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Effects of Cognitive Training and Social Support on Cancer-Related Fatigue and Quality of Life in Colorectal Cancer Survivors: A Systematic Review and Meta-Analysis

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Abstract

Background: Few studies have evaluated the effects of cognitive training and social support on cancer-related fatigue and quality of life. We performed a meta-analysis of randomized controlled trials to examine the efficacy of cognitive training and social support in colorectal cancer patients and survivors. **Methods:** The PubMed, Ovid, EMBASE, Cochrane Central Register of Controlled Trials, and China National Knowledge Infrastructure databases were searched from database establishment until August 2021 to identify suitable studies according to relevant key words, taking cancer-related fatigue and quality of life as the outcomes. The Jadad scale was used to evaluate the methodological quality of the studies. Stata 15.1 software was used for statistical analyses, and sensitivity analyses were performed. **Results:** Eleven studies (6 published in English and 5 published in Chinese) involving 980 patients and survivors were included in the meta-analysis. All studies had Jadad scores $\geq$3. Statistically significant effects of cognitive training and social support were detected for cancer-related fatigue within 14 weeks (SMD = −1.13, $P < .001$) and after 14 weeks (SMD = −0.56, $P < .001$), overall quality of life within 14 weeks (SMD = 0.73, $P < .001$) and after 14 weeks (SMD = 0.54, $P = .003$). However, no statistically significant effects of the combination intervention were detected on long-term QOL (SMD = 0.50, $P = .435$). **Conclusions:** Distinct cognitive interventions and a combination of cognitive and social support interventions can help to alleviate long-term and short-term CRF and short-term QOL. Further studies are needed to examine the mechanisms of cognitive training and social support for cancer-related fatigue and overall quality of life in patients and survivors with colorectal cancer.

Keywords

quality of life, cognitive training, colorectal neoplasms, social support, cancer-related fatigue

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Introduction

The National Comprehensive Cancer Network (NCCN)[1] of the United States released the 2018 edition of the "Clinical Practice Guide for Cancer-Related Fatigue," which defines cancer-related fatigue (CRF) as "painful, persistent, subjective, physical, emotional, or cognitive fatigue that is not consistent with the amount of recent activity that is related to cancer or cancer treatment and hinders daily function." CRF is a common subjective symptom experienced by patients with cancer and cancer survivors.[2] It develops rapidly, is often severe, lasts for a long time (generally more than 6 months) and is not relieved by rest and sleep. The disease itself and treatment measures promote the development of CRF.[3] The high energy consumption of colorectal cancer cells and treatment measures, such as surgery, radiotherapy and chemotherapy, easily lead to fatigue and affect physical function. In addition, medical treatment of cancer focuses not only on the treatment of the disease itself but also on improving the quality of life (QOL) of patients and

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cancer survivors, which is a recent focus. World Health Organization[4] refers to QOL as the experience of individuals in different cultures and value systems of living conditions related to their goals, expectations, standards, and concerns, including their physical health, psychological state, independence, social relations, personal beliefs, and relationship with their environment. CRF may reduce QOL by affecting physical function. The effects on the QOL of patients with cancer are greater than the effects of pain, nausea, and vomiting.[5] Therefore, we chose both QOL and CRF as the outcomes.

