

# Effects of Laughter Yoga on Patients Receiving Hemodialysis

## A Systematic Review

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When it comes to end-stage renal disease patients, hemodialysing is one of the most critical treatments they can receive. Even if they received hemodialysis (HD) treatment regularly, patients would experience many complications such as cardiovascular disease, fatigue, anxiety, depression, sleep disturbances, and a declining quality of life. Laughter Yoga has been reported to have many positive effects on patients with chronic illnesses. By removing or reducing stress, Laughter Yoga (LY) helps to improve patients' quality of life. Thus, they have a longer chance of survival. However, the effect of Laughter Yoga on HD patients is generally inconclusive. Objective is to evaluate LY's impact on HD patients. We searched electronic databases that included Web of Science, Embase, PubMed, the Cochrane Library, Wanfang, China National Knowledge Infrastructure, and clinical trial registries. The search period was from their inception to January 29, 2023. The search keywords included laughter therapy, laughter yoga, laugh, hemodialysis, dialysis, and renal dialysis. The systematic review included both randomized controlled trials (RCTs) and quasi-experiments studies. Three RCTs and three non-RCTs met the inclusion criteria. Laughter Yoga showed patients having improvement in several outcomes such as life quality, pain severity, sleep quality, subjective well-being, mood, depression, blood pressure, and vital capacity. A well-designed RCT will be developed to further test the potential benefits of LY for HD patients.

**KEY WORDS:** *hemodialysis, laughter therapy, Laughter Yoga, systematic review* *Holist Nurs Pract* 2024;38(4):202–212

## INTRODUCTION

It is estimated that 4.9 million to 7.1 million patients worldwide require dialysis for renal failure, and the total number of dialysis patients receiving hemodialysis (HD) accounts for 89%.<sup>1,2</sup> Hemodialysis is the main treatment that improves the body's internal environment and maintains body fluid balance for end-stage renal disease (ESRD) patients. However, long-term dialysis is

prone to a series of complications such as vascular access infection, congestive heart failure, dementia, pain, decreased exercise capacity, sarcopenia, fatigue, anxiety, depression, sleep disturbances, and a decline in quality of life.<sup>3</sup> Despite the continuous development and improvement of HD technology, patient mortality remains high and life quality is compromised.

There is evidence that dialysis patients are less active than healthy people of the same age by 50% or more, and this situation is worsening.<sup>4</sup> O'Hareet

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tracked 2,264 maintenance hemodialysis (MHD) patients for one year, and analyzed the correlation between the amount of exercise and the risk of death.<sup>5</sup> The results showed that dialysis patients with low physical activity had a higher risk of death than patients with more physical activity,<sup>5</sup> implying that adequate exercise is essential for dialysis patients. Exercise brings many benefits to patients, including improvements in cardiovascular function, dialysis efficacy, mood, motor function, health-related quality of life, and various blood parameters.<sup>6-9</sup>

The forms of exercise for HD patients include aerobic exercise, resistance exercise, breathing exercise, and flexibility exercise. Yoga is an aerobic exercise that integrates body potential, meditation, relaxation techniques, and breathing.<sup>10-12</sup> It is gentle and soothing, simple and easy to learn, and is not limited by the individual's age, physical ability, and the environment. Laughter Yoga (LY) originated in India in 1995, having been first suggested by an Indian doctor, Madan Kataria.<sup>13</sup> The core techniques of LY consist of gentle warm-up exercises, simulated laughing, yoga breathing, and meditation relaxation technology.<sup>14</sup> Compared with other forms of yoga, LY practitioners do not need to go to a particular gym for learning and training, neither do they need professional equipment and professional inspection or supervision.<sup>15</sup> In addition, LY also has the characteristics of being more straightforward, safe, and low-intensity.<sup>15</sup> Practitioners can learn in a short period of time and practice alone. Exercise cost is low while patient participation is substantial as LY is easy to pursue. In most instances, LY is performed in groups since experiencing laughter in a group setting may result in more positive emotions.<sup>16</sup>

In recent years, there has been evidence indicating that LY has positive effects on certain ailments among particular groups. A study in the United States showed that health status of adults with Parkinson's disease and their caregivers had significant improvement after taking part in the LY program.<sup>17</sup> Yazdani et al. (2014) found that LY was good for nursing students' general health. The nurses showed improvement in physical and sleep disorders; their anxiety and depression levels were lowered; they were able to function better socially.<sup>18</sup> In the study by Ko and Youn, LY was found to improve insomnia, quality of sleep, and depression among older people.<sup>19</sup> The results of a study in Iran indicated that LY could be an effective method to relieve depression and anxiety among retired women.<sup>20</sup> From the above research, it can be seen that

