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Effect of Baduanjin Exercise on the Rehabilitation of Maintenance Hemodialysis Patients: A Systematic Review and Meta-Analysis

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Abstract: *Background:* Enhancing the physical function, psychological state and quality of life of hemodialysis patients represents a significant challenge in the rehabilitation process. Baduanjin training is a Chinese martial-arts exercise combined with TCM (traditional Chinese medicine), and increasing numbers of studies have shown its positive effects on clinical rehabilitation of maintenance different groups. However, there is currently no systematic review to evaluate the effect of Baduanjin training on the rehabilitation of hemodialysis patients. *Objective:* To systematically evaluate the effects of Baduanjin on physical function, psychological state and quality of life of hemodialysis patients. *Methods:* Six databases (PubMed, Web of Science, China National Knowledge Infrastructure, Wanfang, China Biology Medicine, China Science and Technology Periodical) were searched from inception through July 2025. Randomized controlled trials (RCTs) evaluating the effect of Baduanjin exercise on the clinical physical rehabilitation of patients were included. Review Manager 5.4 software was used to assess the risk of bias in the included studies and to conduct a comprehensive analysis of the data in accordance with the methods provided in the revised Cochrane Handbook. *Results:* Baduanjin training showed significant benefit for the rehabilitation of maintenance hemodialysis patients, including overall quality of life, psychology and physical function and their sub-domains, but no significance was found in 6MWD or ASM (a sub-domain of life), HB or Serum Phosphorus (a sub-domain of physical). No related adverse events were reported in the included studies. *Conclusions:* The research results of this review indicate that Baduanjin is safe and effective for the psychological rehabilitation and quality of life improvement of maintenance hemodialysis patients, and may be beneficial to some physical functions. However, before drawing more definite conclusions, more trials with larger sample sizes and more rigorous designs are needed.

Keywords: Baduanjin Exercise; Maintenance Hemodialysis; Systematic Review.

1. Introduction

Hemodialysis is the most important method of renal replacement therapy, which can effectively remove water and toxins retained in the body of patients with end-stage kidney disease. Current studies show that the life cycle of hemodialysis patients has been significantly prolonged, but their physiological indicators, psychological state and quality of life are significantly lower than those of healthy people during the rehabilitation process. Therefore, it is urgent to improve the quality of life and psychological state of hemodialysis patients. Baduanjin, as a traditional Chinese physical and mental exercise, focuses on symmetrical postures, unity of body and mind, and natural breathing. Baduanjin is a traditional fitness method that combines traditional Chinese medicine and martial arts. It can have a deep-inhalation effect on people [1].

Previous studies have reported that Baduanjin exercise might be an effective way to alleviate the psychological state of hemodialysis patients and enhance their physical fitness. However, to the best of our knowledge, there has been no systematic review reporting on the impact of Baduanjin exercise on the physical and mental health of hemodialysis patients so far.Therefore, this study aims to assess the effects of Baduanjin exercise on the physical function, psychological state, and quality of life of hemodialysis patients.

2. Methods

2.1. Eligibility Criteria

The inclusion criteria for the current systematic review were established as follows: (1)only RCTs regarding the effect of Baduanjin exercise on rehabilitation were included; (2)participants were dialysis patients (peritoneal dialysis or hemodialysis patients); (3) the intervention measures for the treatment group were regular Baduanjin training for at least eight weeks, at least twice a week, each session lasting no less than 20 minutes, or regular Baduanjin training combined with other non-exercise interventions; (4) the control group had no specific exercise intervention but maintained routine care, or received the same non-exercise intervention as the treatment group; (5) the outcome indicators were overall physical function or at least one specific psychological domain assessed through clinical psychological evaluations (SAS, HAMD, SDS) or other objective measurements.

2.2. Search Strategy

Electronic literature retrieval was conducted using six literature databases (PubMed, Web of Science, CNKI, Wanfang, China Biomedical Literature Database, and China Science and Technology Journal Database). The search period covered from the establishment of each database to July 2025. The search terms included: Baduanjin, Chinese martial arts/martial arts, Qigong, exercise rehabilitation, exercise

therapy, sports rehabilitation, dialysis, hemodialysis, and related terms. For Chinese databases, corresponding Chinese search terms were used.