Nondrug interventions for CRF and QOL have become a research hotspot. Interventions targeting CRF and QOL should not be limited to hospitals but should also involve families and communities. Recent studies of the effects of nondrug intervention programs for CRF showed that common nondrug interventions, such as nutritional support, social support, and appropriate exercise, improved CRF,[6-8] health-related QOL and clinical outcomes.[9-12] Cognitive intervention refers to a series of psychological intervention measures to correct patients' incorrect or distorted understanding, change patients' negative views and attitudes toward themselves, others and things, and promote patients' emotional and behavioral changes. Therefore, cognitive intervention includes psychological intervention, emotional support, and cognitive behavioral intervention.[13] Occupational therapy refers to purposeful and selective occupational activities to maximize the functional recovery of patients with physical, mental, and social participation. Therefore, cognitive behavioral therapy is also called cognitive occupational therapy in some studies. As an external resource, social support provides protection to individuals under stress; that is, it plays a buffering role against arousal. In addition, it is important to maintain a generally good emotional experience.[14] Some studies have shown that good social support is an important means to reduce CRF and improve QOL.[15-17] In addition, many studies have shown a strong correlation between cognitive interventions and social support.[18,19] Some psychological interventions have been defined as various kinds of interventions provided to influence or change cognition, emotion, behavior, social interventions, or a combination of these.[20,21] In addition, some studies have also shown that combined interventions for social support and cognitive skills can help to improve the psychological function of cancer patients.[22] Thus, the 2 interventions can be combined to analyze the impact of common social-cognitive interventions on cancer patients and cancer survivors. An experimental study of the effects of nondrug interventions on colorectal cancer found that the combination of social interactions and cognitive stimulation regulated serum inflammatory factors, intestinal mucosal inflammatory factors and hypothalamic ghrelin levels.[23] Social interaction and cognitive stimulation may regulate inflammatory factors and the hypothalamic–pituitary–adrenal (HPA) axis in patients with colorectal cancer. The regulation of inflammatory factors and the role of the HPA axis are important contributors to the pathogenesis of CRF in patients with colorectal cancer.[24-28] Thus, social interaction and cognitive stimulation may alleviate CRF in colorectal cancer patients.

Previous studies have examined the effects of nutritional support and exercise on CRF and QOL using meta-analysis.[10,29] However, a meta-analysis of the effects of cognitive interventions and social support on CRF and the QOL of patients with cancer and cancer survivors was not performed. The duration of cognitive and social support interventions generally ranged from 2 weeks to 6 months in similar studies.[30-33] Fourteen weeks was the median duration, and the present study used 14 weeks as a cutoff point. The present study performed a meta-analysis to assess the efficacy of cognitive training and social support within and after 14 weeks in alleviating CRF in colorectal cancer patients and survivors after surgery.

Materials and Methods

Literature Search Strategy

We followed the standard PRISMA criteria for reporting meta-analysis. The electronic databases PubMed, Ovid, EMBASE, Cochrane Central Register of Controlled Trials, and the China National Knowledge Infrastructure database were searched from database establishment until August 2021 for the following terms:

- Cognitive stimulation OR Cognitive training OR Social Support OR Occupational therapy
- Colorectal neoplasms OR Colorectal cancer
- Cancer-related fatigue.

Studies performed using human subjects were identified, and the language was limited to English and Chinese. Language was evaluated after the search. At least one or more indicators of CRF or QOL should be used as study outcomes. The reference lists of reviews and retrieved articles were also searched manually. Abstracts or unpublished reports were not considered. The interventions of the included studies included distinct cognitive training-related measures, distinct social support or a combination of these 2 approaches. Face-to-face and online intervention modes were considered.

Members of the study team read each article in detail to analyze the measures included in the intervention, and each article was analyzed by 2 authors independently (DL and XYW). A third reviewer (STH) mediated the discussion when there was a disagreement. All the measures were described in the description of the clinical characteristics of the included studies. Subgroup analysis was also conducted to analyze the differences between the 2 distinct interventions and comprehensive interventions.

Inclusion and Exclusion Criteria

Clinical trials of patients (adults and children) with colorectal cancer and cancer survivors who underwent elective colorectal surgery and chemotherapy were included. The measures of the intervention group were cognitive training-related measures, distinct social support or a combination of these 2 interventions. The measures in the control groups were usual care, conventional care or conventional healthy education. The outcome indicators of each study included CRF, QOL and other related indicators, such as emotional or physical function. Studies that were not coordinated or performed by a specialized team were excluded. CRF and QOL were evaluated using associated questionnaires. CRF and QOL that were not assessed using standardized and validated questionnaires were excluded. Randomized and nonrandomized controlled trials were included. Cross-sectional, qualitative and pilot studies were excluded. When duplicate articles from the same institution were reported, the better quality or most recent publication was included unless the endpoints were mutually exclusive or were measured at different time intervals. Other exclusion criteria included the following factors:

- Animal studies,
- Lack of approval of the local ethics committee,
- Incomplete outcome data and
- Undetermined study type.