LY is beneficial for certain ailments among particular groups. However, only a few studies have reported the effects of LY as a complementary therapy in HD patients. Hence, the efficacy of LY in patients with HD is unclear and it is hence important to evaluate scientific evidence of its benefits. Therefore, to fill this knowledge gap, a systematic review is designed to assess the effect of LY in patients on HD to provide directions for future research.

## METHODS

According to the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA guidelines), this systematic review was conducted.<sup>21</sup> This study has been registered with PROSPERO as CRD42023395722.

### Search strategy

A comprehensive LY literature search approach was conducted by PubMed, Embase, Web of Science, the Cochrane Library, China National Knowledge Infrastructure (CNKI), Wanfang databases, and clinical trial registries. The retrieval duration of the articles was from their inception to November 11, 2022. The keywords used were "Renal dialysis," "Hemodialysis," "Haemodialysis," "Laughter therapy," "Laughter Yoga," and "Laugh." We also identified the references of some important reviews through manual searches. Appropriate articles were selected by two authors independently.

### Study selection

We determined included and excluded criteria via consensus. The included studies were as follows: (1) the studies were randomized controlled trials (RCTs), quasi-experimental studies, and single group studies that adopted pretest-posttest designs; (2) the study population must be older than or equal to 18 years; (3) ESRD patients were receiving HD treatment at least twice a week for at least 3 months; (4) the articles were published either in English or Chinese; (5) LY consisted of the following steps: (a) warm-up exercises, (b) breathing exercises, (c) laughter exercises, and (d) meditation. Studies with interventions that included the above 4 core elements were included in this review; and (6) the control groups in the study were given routine care. The exclusion criterion was applied to studies that combined multiple interventions in addition to LY.

## DATA EXTRACTION

Data extraction was carried out independently by two authors. Literature screening was conducted according to the inclusion and exclusion criteria formulated in this study with the title, abstract, and full text examined. Where the two authors' opinions differed, a third researcher participated in the discussion to resolve the impasse. Information extraction content included author, publication time, country/region, sample, experimental group intervention measures, evaluation tools, and outcomes (Table 1).

### Study quality appraisal

A Cochrane Collaboration tool was used to assess RCT quality.<sup>28</sup> Study designs with pretest-posttests were evaluated according to "the Critical Appraisal Checklist for Quasi-Experimental Studies of the Joanna Briggs Institute."<sup>29</sup> Two researchers independently assessed the quality of the literature; if there was disagreement, a third party participated in discussions to provide a resolution.

### Data analysis

As a result of the high heterogeneity among the studies, such as differences in study type, evaluation scale, and intervention time, a full meta-analysis could not be performed. A qualitative description was hence used to integrate and analyze the information.

## RESULTS

### Literature search

We searched six electronic databases and one clinical trial registry to identify 47 studies. After duplicates were removed, 35 articles were reviewed. Following reading of the titles and abstracts, 18 articles did not meet the subject theme requirements, full texts were unavailable for another 5 articles, and 1 study was unpublished, leaving 11 articles. Based on the inclusion criteria, five studies were further removed and finally, six studies were included in the present study. A diagram of the PRISMA process is shown in Figure 1.

### Characteristics of the included studies

Six studies that met the inclusion criteria had publication years from 2015 to 2021. Among these, two were from Australia,<sup>22,25</sup> and one each from the United

States,<sup>23</sup> Turkey,<sup>24</sup> Korea,<sup>26</sup> and China.<sup>27</sup> Three studies<sup>23,24,27</sup> were RCTs and three others<sup>22,25,26</sup> were based on pretest-posttest quasi-experimental designs. The six studies included a total of 365 patients who were all above 18 years old.

