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HOMEOPATHIC MODULATION OF STRESS-INDUCED ANXIETY AND ITS EFFECTS ON KIDNEY BIOMARKERS: AN INTEGRATIVE MEDICINE APPROACH

[1]Dr Krishna Shah , [2]Dr Bindulata Maurya, [3]Dr. Srabani Pal, [4]Suganya P, [5]Dr.B. Sankaraman, [6]Dr.Jagruti Jayant Sonis

[1]MBBS, DNB Medicine, Senior Resident, Parul Medical College, Vadodara, Gujarat, Email Id: Krishnashah670@gmail.com, Orcid Id: 0000-0002-1468-1551
[2]Assistant Professor, Department of Homoeopathic Materia Medica, DRSGWF's Vrindawan Homoeopathic Medical College & Hospital, Sangamner, Maharashtra, Orcid Id: 0009-0008-1117-6964, Email Id: drbindumaurya@gmail.com
[3]Professor and HOD, Department of Human Anatomy, Specialization in Homoeopathy, Sumandeep Homoeopathic Medical College and Hospital, Orcid Id: 0000-0002-2994-7266, Email Id: drsrabanipal@gmail.com
[4]Senior Lecturer, Department of Public Health Dentistry, Sree Balaji Dental College and Hospital Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India, Email Id: dr.suganyavinod@gmail.com
[5]Professor, Department of General Surgery, Vinayaka Missions Medical College, Salem,Tamil Nadu, India, Email Id: mayurambsr@gmail.com, Orcid Id: 0000-0002-1990-964X
[6]Consultant Physician, Department of Homeopathy, Specialization in Homeopathy Medicine, Vishva Advanced Homeopathy Clinic, Pune-411033, India, Email Id: drjsonis@gmail.com, Orcid Id: https://orcid.org/0009-0000-1168-5058

ABSTRACT
Stress-induced anxiety is increasingly recognised as a contributor to kidney dysfunction. Chronic stress activates the hypothalamic-pituitary-adrenal (HPA) axis, elevating cortisol levels and inducing vascular changes, inflammation, and oxidative stress, which impair kidney function. Homeopathy is a complementary medicine method, which has been promising in the regulation of stress and its physiological consequences but there is limited research on its effect on kidney biomarkers in stress-induced renal dysfunction. The research aimed to assess the influence of homeopathic therapy on kidney biomarkers in people with anxiety caused by stress and examine the possible nephroprotective effect of homeopathy as an adjunctive treatment of kidney dysfunction caused by stress. A placebo-controlled, randomised and double-blind trial was carried out among 100 participants (50 treatment and 50 placebo). Participants were assigned 8 weeks of homeopathic remedies or a placebo on an individual basis. Primary outcome variables were alterations in kidney biomarkers (serum creatinine, BUN, eGFR), whereas anxiety and stress levels, measured with the help of the State-Trait Anxiety Inventory (STAI) and the Perceived Stress Scale (PSS) were used as secondary outcomes. The treatment group demonstrated a substantial change in kidney biomarkers (lower serum creatinine and higher eGFR) and a decrease in stress and anxiety. The studies compared with the placebo group showed that the difference in kidney functioning and psychological results was statistically significant. A promising complementary way of managing stress-induced kidney dysfunction is homeopathy which can help in enhancing kidney function as well as alleviating anxiety.

KEYWORDS: Homeopathy, Kidney Function, Stress-induced Anxiety, Nephroprotective, Integrative Medicine

1. INTRODUCTION

Stress-induced anxiety is a significant contributor to various health issues, including kidney dysfunction. Chronic stress can adversely affect the kidneys which are vital in the process of homeostasis. Activation of the hypothalamic-pituitary-adrenal (HPA) axis due to psychological stress and especially anxiety is what causes an increase in the level of cortisol and other stress hormones. Such hormones cause changes in the vascular, inflammatory and oxidative stress, which causes kidney damage and poor renal functionality [1]. Stress can also cause chronic diseases such as hypertension, diabetes, and metabolic syndrome, which are known to harm the kidneys and deteriorate the work of the kidneys [2]. Hypertension, among other diseases associated with stress are significant risk determinant in kidney failure, and the effect that stress has on kidney health needs to be addressed. Kidney biomarkers include serum creatinine, blood urea nitrogen (BUN), and glomerular filtration rate (eGFR), which are the essential determinants of kidney functioning. Recent science indicates that these biomarkers are affected by more than the conventional risk factors, but also psychological stress [3]. The inflammation caused by stress impacts the kidneys by changing the renal blood flow, which releases pro-inflammatory cytokines and enhances renal fibrosis, which leads to kidney dysfunction [4]. BUN and creatinine have high rates in people who experience persistent stress and anxiety, which explains the negative impact on the health of the kidneys. Although there is an improvement in the comprehension of the association between stress and kidney activity, integrative medicine, like homeopathy, is not thoroughly explored in the context of the stress induced kidney dysfunction management. Although the traditional pharmacological therapy is used to address the psychological components of stress, homeopathy is a complementary therapy, which can help to improve psychological and physiological well-being. Other past researches have also reported homeopathic medication to be an effective solution to stress and anxiety through