Data Collection and Validity Assessment

Three researchers participated in data retrieval collection and validity assessment. All procedures were performed manually. Two of the authors (DL and XYW) independently extracted the data and consulted with each other to resolve any disagreements. The collected data included the name of the first author, country of origin of each study, year of publication, intervention phase and measures, study type, number of patients or cancer survivors, treatment, measures of control groups and length of treatment. A third reviewer (STH) mediated the discussion when a consensus could not be reached.

The methodological quality of the studies included in the meta-analysis was scored using the Jadad[34] scale, which is a 5-point (from 0 to 5) quality scale designed to evaluate random allocation, blinding, and loss to follow-up in each study. Two reviewers (DL and XYW) independently performed study quality assessments. A random number table or computer-generated random sequence was used for grouping, and the score was 2. Trials that mentioned random grouping but did not explain the specific method received 1 point, and a 0 point was assigned when no randomization method was used. The double-blind method was assigned 2 points. When the double-blind method was mentioned but not explained, the study received 1 point. The score for no blinding method was 0. Studies in which the number and reasons for withdrawal and loss to follow-up were described in detail received 1 point. Studies with no exit or loss of follow-up were scored as 0.

Low-quality studies were defined as studies with scores <3, and high-quality studies were defined as studies with scores ≥ 3. Two independent authors (DL and XYW) described each item as having a low risk of bias, high risk of bias or unclear risk of bias.[35] Studies with low-quality scores (<3 points) were not removed because of the relatively few studies identified.

Statistical Analysis

Statistical analyses were performed using Stata 15.1 software (Stata Corp, College Station, TX, USA). P values $<.05$ were considered statistically significant. Then, the P-values for multiplicity were adjusted using the Benjamini–Hochberg FDR. The means and standard deviations of CRF, cognitive factors, social factors, and physiological factors in the intervention and control groups were extracted from the literature. Standardized mean differences (SMDs) were calculated using the meta-analysis. Heterogeneity was evaluated using the I^2 test, with I^2 values $>50\%$ indicating that the difference in heterogeneity was statistically significant. A random-effects model was used for the analysis of these studies. For studies with I^2 values $\leq 50\%$ (the difference in heterogeneity was not statistically significant), a fixed-effect model was used. If less than 10 data points were included, only fixed effect models were used. Publication bias was assessed using funnel plots. Subgroup analysis was performed to determine the effects of distinct cognitive training and social support interventions and a combined intervention on CRF.

Results

Study Characteristics

A total of 1520 relevant trials were identified using the predefined search strategy. Only 11 studies (6 published in English and 5 published in Chinese) involving 980 patients and cancer survivors met the criteria for inclusion in this meta-analysis (Figure 1).[33,35-44] After the full texts were reviewed, the interventions of 4 studies were found to include a combination of cognitive training and social support, as they adopted the methods of group discussion and friendship association.[33,37,42,43] The other 7 studies only adopted cognitive training and did not study social support.

For the 11 included RCTs, the baseline characteristics of the included patients or cancer survivors (age, sex, etc.) were compared. Statistically significant differences in these