### Interventions

LY sessions varied among the six studies. The minimum number of LY sessions was 4, the maximum was 16, while the average was 9.2. The frequency of the interventions also varied; 4 studies had interventions conducted once a week,<sup>23,25-27</sup> 1 study 3 times per week,<sup>22</sup> and one study twice per week.<sup>24</sup> A session's duration was also different, with 3 studies lasting 30 min per session,<sup>23,24,27</sup> 1 study 15 to 30 min,<sup>25</sup> 1 study 30 to 45 min,<sup>22</sup> and 1 of 60-min duration,<sup>26</sup> the longest intervention study. Of the six studies, four<sup>22-24,27</sup> reported the specific time for each LY intervention: during the first hour of dialysis in two studies,<sup>23,24</sup> within the first 2 hours of dialysis in another study,<sup>22</sup> and during the dialysis interval in a fourth study.<sup>27</sup> This information was not given in the remaining studies. Details of group attendance were not reported in the six studies. Three studies<sup>22,23,26</sup> reported attrition of sample size, while the remaining three studies<sup>24,25,27</sup> did not report on this condition. Trained and qualified laughter therapists were involved in five studies<sup>22-26</sup> but not mentioned in only one study.<sup>27</sup>

### Outcome measurements

Of the six studies that measured outcomes at pre-intervention and post-intervention for LY, only one measured outcomes three times (pre-intervention, mid-way, post-intervention).<sup>24</sup>

The DASS-21 subscales were used to measure negative emotional states (depression, stress, and anxiety).<sup>30</sup> Depression and anxiety were measured with the PHQ-4 scale in Bennett et al.'s RCT.<sup>23</sup> A Positive and Negative Affect Scale (PA-NAS) was adopted in a RCT in China.<sup>27</sup> Additionally, a 10-cm horizontal visual analog scale (VAS) was used to evaluate mood scores in Heo et al.'s study<sup>26</sup> in which the kidney disease quality of life instrument (KDQOL-SF™ 1.3) and a VAS for pain level was adopted as well. Ozer et al. used the Pittsburgh Sleep Quality Index (PSQI) to measure sleep quality.<sup>24</sup> In Brown et al.'s study, a non-validated tool was used in both the pre-and post-survey to enable the evaluation of improvement in patients feelings of well-

TABLE 1. Overview of Included Studies

Study Author (year)	Study Design	Country	Sample	Intervention	Evaluation tools and measurement time points	Outcomes
Bennett et al. (2015) <sup>22</sup>	Pre-and post-intervention study	Australia	17 patients with ESKD receiving HD treatment for more than 3 months Age ranged from 20–89 years (mean = 68.06, SD = 17.23)	LY group (n = 17) – 11 sessions 3 times/week (30–45 min) – 2 LY therapists – Contents: Breathing and stretching exercises, laughing exercises, meditation. Conducted within the first 2 hours of HD treatment.	<ul style="list-style-type: none"> <li>– Life satisfaction scale: General Life Satisfaction (GLS);</li> <li>– Subjective well-being was measured using the Personal Wellbeing Index (PWI);</li> <li>– Control was measured via Pearlín and Schooler's Mastery scale;</li> <li>– Optimism was measured using the Life Orientation Test-Revised (LOT-R);</li> <li>– Mood scale: nine affective descriptors;</li> <li>– Self-esteem was measured via the five positively worded items from Rosenberg's Self-Esteem Scale;</li> <li>– Depression, anxiety, and stress were measured by the subscales of the DASS-21;</li> <li>– Lung function (forced expiratory volume);</li> <li>– Mean arterial pressure (MAP);</li> <li>– Intradialytic hypotension (IDH) episodes;</li> <li>– Time points: [T0 to T2]</li> <li>– Depressive symptoms were evaluated by the Patient Health Questionnaire (PHQ-4);</li> </ul>	<p>There was a subtle increase in life satisfaction, positive mood, anxiety, depression, optimism, subjective well-being, and control.</p> <p>There was a slight decrease in stress. However, None of these differences were statistically significant.</p> <p>IDH episodes decreased, which was statistically significant.</p>
Bennett et al. (2020) <sup>23</sup>	Randomized controlled trial	United States	151 participants were confirmed as patients receiving HD. All adults were over the age of 18 years.	LY group (n = 72) – 8 sessions once/week (30min) – 2 LY therapists – Contents: breathing	<ul style="list-style-type: none"> <li>– Depression, anxiety, and stress were measured by the subscales of the DASS-21;</li> <li>– Lung function (forced expiratory volume);</li> <li>– Mean arterial pressure (MAP);</li> <li>– Intradialytic hypotension (IDH) episodes;</li> <li>– Time points: [T0 to T2]</li> <li>– Depressive symptoms were evaluated by the Patient Health Questionnaire (PHQ-4);</li> </ul>	<p>Laughter therapy could reduce depressive symptoms in HD patients.</p>