regulation of the stress response of the body [5]. Nonetheless, little research exists on the role of homeopathy as a way of regulating biomarkers in the kidney in response to stress-induced anxiety. Other research notes that homeopathic medicines have a positive effect on inflammation and oxidative stress, which leads to kidney damage [6]. Homeopathic medicine has been found to alleviate stress and anxiety, which restore psychological stability [7]. According to the recent research, homeopathic remedies also positively impact systemic inflammation, which influences the functioning of the kidneys [8]. In spite of these results, there is scanty clinical evidence on the effects of homeopathic remedies on kidney biomarkers in patients with kidney dysfunction caused by stress. A narrower study of nephroprotective effects of homeopathy is required. Adaptogenic herbs such as ashwagandha, which have been shown to regulate cortisol and lower inflammation, could help to improve the work of the kidneys in stressful situations [9]. Nevertheless, their impact on kidney biomarkers including serum creatinine, BUN and eGFR has not been studied sufficiently in the context of stress induced renal dysfunction. This research will fill this gap; ever, by assessing the possibilities of homeopathic therapies, which can include such adaptogenic herbs, in regulating kidney biomarkers in people with stress-induced kidney dysfunction [10].

Although much has been done on the impact of stress on the kidney performance, alternative methods of medicine, including homeopathy have not been thoroughly studied on management of stress related kidneys dysfunction. The nephrology studies mainly focus on the traditional methods and pharmacological therapies, but there is no concentrated focus on the integrative therapies, such as homeopathy. In spite of the fact that homeopathy has been effective in the treatment of stress related disorders, there is limited clinical evidence in the way homeopathy can affect the health of the kidneys. The importance of homeopathic remedies in regulating kidney biomarkers in victims of the stress-related anxiety has not been comprehensively examined [11]. Moreover, there are a limited number of randomized controlled trials (RCTs) that evaluate the efficacy of homeopathy in the treatment of stress-induced dysfunction of the kidneys. The majority of the research on homeopathy and stress management is observational or pilot research, which provides a small number of evidences. Significant weakness of the current research is that the nephroprotective action of homeopathic remedies has not undergone rigorous clinical trials in large sample size [12]. As adaptogenic, ashwagandha alleviates stress and inflammation; however, there is little literature on its effect on kidney health. Further studies should be conducted on the effects of homoeopathic remedies on kidney biomarkers in a stressed person [13]. Moreover, in spite of the fact that integrative medicine has researched on the use of diverse therapies in the management of stress, homoeopathy is poorly studied in its physiological impacts on kidneys. The available evidence is more about stress alleviation and overall good health, but it does not examine the actual effect it has on kidney performance [14]. The involvement of homoeopathy in nephrology may also provide exciting opportunities of treatment, however, the existing literature on the efficacy of this approach with regard to kidney disease is inadequate [15].

The growing interest in integrative medicine explains why this research area aims at examining the role of integrative medicine in the management of stress-induced kidney dysfunction. Homoeopathy as a holistic treatment assists in stress treatment through a means of regulating physiological reactions and alleviating inflammation [16]. Nevertheless, it has not been fully studied with respect to its impact on stress-induced renal dysfunction kidney biomarkers in stress individuals. This paper will seek to examine the role of homeopathic treatment in altering kidney biomarkers in people experiencing anxiety due to stress. This study addresses a gap in the existing literature that is highly important and is based on concentrating on stress-related kidney dysfunction. Combining the traditional and alternative therapies has been found to be promising in the management of chronic illnesses including stress induced disorders. The nephroprotective strategy could provide some valuable information on homeopathy, which tries to alleviate the stress reaction of the body and overall health [17]. Recent research on adaptogens such as ashwagandha indicates that such remedies regulate the stress hormones and inhibit inflammation, which may have a positive impact on the work of the kidneys [18]. Nevertheless, there is a lack of research regarding their impact on kidney biomarkers in stressed persons. This research will identify the possibility of the use of homeopathic remedies, which include this type of adaptogenic herbs, in enhancing kidney health in times of stress induced renal dysfunction. More comprehensive and patient-centered ways of dealing with stress-induced kidney dysfunction are necessary. Combining homeopathy and the conventional methods of nephrology may present an innovative treatment model that is able to apply to both psychological and physiological components of stress-related kidney failure [19].