2.3. Study Selection

All retrieved records were imported into the reference management software (Note Express 4.2). After removing duplicate records with this software, two independent reviewers (WDT, ZAW and ZL, LSC) screened the studies that met the inclusion criteria by reading the titles, abstracts or full texts according to the pre-defined inclusion criteria. In case of disagreement, a third reviewer (YHZ) was consulted to resolve the issue through discussion.

2.4. Data Extraction and Quality Assessment

Two independent groups of reviewers (WDT, ZAW and ZL, LSC) extracted data from eligible studies. The extracted data included basic information of the studies, demographic characteristics of the participants, frequency and duration of Baduanjin exercise, control conditions, outcomes and their measurements, and adverse events. Any discrepancies were resolved through discussion with a third reviewer (YHZ). Two reviewers independently assessed the methodological quality of eligible studies using the optimized assessment tool for risk of bias in the Cochrane Handbook [2].

This optimization tool is derived from the 8 evaluation criteria of the revised design of the PRISMA[3] statement for scoring: 1.clear inclusion criteria; 2.randomization; 3.no significant differences in baseline values between groups; 4.blinding of assessors for the primary outcome; 5.all participants receive the intervention as per the protocol, or the primary results are analyzed using an 'intent-to-treat' approach; 6.description of dropout or missing data, with a dropout rate <20%; 7.the number of participants meets the required sample size; 8.reporting of outcomes, effect sizes, and precision for each group. Finally, the literature is categorized into three risk levels based on cumulative scores: low risk (7-8 items), moderate risk (4-6 items), and high risk (0-3 items).

2.5. Data Analysis

The meta-analysis was performed utilizing Review Manager 5.4 software. For continuous outcome measures, data were synthesized employing either mean difference (MD) or standardized mean difference (SMD) with corresponding 95% confidence intervals (CIs) between intervention and control groups.

Effect sizes were pooled using a fixed-effects model when available data demonstrated no substantial heterogeneity; otherwise, a random-effects model was implemented where applicable. Heterogeneity across studies was assessed through Higgins I^2 statistics and chi-square tests.

3. Results

3.1. Study Search and Selection

A total of 175 records were retrieved from the electronic database. After removing 24 duplicate records, 120 records with unclear titles and abstracts were excluded. Next, 31 full-text articles were evaluated for eligibility, and 19 were excluded. The reasons for exclusion included: inappropriate indexing and data (n=12); incomplete data (n=4). Ultimately, 15 studies involving 1,396 participants were included in the final analysis. The flowchart of study selection is shown in Figure 1.