(continues)

**TABLE 1. Overview of Included Studies (Continued)**

Study Author (year)	Study Design	Country	Sample	Intervention	Evaluation tools and measurement time points	Outcomes
Ozer et al. (2021) <sup>24</sup>	Randomized controlled trial	Turkey	Patients did not consent to provide demographic information.  68 patients receiving HD treatment at least twice a week At least 18 years of age (mean = 62.67± 6.82)	and stretching exercises, laughter exercises and meditation  LY sessions were performed approximately 1 hour after patients commenced their HD treatment	<ul style="list-style-type: none"> <li>- Anxiety: The anxiety sub-scale of the PHQ-4</li> <li>- Subjective well-being scale: PWI;</li> <li>- The London Evaluation of Illness (LEVIL)</li> </ul> The instrument is a 6-item visual analog scale (VAS) that measures general well-being, pain, sleep, breathing, energy, and appetite.	LY Improved sleep quality and reduced pain severity in HD patients.
Brown et al. (2019) <sup>25</sup>	Pre-and post-intervention design	Australia	16 patients with ESRD receiving HD treatment 3 times per week. Age >18 years	LY group (n = 16) - 4 sessions once/week (15-30 min) - 1 LY therapist - Contents: warm-up exercises, breathing exercises, laughter exercises, meditation  Performed in the first hour of the dialysis.	<ul style="list-style-type: none"> <li>- Non-validated instruments consisting of subjective indicators of personal well-being, general feelings, personal life expectations, and hope, ability to relax, and levels of chronic pain.</li> <li>- Time points: [T0 to T2]</li> </ul>	There was an increase in positive indicators for well-being, general overall satisfaction with life, health, positive feelings, and life expectations of HD patients.  There was a decrease in adverse indicators for well-being, challenging feelings, difficulty with

(continues)



TABLE 1. Overview of Included Studies (Continued)