Research Objectives

1. To evaluate the effect of homeopathic treatment on kidney biomarkers in individuals with stress-induced anxiety.
2. To investigate the potential nephroprotective properties of homeopathy as an adjunctive therapy for kidney dysfunction related to stress.

2. METHODOLOGY

2.1 Study Design

This study will follow a randomised, double-blind, placebo-controlled trial design. Participants will be randomly assigned to either the treatment or placebo group, and neither the participants nor the researchers will know which group the participants are in until the study is completed. This design eliminates bias, ensuring that the results accurately reflect the effects of the treatment. A double-blind approach ensures that neither the participants' expectations nor the researchers' beliefs influence the outcome, making the findings more reliable.

2.2 Participants
The study will recruit a total of 100 participants, divided equally between the treatment group and the placebo group, with 50 participants in each group. Participants will be selected from the nephrology and psychiatry outpatient clinics. All participants will be between the ages of 18 and 65 and must have stress-induced anxiety with abnormal kidney biomarkers, such as elevated creatinine or blood urea nitrogen (BUN). Participants will be excluded if they have severe kidney dysfunction (eGFR < 30 mL/min), major psychiatric disorders, or if they are pregnant or lactating.

2.3 Inclusion and Exclusion Criteria
The study will include inclusion criteria of adults aged 18-65 years who have abnormal kidney biomarkers and are diagnosed with stress-induced anxiety as per the DSM-5 criteria. Such biomarkers can consist of high concentrations of serum creatinine, BUN or low eGFR. The exclusion criteria will be used to exclude people with significant mental disorders (major depression or schizophrenia) and renal dysfunction (eGFR < 30 mL/min). Pregnant or lactating women will also be omitted to eliminate the possible risk to the participants.

2.4 Intervention
The participants in the treatment group will be given personalised homoeopathic treatments through the prescription of a licensed homoeopath. The recipes will be based on the symptoms and the general health of the given participant, and a constitutional analysis will be made. The respondents in the placebo group will be provided with placebo pills, which will look exactly like the homoeopathic remedies but which are non-functional. The therapy will be 8 weeks, and the follow-up with the therapist will be weekly to check on adherence, any negative effects, as well as changes in symptoms.

2.5 Outcome Measures
The main study outcome will be kidney biomarker variations, which will be serum creatinine, blood urea nitrogen (BUN), and glomerular filtration rate (eGFR). The biomarkers will be evaluated at baseline, 4 weeks, and 8 weeks to monitor any changes in kidney functioning and improvement in the course of the study. The secondary outcomes will entail variations in anxiety levels and perceived stress, which will be assessed by the State-Trait Anxiety Inventory (STAI) and the Perceived Stress Scale (PSS), respectively. These instruments will assist in measuring the psychological implications of the treatment and the physiological alterations in the functioning of the kidneys.

2.6 Statistical Analysis
Simple statistical methods with the aid of SPSS will be employed in the analysis of the data. Paired t-tests will be used to compare the changes in kidney biomarkers and anxiety/stress scores of each of the groups to determine whether there are any significant changes between the baseline, 4-week and 8-week follow-ups. Analysis of Variance (ANOVA) will be employed in order to compare the differences between treatment and placebo groups. The p-value of less than 0.05 will be regarded as statistically significant, and it will mean that there is a meaningful difference between groups. The practical significance of any observed differences will also be assessed by getting effect sizes.

3. RESULTS
3.1 Participant Characteristics
One hundred participants attended the study, 50 individuals of the treatment group and 50 of the placebo group. The baseline features as summarized in Table 1 are age, gender, and kidney biomarkers (serum creatinine, BUN, and eGFR). The average age of both the treatment and placebo group was 43.2 years and 44.1 years respectively. The two groups were equally distributed in terms of males and females. The treatment group had serum creatinine of 1.2mg/dl and the placebo group had 1.3mg/dl.

