p₀ | | | - | | - | | | | <0.001* | | | <0.001* | | | |
| The percent reduction | | | - | | - | | | | 52.22 | | | 63.33 | | | |

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at $p \leq 0.05$

p: p value for comparing between the studied groups

p₀: p value for post Hoc Test (Dunn's) for Friedman test for comparing between pre and each other period

Table (6): Percentage distribution of the control and study group patients regarding effect of restless legs syndrome on social activities pre and post application of progressive muscle relaxation (n= 60).

| Restless leg syndrome effect on social activities | Control (n = 30) | | | | | | Study (n = 30) | | | | | | $\chi^2(p)$ Pre application | $\chi^2(p)$ 6 th session post application | $\chi^2(p)$ 12 th session post application | |
|---|------------------|------|--|------|---|------|-----------------|------|--|------|---|------|-----------------------------|--|---|--|
| | Pre application | | 6 th session post application | | 12 th session post application | | Pre application | | 6 th session post application | | 12 th session post application | | | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | | | | |
| Getting out from home. | | | | | | | | | | | | | | | | |
| Not at all | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4.170 (=0.201) | 22.933* (<0.001*) | 49.754* (<0.001*) | |
| Somewhat | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 3.3 | 4 | 13.3 | 24 | 80.0 | | | | |
| Much | 15 | 50.0 | 15 | 50.0 | 15 | 50.0 | 16 | 53.3 | 26 | 86.7 | 6 | 20.0 | | | | |
| Very much | 12 | 40.0 | 12 | 40.0 | 12 | 40.0 | 13 | 43.3 | 0 | 0.0 | 0 | 0.0 | | | | |
| Participating in social activities. | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3.089 (=0.251) | 25.724* (<0.001*) | 34.933* (<0.001*) | |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 8 | 26.7 | 24 | 80.0 | | | | |
| Much | 9 | 30.0 | 9 | 30.0 | 9 | 30.0 | 8 | 26.7 | 22 | 73.3 | 6 | 20.0 | | | | |
| Very much | 18 | 60.0 | 18 | 60.0 | 18 | 60.0 | 22 | 73.3 | 0 | 0.0 | 0 | 0.0 | | | | |
| Household chores. | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 6.7 | 0 | 0.0 | 4.653 (=0.106) | 26.156* (<0.001*) | 26.763* (<0.001*) | |
| Somewhat | 5 | 16.7 | 5 | 16.7 | 5 | 16.7 | 2 | 6.7 | 6 | 20.0 | 22 | 73.3 | | | | |
| Much | 9 | 30.0 | 9 | 30.0 | 9 | 30.0 | 4 | 13.3 | 22 | 73.3 | 8 | 26.7 | | | | |
| Very much | 16 | 53.3 | 16 | 53.3 | 16 | 53.3 | 24 | 80.0 | 0 | 0.0 | 0 | 0.0 | | | | |
| Make you hard to work. | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 16 | 53.3 | 4.489 (=0.149) | 38.814* (<0.001*) | 53.853* (<0.001*) | |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 11.1 | 3 | 10.0 | 4 | 13.3 | 14 | 46.7 | | | | |
| Much | 6 | 20.0 | 6 | 20.0 | 5 | 18.5 | 5 | 16.7 | 26 | 86.7 | 0 | 0.0 | | | | |
| Very much | 21 | 70.0 | 21 | 70.0 | 19 | 70.4 | 22 | 73.3 | 0 | 0.0 | 0 | 0.0 | | | | |
| Meet demands that people place on me. | | | | | | | | | | | | | | | | |
| Not at all | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 4.971 (=0.063) | 32.008* (<0.001*) | 31.534* (<0.001*) | |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 6 | 20.0 | 20 | 71.4 | | | | |
| Much | 8 | 26.7 | 8 | 26.7 | 8 | 26.7 | 4 | 13.3 | 24 | 80.0 | 8 | 28.6 | | | | |
| Very much | 19 | 63.3 | 19 | 63.3 | 19 | 63.3 | 26 | 86.7 | 0 | 0.0 | 0 | 0.0 | | | | |
| Overall Restless leg syndrome effect on Social activities. | | | | | | | | | | | | | | | | |
| Somewhat | 3 | 10.0 | 3 | 10.0 | 3 | 10.0 | 0 | 0.0 | 8 | 26.7 | 22 | 73.3 | 4.971 (=0.060) | 27.806* (<0.001*) | 33.440* (<0.001*) | |
| Much | 8 | 26.7 | 8 | 26.7 | 8 | 26.7 | 4 | 13.3 | 22 | 73.3 | 8 | 26.7 | | | | |
| Very much | 19 | 63.3 | 19 | 63.3 | 19 | 63.3 | 26 | 86.7 | 0 | 0.0 | 0 | 0.0 | | | | |
| | | | | | | | | | | | | | | | | |
| p₀ | | | | | | | | | | | | | | | | |
| The percent reduction | | | | | | | | | | | | | | | | |