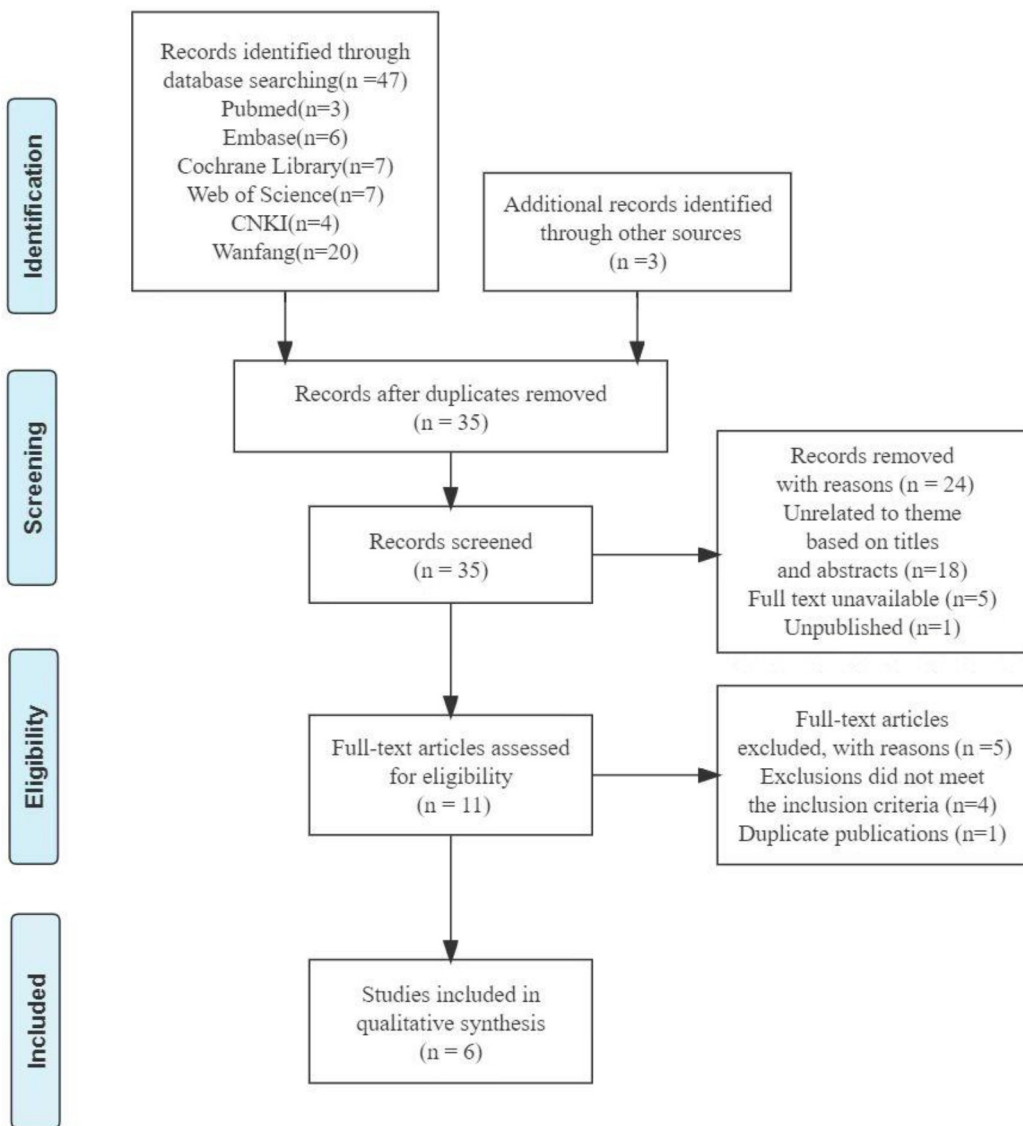
Study Author (year)	Study Design	Country	Sample	Intervention	Evaluation tools and measurement time points	Outcomes
Heo et al. (2016) <sup>26</sup>	Non-equivalent control group and pretest-posttest quasi-experimental design	Korea	40 patients with ESRD receiving HD three times per week Age $\geq 18$ HD duration of $\geq 6$ months	LY group ( $n = 11$ ) – 4 sessions once/week (60 min group sessions and daily 15 s individual laughter sessions) – 2 LY therapists and one dialysis nursing specialist who was certified through a laughter training course. – Contents: warm-up exercises, breathing, stretching exercises, laughter exercises, meditation.	– Health-related quality of life (HRQoL) scale: the kidney disease quality of life instrument (KDQOL-SF™, 1.3); – Cortisol level; – Mood was evaluated using a 10 cm horizontal visual analog scale; – Time points: [T0 to T2]	being able to relax and levels of chronic pain in HD patients after performing LY. LY significantly improved mood in HD patients. After conducting LY, the mental health and MCS (mental component summary) scores were increased; The KDCS (kidney disease component summary) in the laughter group dramatically improved after the laughter program.
Luo et al. (2021) <sup>27</sup>	Randomized controlled trial	China	73 patients with ESRD receiving HD at least twice a week. HD duration of $\geq 3$ months. Age $\geq 18$ (mean = 48.8 $\pm$ 9.0)	LY group ( $n = 36$ ) – 12 sessions once/week (30 min) – Contents: warm-up exercises, breathing exercises, laughter exercise, meditation. Performed in the dialysis interval.	– Mood scale: Positive and Negative Affect Scale (PA-NAS); – Blood pressure; – Vital capacity – Time points: [T0 to T2]	LY-enhanced positive mood, relieved negative mood, stabilized patients' blood pressure, and improved vital capacity.

LY group: Laughter Yoga group, T0: Baseline, T1: Mid-point intervention, T2: Immediately post-intervention.

being.<sup>25</sup> The London Evaluation of Illness (LEVIL) instrument is a six-item VAS; Bennett et al measured general well-being (GWB), pain, sleep, breathing, energy, and appetite using this tool.<sup>23</sup> At the same time, subjective well-being was measured via the Personal Wellbeing Index (PWI) in Bennett's studies where in one of the reports,<sup>22,23</sup> optimism was measured by the three optimism items from the Life Orientation Test-Revised (LOT-R). In the same investigation, a control scale was designed using five items from Pearlin and Schooler's Mastery scale, and a self-esteem scale using five items that had positive wording.

**Risk of bias and quality assessment**

Three RCTs were assessed for quality using the Cochrane risk of bias tool (Table 2a),<sup>23,24,27</sup> while 3 non-RCTs were assessed using the JBI critical appraisal checklist for quasi-experimental studies (Table 2b). The six studies in this review did not provide information about adverse events, and so they could suffer from some effects of other potential biases. Most of the RCT studies did not register the study protocol, and hence had an unclear selection reporting bias. In summary, the included studies provided relatively weak evidences.