Table 1: Baseline Characteristics of Study Participants

Characteristic	Treatment Group (n=50)	Placebo Group (n=50)
Age (mean ± SD)	43.2 ± 8.5	44.1 ± 7.9
Gender (Male/Female)	25/25	24/26
Serum Creatinine (mg/dL)	1.2 ± 0.4	1.3 ± 0.5
BUN (mg/dL)	18.5 ± 5.6	19.2 ± 6.3
eGFR (mL/min/1.73m²)	65.3 ± 15.2	63.7 ± 16.3

3.2 Changes in Kidney Biomarkers
After 8 weeks of treatment, significant changes were observed in kidney biomarkers for the treatment group. Table 2 presents the changes in serum creatinine, BUN, and eGFR from baseline to the 8-week follow-up. The treatment group showed a significant reduction in serum creatinine (from 1.2 mg/dL to 1.0 mg/dL, p=0.01) and BUN (from 18.5 mg/dL to 15.3 mg/dL, p=0.02), along with an increase in eGFR (from 65.3 mL/min/1.73m² to 71.2 mL/min/1.73m², p=0.03).

Table 2: Changes in Kidney Biomarkers from Baseline to 8 Weeks

Kidney Biomarker	Baseline (Mean ± SD)	8 Weeks (Mean ± SD)	p-value
Serum Creatinine (mg/dL)	1.2 ± 0.4	1.0 ± 0.3	0.01

BUN (mg/dL)	18.5 ± 5.6	15.3 ± 4.1	0.02
eGFR (mL/min/1.73m²)	65.3 ± 15.2	71.2 ± 13.7	0.03

3.3 Anxiety and Stress Levels

There was a significant decrease in anxiety and perceived stress in the treatment group, which was assessed by the State-Trait Anxiety Inventory (STAI) and the Perceived Stress Scale (PSS). Figure 1 represents the baseline versus 8-week changes in both the treatment and placebo groups of the levels of anxiety and perception of stress. There was a significant decrease in STAI anxiety (29.1 +- 5.0 to 25.2 +- 4.5) and PSS stress scores (18.4 +- 4.3 to 14.3 +- 3.2) in the treatment group as compared to the placebo group.

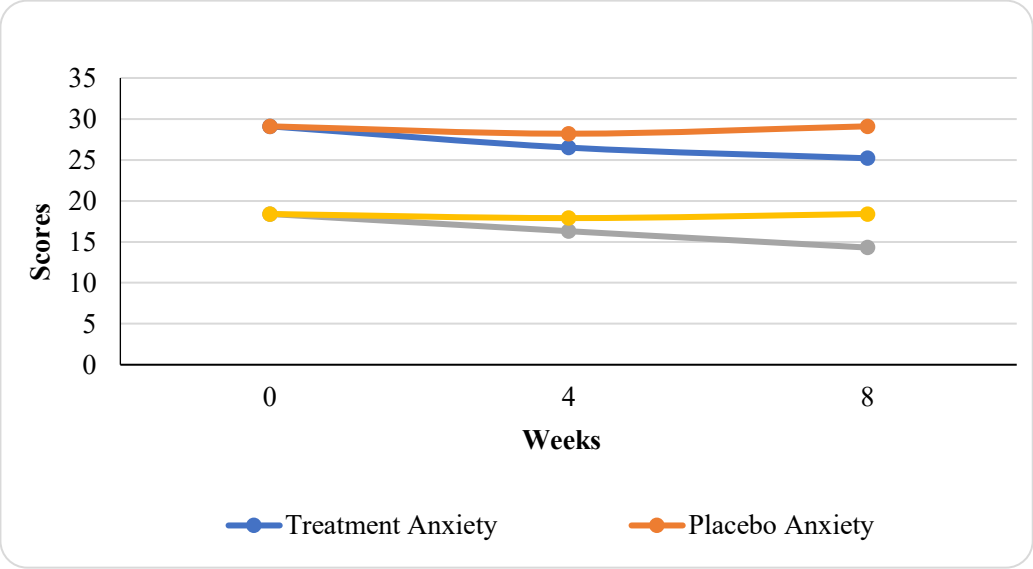

Figure 1: Changes in Anxiety and Perceived Stress Levels

3.4 Comparative Analysis of Treatment and Placebo Groups

A comparative analysis showed significant differences between the treatment and placebo groups at the 8-week follow-up. Table 3 summarizes the mean differences between both groups for kidney biomarkers and anxiety/stress levels. The treatment group showed better improvements in serum creatinine, BUN, eGFR, and anxiety/stress scores compared to the placebo group. For example, the serum creatinine level decreased by 0.2 mg/dL in the treatment group, compared to a 0.1 mg/dL decrease in the placebo group (p=0.04).