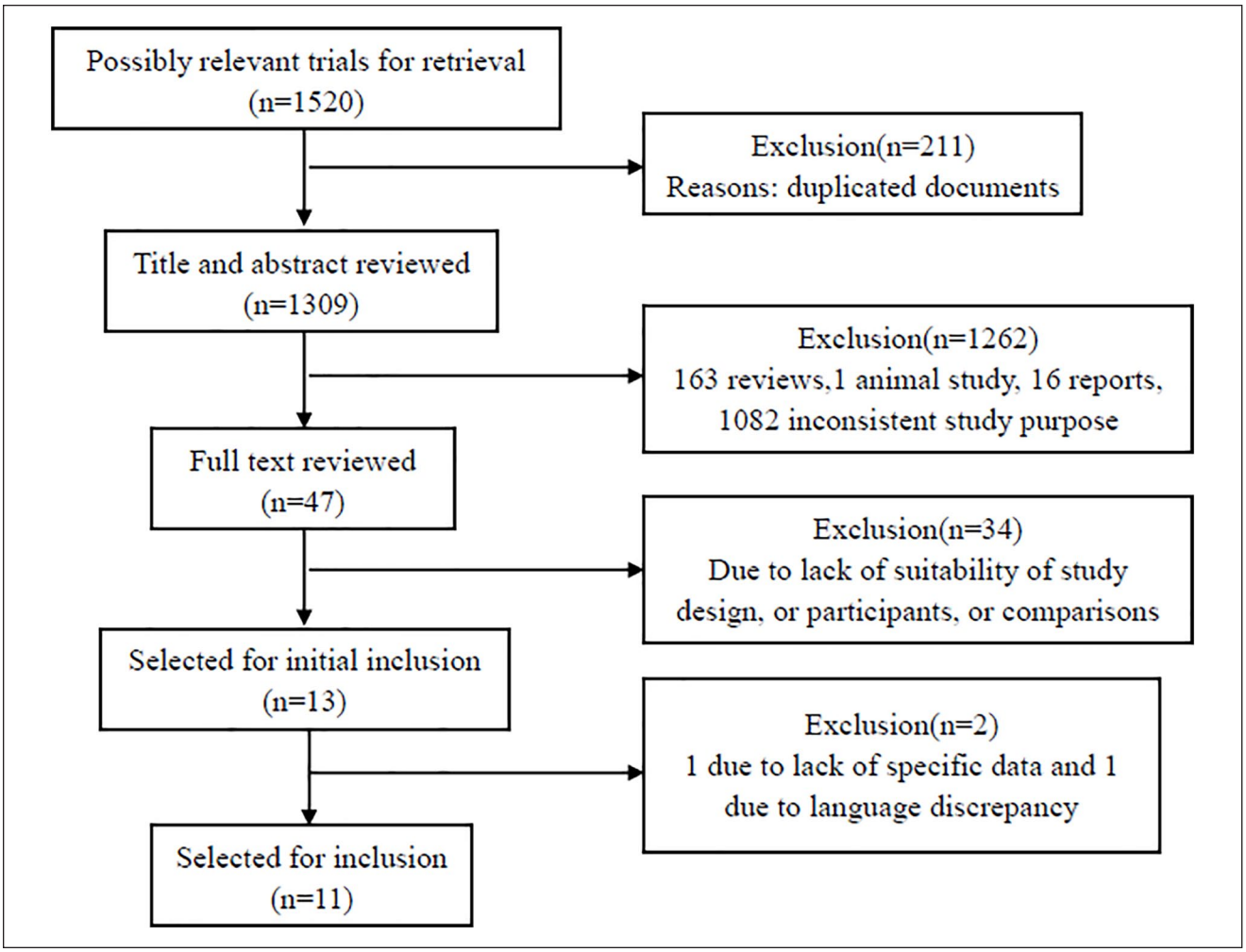

Figure 1. Flow diagram of the study.

parameters were not observed between groups. The characteristics of the studies included in the meta-analysis are presented in Table 1.

The subjects in 2 studies included survivors of breast and colorectal cancer [37,38]; the subjects in Espie[40] included survivors of breast, prostate, gynecological and colorectal cancer; the subjects in Yun et al[41] included survivors of breast cancer, lung cancer, colorectal cancer and stomach cancer; and the subjects in Chen et al[43] included gastrointestinal cancer patients. However, only data pertaining to colorectal cancer patients or survivors were used. The data were obtained freely from the published data files.

Quality Assessment

All eleven studies were performed with adequate random allocation. Two studies included double-blind allocation. All studies had Jadad scores ≥3 (Table 2).