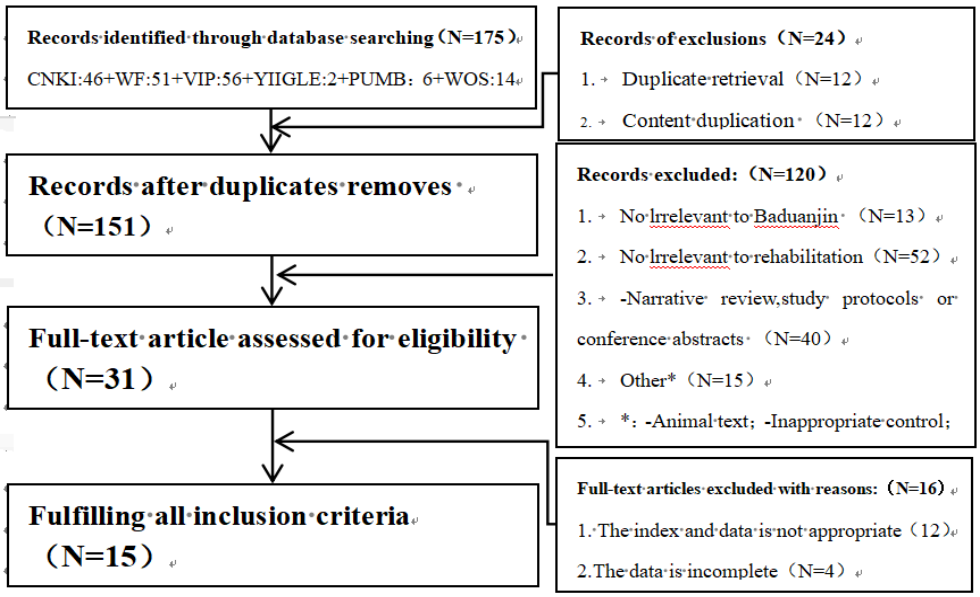

Figure 1. Flow diagram of literature search and selection

3.2. Characteristics of Included Studies

The characteristics of the included studies are systematically summarized in Table 1. Among these randomized controlled trials (RCTs), 15 studies specifically compared Baduanjin intervention with non-exercise control groups (e.g., standard physical activity regimens and routine care protocols). The duration of Baduanjin exercise interventions exhibited considerable variation, spanning from 8 weeks to 48 weeks, with exercise frequency maintained at 3 to 4 sessions per week. Each session duration ranged from 20 to 240 minutes.

3.3. Risk of Bias Assessment

The risk of bias assessment, as presented in Table 2, includes both the risk of bias table [2] and the authors' methodological evaluations. Among the 15 included randomized controlled trials, while all studies reported

randomization procedures, only one explicitly documented the blinding of outcome assessors. The methodological quality assessment revealed that 10 studies were classified as low risk (scoring 7-8 points), while 5 studies were categorized as moderate risk (scoring 4-6 points), yielding an overall mean score of 6.53 points.

3.4. Measures of the Effects

This study included ten research indicators involving 1,396 participants to assess the impact of Baduanjin on physical function, psychological state, and overall quality of life.

Ten studies were evaluated, involving 1,396 participants, aiming to explore the effects of Baduanjin on physical function, psychological state, and overall quality of life in hemodialysis patients. The results indicated significant differences in quality of life, no obvious improvement in the physical aspect, but a significant enhancement in mental health. Detailed analysis is as follows:

3.4.1. Physical Function

Five studies reported the effects of Baduanjin on physical function, using HB, CRP and P+ as indicators. The meta-analysis showed that Baduanjin significantly reduced CRP levels (MD=-0. 64; 95%CI= -0. 92, -0.36; P=0.00001). The remaining two studies (HB, P+) indicated no significant difference between the Baduanjin group and the control group.

3.4.2. Overall Quality of Life

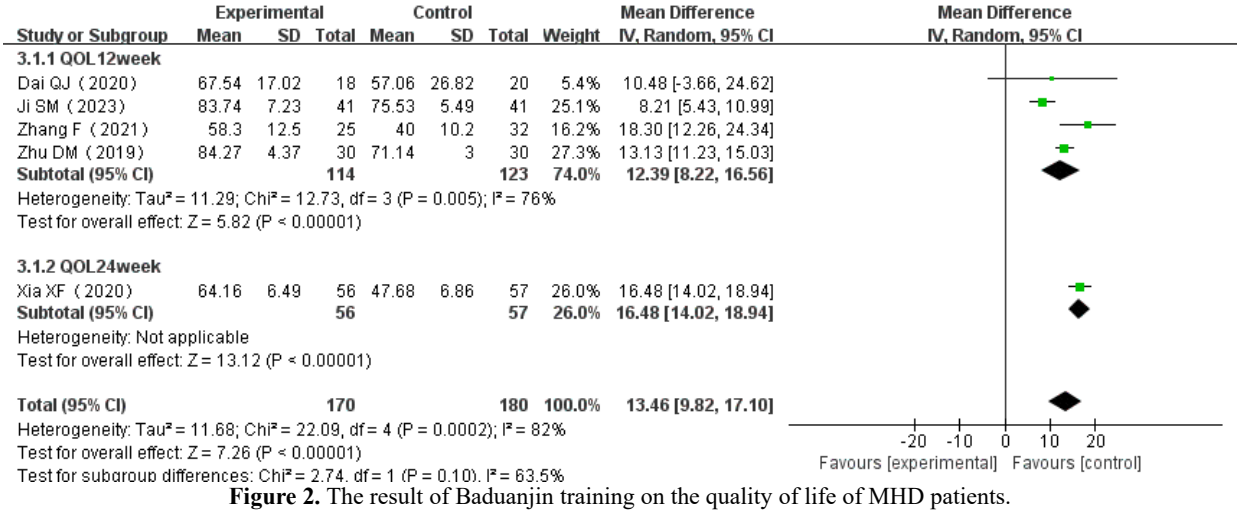

Figure 2. The result of Baduanjin training on the quality of life of MHD patients.