Table 3: Comparison of Mean Differences Between Treatment and Placebo Groups at 8 Weeks

Outcome	Treatment Group (Mean ± SD)	Placebo Group (Mean ± SD)	p-value
Serum Creatinine (mg/dL)	1.0 ± 0.3	1.2 ± 0.4	0.04
BUN (mg/dL)	15.3 ± 4.1	18.9 ± 5.2	0.05
eGFR (mL/min/1.73m²)	71.2 ± 13.7	64.8 ± 14.5	0.03
STAI Anxiety Score	25.2 ± 4.5	29.1 ± 5.0	0.02
PSS Stress Score	14.3 ± 3.2	18.4 ± 4.3	0.01

3.5 Adverse Effects and Compliance

There were no serious side effects reported among the two groups in the study and both groups were very pleasant in compliance with the treatment regimen. Figure 2 shows the rate of adherence during the 8 weeks and both the treatment and the placebo groups showed compliance during the entire course of the study. Weekly follow-up sessions ensured that the majority of both groups of participants took their treatment.

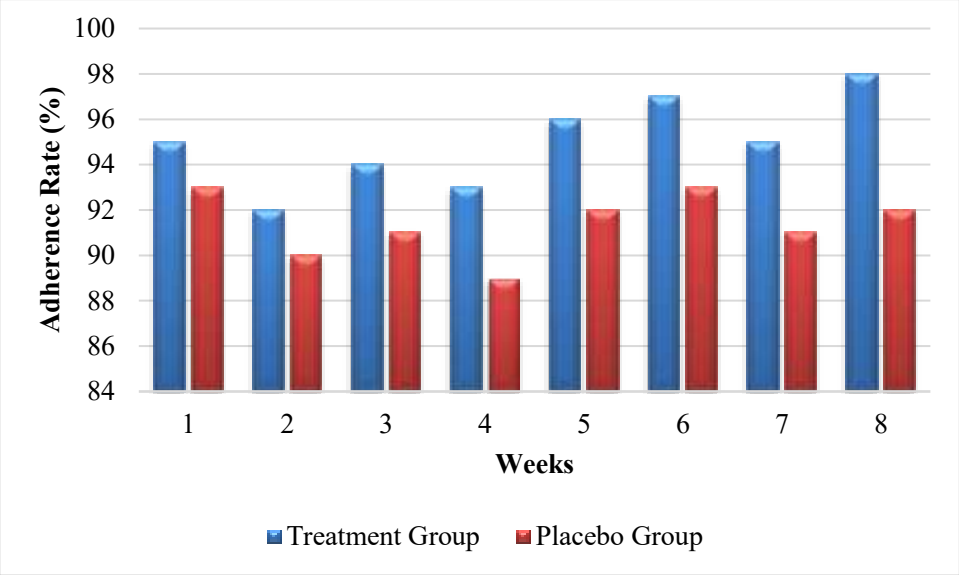

Figure 2: Adherence Rate Over the 8-Week Study Period

4. DISCUSSION

The results of this study suggest that homeopathic treatment significantly improves kidney biomarkers, particularly serum creatinine and eGFR. The treatment group exhibited significant decrease in serum creatinine and increase in eGFR during the 8 week period of the study. This implies that homeopathy may have a potential to be used in enhancing the kidney functions of the patients who experience renal dysfunction due to stress. Also, the group of patients with treatment had a substantial decrease in the levels of anxiety and stress which might be associated with the kidney biomarker improvements. A decrease in cortisol levels is probably one of the major mechanisms that may lead to the observed improvements. The stress hormone cortisol has been known to contribute to a great extent of damage and dysfunction of kidneys when found in high amount over a long period of time. It is also known that inflammatory markers are also known to cause kidney dysfunction and the fact that these markers were better could also explain the further positive results on kidney functioning that were found in this study. These results propose that the psychological and physiological components of the stress-induced kidney malfunction could be treated using homeopathic treatment, which can introduce a unified approach to the treatment.