Cancer-Related Fatigue

Meta-analysis of CRF within 14 weeks. Nine studies (6 published in English and 3 published in Chinese) included in the meta-analysis provided relevant CRF data. The results showed a statistically significant difference in CRF between the intervention and control groups (SMD = –1.13, $P < .001$) (Figure 2). Funnel plots did not reveal statistically significant publication bias (Figure S1).

Seven studies that included cognitive training underwent a separate subgroup analysis. The results showed a statistically significant difference in CRF between the intervention and control groups (SMD = –0.82, $P < .001$) (Figure 2).

Two studies that included a combined cognitive training and social support intervention underwent a separate subgroup analysis. The results showed a statistically significant difference in CRF between the intervention and control groups (SMD = –3.11, $P < .001$) (Figure 2).

Table 1. Clinical Characteristics of the Included Studies.

Study (country)	Study type	No. of patients (intervention/ control)	Age (years), median (range),(intervention/control)	Treatment	Intervention group/after intervention	Control group/ baseline	Length of intervention (T1/T2)	Instrument for measuring CRF
Poort et al[35] (The Netherlands)	DBRCT	24 (13/11)	63.5 ± 8.15/63.93 ± 8.98	Treatments included chemotherapy, targeted therapy, immunotherapy, and hormone therapy, which could be combined with surgery and/or radiation	Cognitive behavioral therapy included several modules addressing different fatigue- perpetuating cognitions and behaviors	Usual care	14 weeks/26 weeks	CIS-fatigue
Zhang et al[36] (China)	RCT	159 (79/80)	60.84 ± 6.96/59.67 ± 8.15	Patients had completed primary treatment (surgery, chemotherapy, or radiation).	Psychological intervention included teach and practice relaxation skills to reduce cancer- related stress, teach and practice emotion- focused coping skills on a cancer-related concern, assist patient identifying and facing emotional needs and support needs, develop proper monitoring and screening behaviors, educate about strategies to reduce risk of recurrence and encourage goal setting	Conventional care	12 weeks/6 months	Cancer-related distress
Johns et al[37] (USA)	DBRCT	11 (4/7)	56.9 ± 9.9/56.4 ± 12.7	Non-metastatic patients with chemotherapy and/or radiation therapy	Psychoeducation is to educate and support patients to better cope with the illness including group discussion of themes of awareness, perception and creative responding, the pleasure and power of being present, reacting on autopilot, creative ways of responding to stress, mindful communication, cultivating compassion, responsiveness in speech an action, taking care of yourself and the rest of your life	Conventional care	3 months/6 months	FSI
Sandler et al[38] (Australia)	RCT	5 (2/3)	53.1 ± 10.3/49.3 ± 8.6	Completed adjuvant therapy prior	Integrated cognitive behavioral therapy included consultations with an exercise physiologist and a clinical psychologist conducted approximately fortnightly. The intervention was manualized but was delivered in an individualized fashion where modules were allocated based on the participant's needs	The education arm included a single visit	12 weeks/24 weeks	SPHERE
Zhao et al[33] (China)	RCT	212 (106/106)	50.31 ± 7.92/49.05 ± 8.58	Not mentioned	Cognitive intervention included building awareness, master coping skills, improve mood, make a plan, strengthen and consolidate cognition and enhance social communication and disease cognition by organizing friendship association	Usual care	14 days	BFI

(continued)

Table 1. (continued)