Table 3 shows the analysis of Baduanjin training for the physical rehabilitation, including six studies with a total of 547 participants. Three studies with 240 participants reported the effect of Baduanjin on the muscle function measured by HGS. Meta-analysis revealed significant improvement (MD= 4.12;95%CI=2.96,5.27; P=0.00001; I^2=0). The remaining two studies (ASM, 6MWD) showed no significant difference between the Baduanjin and control groups.

Fig.2 shows the analysis of Baduanjin training for the quality of life. Five studies involving 350 participants were assessed for the (QOL) scores over 12 weeks or 24 weeks. But there was heterogeneity among these studies (MD=13.46; CI:9.82,17.10; P<0.00001; I^2=82%). Sensitivity analysis by excluding Ji SM did not significantly change the results.

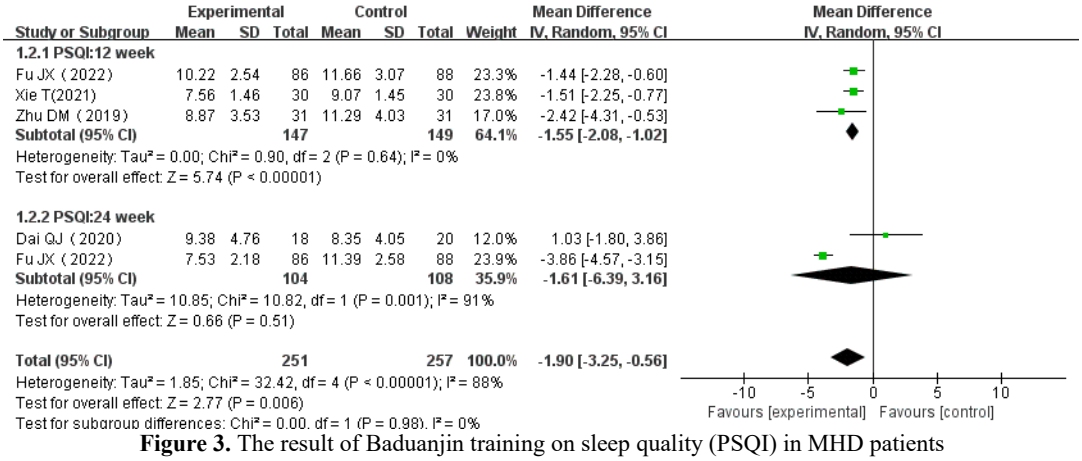

Figure 3. The result of Baduanjin training on sleep quality (PSQI) in MHD patients

Fig.3 presents a study on PSQI using the Mean Difference (MD) statistical method for continuous variables with identical measurement units. The I^2 = 0% at 12 weeks indicates acceptable heterogeneity according to the Cochrane Handbook standards (I^2<50%), thus employing a Fixed Effects Model (FE). No significant heterogeneity was observed with p<0.05, confirming that Baduanjin significantly improved sleep quality in dialysis patients during 24 weeks of rehabilitation training. For the 6-month follow-up analysis where I^2 = 91%, a Random Effects Model (RE) was adopted. However, the combined effect showed no statistically significant difference (p=0.51). As PSQI questionnaires require at least 100 participants for valid data, Dai QJ's study suffered from insufficient sample size leading to potential bias. Overall, Baduanjin demonstrated significant improvement in sleep quality indices (MD = -1. 90; 95% CI:-

3.25, -0.56; P = 0. 006; I^2 =88%) among dialysis patients.

Table 1. Characteristics of included studies.