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at $p \leq 0.05$

p: p value for comparing between the studied groups

p₀: p value for **post Hoc Test (Dunn's)** for **Friedman test** for comparing between **pre** and each other periods

Discussion:

Restless Legs Syndrome is among the most important health problems facing patients on HD worldwide with significant physical, psychological, and economic effects (Kutlu et al., 2018). This syndrome causes individual's disturbed rest, discomfort, and disturbance in occupational activities and familial life. Individuals with RLS initially undertake a variety of non-pharmacological practices to relieve symptoms. Among non-pharmacological modalities, the PMR technique which is the easiest one to be learnt and applied. It is inexpensive, available, and self-induced by the patient and has no side effects (Elsayed et al., 2019). The current study was conducted to evaluate the effects of PMR on the severity of RLS among patients on maintenance hemodialysis.

The current study's results showed no statistically significant differences between the control and study groups concerning demographic and clinical data. This meant that patients in both groups had the same characteristics, being distributed in a homogeneous manner, and properly randomized.

In the present study there was no significant differences found between both group patients regarding RLS rating scale pre application of the PMR technique. The highest percentage of patients in the both groups experienced severe RLS before applications of PMR technique. The results of the present study are in the same line with a study conducted by Motta, et al., (2018) who reported that, RLS symptoms among patients on hemodialysis were severe. Another study conducted by Hosseini et al., (2017)

concluded that, more than two thirds of patients with RLS reported the severity of symptoms as moderate, severe, or extreme. Contrary to the findings of the present study, **Bahgat and Algendy (2019)** indicated that, the majority of patients experienced moderate RLS symptoms.

In the current study it was observed that, the severity of RLS rating scale had significantly decreased among the study group patients, post application of the 6th and 12th sessions of the PMR. High significant improvements related to all items of RLS rating scale were found. Such change was not found among the control group after the implementation of routine hospital care. This finding could be attributed to the fact that, this technique promotes regular relaxation of major groups of muscles in the body, intending to relax mind and body, and decreasing stress response and pain. Accordingly, exercise improves motions related to RLS in patients with idiopathic RLS, besides alleviating RLS symptoms by releasing β -Endorphin. No doubt, exercising lead to increase local blood flow by vasodilation, thereby affecting the RLS severity (**Liu et al., 2016**).

The present study findings are consistent with many other results, which support the effect of the PMR exercises on the RLS among patients on hemodialysis. In this context, **Zirak et al., (2020)** reported that practicing of stretching exercises was effective than application of two methods of cold dialysate on decreasing the severity of RLS among patients on hemodialysis. Also, **Bastani et al., (2018)** concluded that the participants who practiced muscle stretching exercises experienced significant reduction of RLS rating scale more than the control group. This showed that there was a positive effect of muscle stretching exercises on decreasing of RLS scale. Another study conducted by **Saraji et al., (2017)** concluded that, significant changes in the severity of RLS symptoms were observed from start of first week of PMR to the sixth week.