Study (country)	Study type	No. of patients (intervention/ control)	Age (years), median (range),(intervention/control)	Treatment	Intervention group/after intervention	Control group/ baseline	Length of intervention (T1/T2)	Instrument for measuring CRF
Zhu[39] (China)	RCT	81 (41/40)	52.8 ± 5.5/52.6 ± 5.1	Undergoing elective colorectal cancer surgery	Cognitive behavioral intervention combined with clinical management included building awareness, master coping skills, improve mood, make a plan and strengthen and consolidate cognition	Usual care	14 days	BFI
Espie et al[40] (United Kingdom)	RCT	24 (15/9)	60.5 ± 8.35/58 ± 8	Treatment (radiation therapy or chemotherapy) had to be completed by ≥1 month with no further anticancer therapy planned	Cognitive behavior therapy included standard CBT components such as stimulus control, sleep restriction, and cognitive therapy strategies	Usual treatment	post-treatment/6 months	FSI
Yun et al.[41] (South Korea)	RCT	57 (27/30)	52.69 ± 10.52/54.39 ± 11.02	Within 2 months of cancer treatment termination	Including smart management strategies for health (SMASH)-based online health management program, SMASH-based health education booklet and a health strategy workbook for cancer patients, SMASH-based telephone coaching and a workshop for empowerment of patients' SM ability	Usual care	3 months/12 months	BFI
Lian[42] (China)	RCT	94 (47/47)	50.05 ± 6.58/48.73 ± 6.02	The patients have undergone radical surgery and is receiving radiotherapy or chemotherapy	Adopt structured family therapy follow-up management, establish patient personal files and establish follow-up team. Symptoms were assessed through family follow-up. The main measures include cognitive and emotional support, sorting out the problems among family members, helping them change their behavior and dredge their emotions	Usual care	6 months	CFS
Chen et al[43] (China)	RCT	164 (80/84)	Only the numbers of different age groups are provided	Patients have undergone radical surgery and is undergoing the first chemotherapy within one month after operation	Including cognitive intervention, emotional training, wechat platform or telephone follow-up	Usual care	8 weeks	CFS
Liu[44] (China)	RCT	60 (30/30)	53.5 ± 8.5/54.6 ± 7.2	Received FOLFOX chemotherapy for 2 courses	Including improving symptom cognition, health knowledge guidance, self-care skill guidance, and establish communication channels	Usual care	6 weeks	EORTC-QLQ-C30

Abbreviations: RCT, randomized controlled trial; DBRCT, double-blind randomized controlled trial; CIS-fatigue, Checklist Individual Strength, subscale fatigue severity; FSI, Fatigue Symptom Inventory; SPHERE, The Somatic and Psychological Health Report-34-item; BFI, Brief Fatigue Inventory; FSI, Fatigue Symptom Inventory; CFS, Cancer Fatigue Score; EORTC-QLQ-C30, European Organization for Research and Treatment.

Table 2. Jadad Scale Assessment.

Included study	Random allocation	Blinding	Loss to follow-up, dropouts	Jadad score
Poort et al[35]	2	0	1	3
Zhang et al[36]	2	2	1	5
Johns et al[37]	2	2	1	5
Sandler et al[38]	2	0	1	3
Zhao et al[33]	2	0	1	3
Zhu[39]	2	0	1	3
Espie et al[40]	2	0	1	3
Yun et al[41]	2	0	1	3
Lian[42]	2	0	1	3
Chen et al[43]	2	0	1	3
Liu[44]	2	0	1	3