Author year	NO. of participate (EG/CG)	Intervention	Per-session duration	Frequency	Week	Control	Outcome/Measurements
Fu JX (2022) [1]	174(86/88)	Baduanjin exercise	30~40min	3	24	usual care	SPQI,SAS,SDS
Zhu DM(2019)[4]	60(30/30)	Baduanjin exercise	20min	3	12	usual care	PSQI,QOLRPFS
JiSM (2023)[5]	82(41/410	Baduanjin exercise+PMR	30min	3	8	usual care	PSQI,KDTA
Wang XF(2022)[6]	200 (100/100)	Baduanjin exercise	40min	3	24	usual care	HAMD,RPFS,6WMD,30S-STS
Zhu XY(2024)[7]	91(46/45)	Sitting Baduanjin exercise+ATC	20~50min	3~5	20	usual care	SDS ,SAS,IDWG
Wu X (2021)[8]	115(58/57)	Baduanjin exercise	20~30min	3	12	usual care	RPFS,IPAQ -SF,SMI,HGS
Dai QJ (2020)[9]	40(18/20)	Baduanjin exercise	210~240min	3	26	usual care	SF-36,PSQI,BMI
Xie T (2021)[10]	62(31/31)	Baduanjin exercise	40min	3	12	usual care	RPFS,PSQI,HAMA/HAMD
Tian R (2020)[11]	97(45/47)	Baduanjin exercise	40min	3~4	48	usual care	MoCA, ADL, PSMS, IADL
Ding ZR(2020)[12]	120(60/60)	Baduanjin exercise	15min	3	12	usual care+FHS	HAMD,5-HT,NE
Dang XB (2023)[13]	38(18/20)	Baduanjin exercise	30min	3	24	usual care	CMS,FTSST,TUGT,SOLECT
Xia XF (2020)[14]	120(56/57)	Baduanjin exercise	15min	3	24	usual care	CFL,SF-36
Pan W(2024)[15]	72(36/36)	Baduanjin exercise	30min	4	24	usual care+PD	LIVE,BNP,HGB,ALB; MLHFQ,KDQ
Zhang F(2021)[16]	57(25/32)	Baduanjin exercise	30min	3~4	12	usual care	TSST,TUGT,HGS,HRQOL
Wang J(2023)[17]	68(33/35)	Baduanjin exercise +PNS	30~60min	3	12	nutritional support only	GS, NLR

Abbreviations: FHS, fluoxetine hydrochloride capsules; PMR, progressive muscle relaxation; ATC, aversion therapy combined; CFL, cardiac functional level; PNS, plus nutritional support; FTSST, five times sit-to-stand test; TUGT, timed up and go test; HGS, handgrip strength; HRQOL, kidney disease quality of life-short form; SDS, self-rating depression scale; SAS, self-rating anxiety scale; PP/RPFS, revised piper fatigue scale; HGS, handgrip strength measurement. SF-36, short-form 36-item health survey; HAMD, Hamilton Depression Rating Scale; PSQI, Pittsburgh Sleep Quality Index; ASM/ht^2, Appendicular Skeletal Muscle Mass Index.

Table 2. Risk of bias assessment of included studies.

Studies	Assessment criteria								Total
	1	2	3	4	5	6	7	8	
Fu JX(2022)	√	√	√	√	√	√	√	√	8
Zhu DM(2019)	√	√	√	?	×	×	√	√	5
Ji SM(2023)	√	√	√	?	?	?	√	√	5
Wang XF(2022)	√	√	√	?	√	√	√	√	7
Zhu XY(2024)	√	√	√	?	√	√	√	√	7
Wu X(2021)	√	√	√	?	√	√	√	√	7
Dai QJ(2020)	√	√	√	?	√	√	√	√	7
Xie T(2021)	√	√	√	?	√	√	√	√	7
Tian R(2020)	√	√	√	?	√	√	√	√	7
Ding ZR(2020)	√	√	√	?	√	√	√	√	7
Dang XB(2023)	√	×	√	×	√	√	√	√	6
Xia XF(2020)	√	√	√	×	√	√	√	√	7
Pan W(2024)	√	√	√	×	×	√	√	√	6
Zhang F(2021)	√	√	√	×	√	√	√	√	7
Wang J(2023)	√	?	√	×	×	√	√	√	5

Annotation: 1. clearly defined inclusion criteria. 2.Randomized Controlled Trials. 3.No significant differences in baseline values between groups. 4.Blinding of assessors for the primary outcome measures. 5.All participants received the intervention as per the protocol, or the primary outcomes were analyzed using an intention-to-treat analysis. 6.Describe the reasons for withdrawal or missing data, with a withdrawal rate <20%. 7.The number of participants meets the required sample size. 8. Report the results, effect sizes, and precision for each group.