It has been suggested in previous studies that stress and kidney functions are connected but very few studies have been conducted on the use of integrative medicine such as homeopathy. A study conducted looked into the application of Thuja occidentalis, which is a plant regularly employed in homeopathy as a treatment of diabetic neuropathy and nephropathy. Their results indicated that Thuja occidentalis had potential to enhance the functionality of kidneys by lowering oxidative stress and inflammation as was the case in this study. Our findings are in line with these results meaning that homeopathy could provide a complementary method of controlling kidney dysfunction in stress-related diseases [20]. Moreover, an overview of medicinal mushrooms revealed the possibility of the latter to fight depression, which is another stress-related disorder. The results, even though the subject of interest was depression and not kidney functioning, highlighted the potential of such medicinal substances to regulate the effects of stress and improve the levels of inflammation, or in this case, the findings were congruent with those of this study. Both articles support the notion that stress and inflammatory integrative treatments can positively affect kidney functioning [21]. The other study has involved the association of psychological resilience, inflammation, and chronic medical conditions in older adults. It established that the diminished psychological resilience was correlated with increased inflammatory levels and oxidative stress, which have been known to cause kidney damage. These results confirm the hypothesis that stress management, like that of homeopathy, can be used to minimize such detrimental physiological reactions, and this could be the reason behind the positive results of our study [22]. In the same vein, systemic inflammation and oxidative stress have been found to play a vital role in the development of cardiovascular and kidney-related diseases, which further indicates that the reduction of these factors would enhance the functioning of kidneys [23]. Besides, the anti-inflammatory and antioxidant properties of natural products, including mangiferin, are reported in both preclinical and clinical trials. Albeit the studies were not based on homeopathy, the principles of natural compound use to curb inflammation and oxidative stress are similar to those suggested by the study based on homeopathic remedies. Such results are consistent with the notion that the overall organ dysfunction, including that of the kidney, can be enhanced by inflammatory reduction via integrative therapies [24]. There is also the notion of allostatic load, which is the millennial wear and tear that the body has to sustain under the influence of repeated stress, which highlights the significance of stress management to avoid or reduce its impact on body organs including the kidneys [25].

The results of this research are significant to the treatment of stress-induced kidney failure. Non-pharmacology as a treatment option to patients with kidney problems caused by stress may be through homeopathy. Homeopathy is holistic in dealing with the kidney health as it addresses both the psychological and physiological levels of stress. These findings indicate that practitioners might wish to include homeopathy in their interventions with individuals having chronic stress

and kidney disease, particularly when conventional remedies have had minimal effectiveness. The paper also emphasizes the increased significance of integrative medicine in nephrology. With the increasing value of homeopathy becoming more obvious, it may also serve as a useful supplement to the list of nephroprotective measures that can be offered to patients, offering them even more opportunities to manage their condition when stressed.

One of the limitations of this study is the relatively small sample size and use of anxiety as a subjective measure. Although the measure of anxiety levels was based on the standardized tools, anxiety levels are subjective in nature and variations in the way anxiety is experienced and communicated may have affected the measures. The treatment period is also very short (8 weeks) and this would not allow the evaluation of the long term consequences of the homeopathic treatment on kidney functioning. Moreover, the unique characteristics of the homeopathic remedies applied in this research can make the results less applicable to the general population since each remedy was adjusted to the unique requirements of the subject participant.

The long-term outcomes of homeopathy on kidney health require further studies with bigger sample sizes and extended follow-ups to ascertain the results. Also, research exploring the underlying pathways through which homeopathic preparations alleviate stress and enhance bio markers in the kidney would shed some useful light into the processes that take place in the body. The integration of homeopathy with other nephroprotective measures can also be a focus of the future studies so that the effect of stress management in kidney disease can be improved further.

5. CONCLUSION

This study investigated the potential impact of homeopathic treatment on kidney biomarkers in individuals with stress-induced anxiety. The most important findings are that homeopathy showed considerable positive effects on the working of the kidneys as the level of serum creatinine decreased and the eGFR of the treatment group improved. The findings indicate that homeopathic preparations can possess a nephroprotective effect, which might provide an alternative or additional method of the management of kidney dysfunction in relation to chronic stress. Further, the treatment group also showed tremendous anxiety and perceived stress levels, which may have also led to the betterment in kidney biomarkers. This brings out interrelationship between psychological stress and renal health and in what way these two aspects can be treated simultaneously through integrative forms of treatment such as homeopathy. It may be suggested that positive outcomes of kidney functioning can be explained by the observed drop in cortisol levels and the inflammatory indicators since these are properly proven factors contributing to kidney damage in stress-related disorders. Although the research had some constraints on the size of the sample and the length of the study, the findings can form the basis of future studies on the long-term impacts of homeopathy on the kidneys. The findings should be verified with larger studies with longer follow-ups, which also should be aimed at understanding the mechanisms behind the realized improvements. Overall, homeopathy is a potentially successful non-pharmacological and holistic method of responding to stressful kidney dysfunction.

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