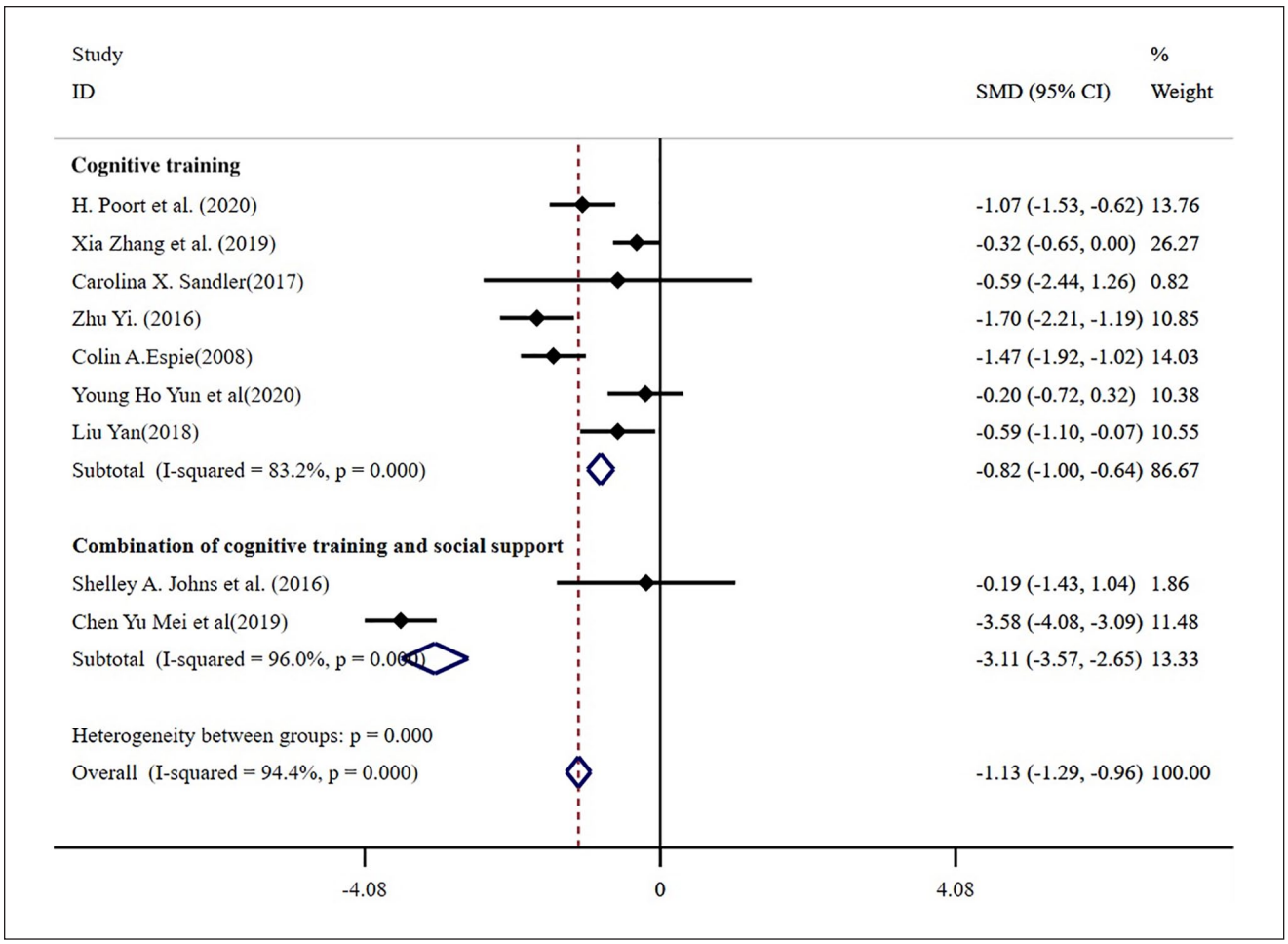

Figure 2. Forest plot showing the SMDs for comparisons of cancer-related fatigue between the group administered the intervention and control group within 14 weeks.

Meta-analysis of CRF after 14 weeks. Six studies (5 published in English, 1 published in Chinese) included in the meta-analysis provided relevant CRF data. Funnel plots did not reveal statistically significant publication bias (Figure S2). The results showed a statistically significant difference in CRF between the intervention and control groups (SMD = –0.56, $P < .001$) (Figure 3).

Four studies that included cognitive training underwent a separate subgroup analysis. The results showed a statistically significant difference in CRF between the