**FIGURE 1.** PRISMA flow diagram for selection of relevant literature.

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**TABLE 2a.** Quality Assessment of the Three RCT Studies with the Cochrane Risk of Bias Tool

Evaluation categories	Bennett et al. (2020)	Ozer et al. (2021)	Luo et al.(2021)
Generation of random sequences (selection bias)	Low risk	Low risk	Low risk
Distribution concealment (selection bias)	Low risk	Low risk	Unclear
Blind treatment of participants and personnel (performance bias)	High risk	High risk	High risk
Blinding to outcome assessment (detection bias)	High risk	High risk	High risk
Incomplete result data are processed (attrition bias)	High risk	High risk	High risk
Selective reports (reporting bias)	Unclear	Unclear	Unclear
Other sources of bias	Low risk	High risk	High risk

**Results of individual studies**

In Bennet’s (2015) study, there were subtle increases in the levels of general life satisfaction, positive mood, optimism, subjective well-being, anxiety, depression, and control after performing LY. After the LY intervention, stress decreased slightly. However, none of these differences were statistically significant. In Bennet’s (2020) other study, In comparison to a control group, laughter therapy reduced depressive symptoms among dialysis patients. OR 0.37 (95% CI:0.13-1.01, *P* = .05). In the study by Heo et al. (2016), a better mood was observed in the laughter group than in the control group (*P* < .044), and improvement in quality of life after the laughter program. Laughter group had a higher mental health score and an improved MCS (mental component summary), as compared to the control group (*P* < .05). The KDCS (kidney disease component summary) in the laughter group also improved after

the laughter program (*P* < .05). In Ozer et al.’s (2021) study, LY improved sleep quality in HD patients. Pittsburgh Sleep Quality Index (PSQI) total scores of the LY group significantly decreased (*P* < .001) (where lower scores denoted a healthier sleep quality) and pain severity was reduced. Pain scores in the intervention group were statistically significantly different before and after implementation (*P* < .01). In the study by Luo et al. (2021), LY enhanced positive mood, relieved negative mood, stabilized patients’ blood pressure, and improved vital capacity (*P* < .05).

Brown et al.’s (2019) study revealed that positive indicators for well-being increased in HD patients. They had higher levels of general overall satisfaction with life and health, positive feelings, and life expectations. Moreover, after performing LY, HD patients had decreased adverse indicators for well-being, the challenging feeling, difficulty with being able to relax, and levels of chronic pain.

**TABLE 2b.** Quality Assessment of the Three non-RCT Studies with the Joanna Briggs Institute Critical Appraisal Tool

Evaluation questions/Areas	Bennett et al. (2015)	Brown et al. (2019)	Heo et al. (2016)
1. Did the study show clearly the cause and effect?	Y	Y	Y
2. Were these participants included in any similar comparisons?	N/A	N/A	Y
3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposures or intervention of interest?	N/A	N/A	Y
4. Was there a control group?	N	N	Y
5. Are there multiple measures of pre- and post-intervention outcomes?	Y	Y	Y
6. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?	U	U	Y
7. Was the outcome of participants included in any comparisons measured in the same way?	Y	N	Y
8. Were outcomes measured reliably?	Y	Y	Y
9. Was appropriate statistical analysis used?	Y	Y	Y

Y – YES; U – UNCLEAR; N – NO; N/A – Not Applicable

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## DISCUSSION

The aim of this review was to assess the impact of LY on patients with HD. Six studies that fulfilled eligibility criteria showed that generally, LY intervention positively affected physical function and psychosocial outcomes in HD patients. Improved physical function included better readings for blood pressure, vital capacity, sleep quality, as well as reduced pain severity. Favorable psychosocial outcomes consisted of lower scores for depression, and higher scores for better mood, subjective well-being, and quality of life.