Table 3. Effectiveness of Baduanjin exercise on sub-domains of rehabilitation.

Subdomain of rehabilitation	NO.of studies	NO.of participants	MD (95%CI)	P value	Effect model	I^2(%)
Physical function						
HB24week	1	174	2.83 [-0.86, 6.52]	0.13	FEM	-
HB24week	4	395	-1.80[-9.23, 5.62]	0.63	REM	95
C-reactive protein	2	212	-0.64[-0.92,-0.36]	0.00001	FEM	0
Serum Phosphorus	3	247	-0.07 [-0.25,0.10]	0.41	REM	69
Overall Quality of Life						
HGS	3	240	4.12 [2.96, 5.27]	0.00001	FEM	0
ASM/ht²	2	183	-0.09[-0.30,0.11]	0.38	FEM	16
6MWD	5	508	0.25 [-0.23, 0.73]	0.31	REM	85
QOL	5	450	13.46[9.82,17.10]	0.00001		82
Psychological state						
Fatigue	6	697	-0.68[-0.96,-0.40]	0.0001	REM	81
HAMD12week	3	338	-0.76[-1.07,-0.45]	0.00001	REM	92
HAMD24week	1	200	-1.51[-2.00,-1.02]	0.00001	FEM	-
SDS12week	1	174	-3.60[-5.43,-1.77]	0.0001	FEM	-
SDS24week	2	265	-6.57[-7.97,-5.16]	0.00001	FEM	0

3.4.3. Psychological States

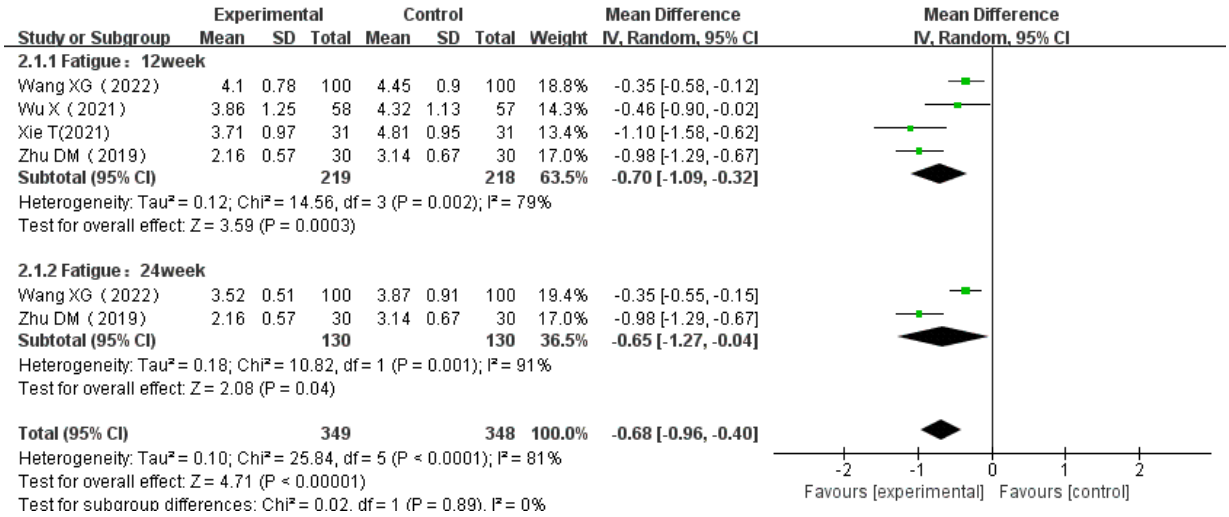

Figure 4. The result of Baduanjin training on Fatigue (PP) in MHD patients.

Tab 3 and Fig.4 show the analysis of Baduanjin training on the psychological state. It includes seven studies with a total of 665 participants. Regarding the sub-domain of psychological state, fatigue was assessed using the digit PP Short Form in six studies, and HAMD was used for 12 weeks in three studies, HAMD for 24 weeks and SDS for 12 weeks in one study, and SDS for 24 weeks in two studies, and the pooled results show significant improvement in the Baduanjin intervention group, with the pooled MD values being depressed -0.68(95%CI: -0.96, -0. 40; P<0. 0001), -0. 76(95%CI: -1.07, -0.45), -1.51(95%CI: -2.00, -1.02), -0. 36(95%CI: -5.43, -1.77), and-6.57(95%CI: -7.97, -5.16), respectively, compared with those of the controls.