The results of the current study indicated that, post application of PMR technique, there was significant improvement

in sleep pattern, among study group compared to the control group patients. Also, post Hoc Test & Friedman results showed significant improvements in the study group sleep pattern, when considering the pretest as a reference. In addition, the percent reduction of RLS on sleep pattern showed that 46.67 % of sleep pattern improvement, within the study group by the 12th sessions. This finding supports the positive effect and importance of PMR technique on improving sleep pattern among patients having RLS. No doubt, PMR technique improves sleep pattern by relaxing the body, keeping blood pressure normal, stimulating blood circulation, and ensuring muscle relaxation. In addition, the practice of PMR technique facilitates the passage to the parasympathetic nervous system, thereby ensuring physical and mental relaxation (**Roozbahani et al., 2016; Ferendiuk et al., 2019**).

Harorani et al., (2020) assessed the effectiveness of PMR on sleep pattern in burned patients. Their findings revealed that, there was significant improvement in sleep pattern scores in the study group post application of PMR technique. In this context, **Seyedi et al., (2019)** indicated that, PMR can decrease fatigue and improve sleep quality among study group patients. PMR technique may decrease the effects on the sympathetic nervous system and adverse effects of anxiety. Also, **Hamdi et al., (2021)** concluded the efficacy of PMR in improving sleep quality among studied patients.

Regarding effects of RLS on physical activities, results of the present study showed that, there was no statistical significant difference between both groups pre application of PMR technique. While, physical activity improved in the study group than in the control group post application of the PMR technique. This result may be attributed to, PMR stimulates the parasympathetic nervous system, evokes the relaxation response, enhances venous return, increases local circulation, and it has stimulation effect that decreases neuromuscular excitability, pain, and muscle tension or spasm (**Joyner & Casey, 2015**).

Similar findings were declared in a study by **Ismail and Elgzar (2018)** who had conducted a randomized controlled clinical trial to evaluate the effects of PMR on pain and physical activities. A significant improvement was achieved in physical activity after PMR. They emphasized that severe activity limitation was significantly reduced among the study group after PMR, compared to 70% of their control group.

For the effects of RLS on emotional well-being, the findings of the present study revealed that there were no statistical significant differences between both groups regarding effect of RLS on emotional well-being pre application of PMR technique. Interestingly, there was statistical significant improvement in the study group emotional well-being post application of the PMR technique. This finding may be rationalized by, PMR leads to a voluntary and regular relaxation of the major muscle groups and thus relaxes the entire body, reduces tension, stress, and lactic acid production. In addition, stimulates secretion of β -Endorphin (**Ibrahim et al., 2021**). This finding is in line with **Lindner et al., (2015)** who stated that, most commonly patients on hemodialysis complain of waking up at night with severe RLS symptoms that affect patient's psychological status and interferes with functioning. Also these findings were supported by **Essa et al., (2017)** who reported in similar study that; implementation of nine sessions PMR techniques minimized stress, anxiety, depression and improved psychological comforting.

In relation to the effect of PMR on social activities, results of the present study showed that, there was statistical significant improvement among the study group patients compared to their control group patients, post application of the PMR technique. This finding is in harmony with **Sianoja et al., (2018)** who found that, PMR improves physical activities and psychological status which in turn results in improved social activities. Also, **Sawni, & Breuner (2017)** suggested that PMR technique could be utilized as an effective nursing intervention to reduce depression and stress response, and in

turn improved psychological status and socialization.

Finally, the findings of the current study clarified the fact that PMR technique used to decrease severity of RLS, improving sleep pattern, physical activity, emotional well-being and social activities among HD patient, which can be achieved through educating those patients PMR technique.

Conclusion:

The findings of the present study concluded that, PMR technique had high statistical significant positive effects on severity of RLS, improving sleep pattern, physical activity, emotional well-being and social activities, among patients suffering from RLS and on maintenance hemodialysis.

Recommendations

The findings of this study recommended that:

- Providing educational sessions to patient on hemodialysis and suffering from RLS, regarding PMR, how to perform and its benefits.
- Applying PMR to therapeutic routine management of patients on hemodialysis and suffering from RLS.
- Nephrology nurses should integrate PMR in their routine care to reduce the psychological effects and dependence on pharmacological measures.
- Encouragement training programs for Nephrology nurses about application of PMR techniques.
- Replication of the current study on larger samples.

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