In the included studies, one investigation showed that the number of intradialytic hypotension episodes decreased after taking part in LY intervention.<sup>22</sup> One study in China suggested that LY could stabilize patients' blood pressure, while Ozer et al.'s (2021)<sup>27</sup> study indicated that LY improved sleep quality and reduced pain severity in HD patients.<sup>24</sup>

These findings were similar to those in Gonot-Schoupinsky and Garip's (2018) systematic review showing that LY could improve blood pressure and sleep quality among older adults.<sup>20</sup> It was reported that laughter could reduce stress hormones, thus stimulating the cardiovascular and circulatory systems, resulting in increased oxygen supply and maintaining stable blood pressure and cardiac rates.<sup>31,32</sup> One study in China found that LY could improve vital capacity in HD patients.<sup>27</sup> A plausible explanation is that laughter facilitates expiratory muscle exercise and Trunk muscle mobilization, as well as improves muscle tone and relaxation.<sup>33-35</sup> Two findings in the included studies suggested that LY could relieve pain.<sup>24,25</sup> Similar to the results of the other studies, it was reported that four sessions of LY undertaken once a week in osteoarthritic patients could relieve pain.<sup>19</sup> Another study showed that pain levels significantly decreased in elderly individuals after undergoing a laughter program.<sup>36</sup>

This systematic review also revealed the effects of LY on the psychosocial status in HD patients. Three studies addressed the effect of LY on emotions in HD patients.<sup>22,23,27</sup> Two of the studies showed that LY could improve mood,<sup>26,27</sup> although the mood assessment scales used were different. Another study demonstrated that LY reduced depressive symptoms in HD patients.<sup>22</sup> However, one study indicated that LY only subtly decreased stress, and the results were not statistically different.<sup>22</sup> The results in this paper showed anxiety and depression were slightly increased, and the results were again not statistically

different.<sup>22</sup> A possible reason for consideration was the small sample size and the fact that no control group was set. These aspects could be the focus of future RCT research. The most promising intervention effect of LY was in improving mood in HD patients, although the scales for measuring mood were inconsistent. Heo et al. (2016) stated that LY improved the health-related quality of life including mental health, MCS, and KDCS scores.<sup>26</sup> The study was among the two that had the fewest number of sessions (only 4 sessions) of the 6 studies, and improved only a small percentage of participants in the health-related quality of life. The question to consider is whether the quality of life will improve with more LY sessions. Two studies also showed that LY improved subjective well-being and life satisfaction.<sup>22,25</sup> Both studies were of the single-group pre-post design. The small sample sizes for the two studies, 16 and 17, respectively was a clear limitation. One study showed only a subtle non-significant change in the statistical data analysis, and the other study showed improvements in subjective well-being and life satisfaction, but no statistical data analysis was done.

Of the six studies that were eligible for inclusion, the number of interventions per week was inconsistent, with four studies intervening once a week, one study intervening twice a week, and one study three times a week. The reason might be that LY intervention for group activities, from preparation activities to implementation, requires human and material resources and the need to be fully prepared. In that regard, the practical frequency of an intervention of once a week is reasonable. The number of sessions was different among the six studies. The quantity of meetings in two studies was four,<sup>25,26</sup> which was the lowest whereas the highest number of LY sessions was 16. It is worth thinking about whether too many sessions might be counter-productive, and whether a small number of sessions might not be as effective. Five studies had about 30 min per intervention, and only one study intervened for 60 min. One might wonder whether the patients would be too tired if the intervention were too long. To ensure the effectiveness of LY intervention, a qualified training instructor is essential. Only one of the six studies did not mention laughing therapists. Since the durations of the interventions were different, and the intervention effects were inconsistent, the optimal number of interventions could not be determined. As adverse effects during the interventions have yet to be investigated, future studies could fill this

gap. Considerable thought should also be given to promoters and barriers to selecting patients for intervention. Future studies could incorporate caregivers' views in popularizing LY.

### Limitations of the review

Although we searched a large number of databases and study protocols of clinical trial registries, some unpublished literature might still have been missed. Owing to the limited amount of original research and the high-degree heterogeneity of findings, a comprehensive meta-analysis could not be undertaken.

### CONCLUSION

This systematic review suggests that LY is generally beneficial to HD patients. Improved physical functions include lower blood pressure and pain severity while vital capacity and sleep quality are enhanced. Favorable psychosocial outcomes include lower levels of depression, and improved mood, subjective well-being, and quality of life. However, more in-depth research is needed to prove the effects of LY more conclusively. Future research should establish a strict training and assessment mechanism and develop a replicable operational process or manual to ensure standardized and reproducible intervention effects. Future adequately powered RCT studies should be undertaken, utilizing a longer-term follow-up period, with demographic characteristics standardized to improve research quality. A more comprehensive meta-analysis should be attempted when the number of studies increase in future.

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