Regarding the sub-domain of HAMD and SDS, the pooled results were assessed. The results showed significant improvement in the 24 - week Baduanjin intervention groups, with the pooled MD values decreasing to - 0.98(95%CI=-1. 24,-0. 71; P=0. 01)and-5. 47 (95%CI=-6 58, -4.35; P=0.01), compared with those of the 12-week groups. No significant difference was found between weeks 12 and 24 in the fatigue test(MD= -0. 68; 95%CI=-0.96,-0.40; P=0.89).

3.5. Adverse Effects

Among the studies conducted, no severe adverse events were documented throughout the Baduanjin training sessions. One study reported that two participants in the Baduanjin groups quit the trial because of kidney transplant surgery during the intervention period. Another study reported that one participant withdrew from their study because of significant aggravation of recurrent pulmonary infections.

4. Discussion

This systematic review assessed the effects of Baduanjin on physical function[18] overall quality of life and psychological state in the MHD patients. This systematic review encompassed ten studies with a total of 1,396 participants. All selected studies were specifically designed to compare the effects of Baduanjin exercise with non-exercise control groups. Methodological assessment indicated that the included studies demonstrated moderate methodological quality. The results showed that while Baduanjin did not significantly improve physiological indicators, it notably

enhanced hand grip strength, quality of life, and psychological state. In the specific domain of psychological research, the Baduanjin exercise group demonstrated significant positive outcomes across multiple validated assessment scales, including the Revised Piper Fatigue Scale, the Hamilton Depression Rating Scale, the Self-Rating Anxiety Scale, and the Self-Rating Depression Scale. And, as time went on (12 to 24 weeks), the improvement became more significant. For the specific domain of quality of life, the positive effects favoring the Baduanjin exercise group were the Pittsburgh Sleep Quality Index and handgrip strength, but no obvious improvement was found in 6MWD and ASM. The reviewed studies did not report any adverse effects associated with Baduanjin exercise. Consequently, this traditional Chinese exercise modality appears to be both safe and potentially beneficial for enhancing rehabilitation outcomes in maintenance hemodialysis patients.

Baduanjin, a traditional Chinese Qigong practice renowned for its integrated focus on physical and mental well-being, systematically regulates the body, breath, and mind through characteristic movements to achieve therapeutic effects. This regimen emphasizes mind-body harmonization, alignment with natural rhythms, and the maintenance of Yin-Yang equilibrium. Its specific postures—such as "Supporting the Heavens with Both Hands to Regulate the Triple Burner" and "Swaying the Head and Tail to Dispel Heart Fire"[1,14] demonstrably alleviate negative emotional states including chronic illness-associated irritability, anger, anxiety, and depression. Characterized by the integration of dynamic exertion with stillness, relaxed tranquility, gentle pacing, and continuous fluid motion, the practice is frequently performed to soothing music to enhance overall bodily function. Consequently, regular engagement in Health Qigong Baduanjin significantly enhances upper and lower limb muscle strength, joint flexibility, and postural stability in middle-aged and elderly populations, while markedly enhancing respiratory system function within this demographic [16-18].

5. Conclusion

In summary, a comprehensive systematic review and meta-analysis was conducted to evaluate the efficacy of Baduanjin training on the rehabilitation of MHD patients. The findings generally suggest that Baduanjin is safe and effective in enhancing sleep quality and quality of life in MHD patients, and alleviates depressive and anxious symptoms, and may benefit parts of physical function, such as mitigating inflammatory responses while augmenting muscular capacity.

Author Contributions

All authors actively participated in the research process of this study. WDT and ZAW were responsible for the conceptualization and design of the study, conducted data analysis and quality assessment of the included studies, and drafted the manuscript. YHZ, ZL, and LSC performed the literature search and data extraction procedures. All authors contributed to the intellectual discussion, critically reviewed, and revised the manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

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