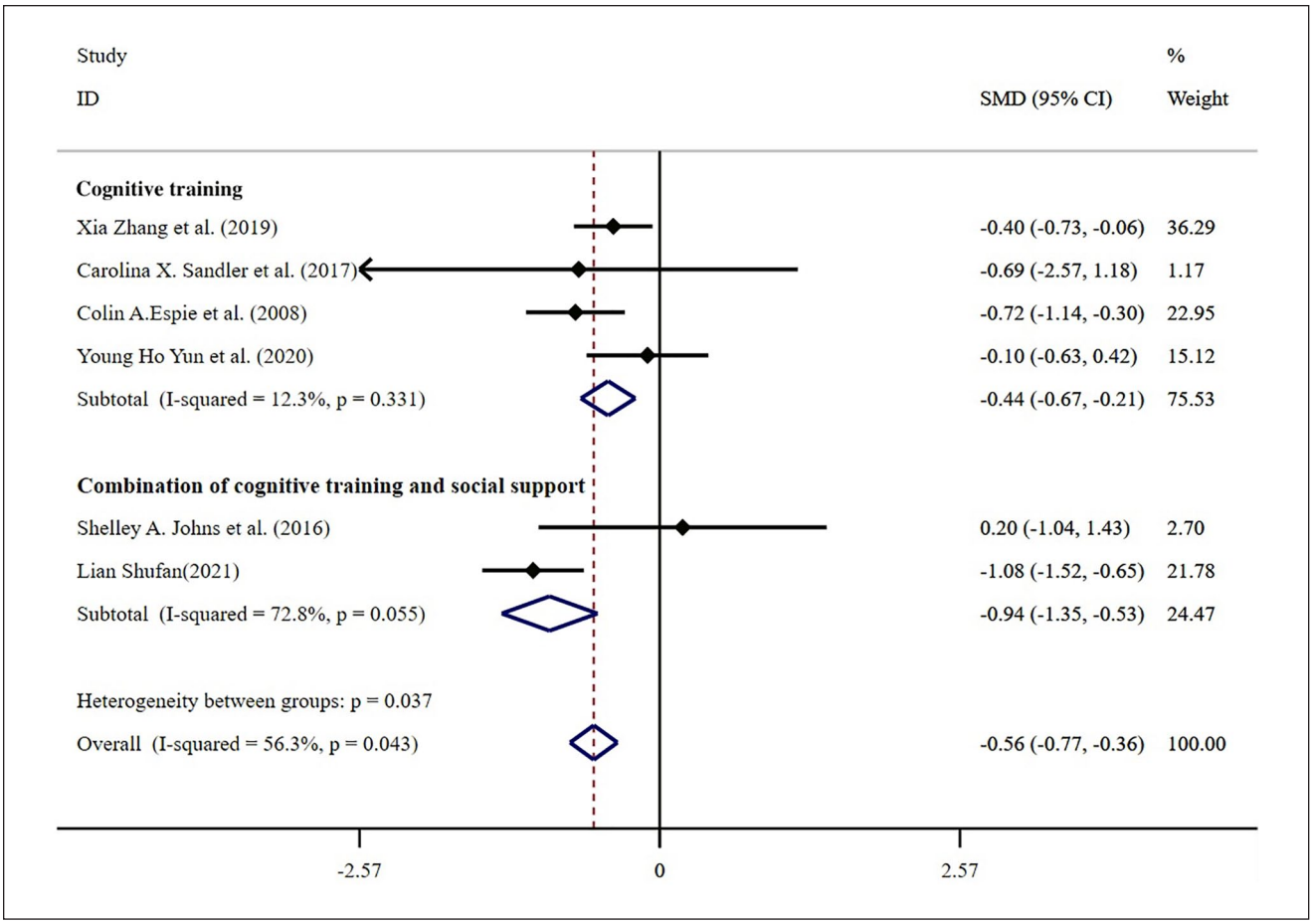

Figure 3. Forest plot showing the SMDs for comparisons of cancer-related fatigue between the group that received intervention and control group after 14 weeks.

intervention and control groups (SMD = –0.44, $P < .001$) (Figure 3).

Two studies that included a combined cognitive training and social support intervention underwent a separate subgroup analysis. The results did not show a statistically significant difference in CRF between the intervention and control groups (SMD = –0.94, $P < .001$) (Figure 3).

Quality of Life

Meta-analysis of overall QOL within 14 weeks. Six studies (4 published in English, 2 published in Chinese) included in the meta-analysis provided relevant QOL data. Funnel plots did not reveal statistically significant publication bias (Figure S3). The results showed statistically significant differences in QOL between the intervention and control groups (SMD = 0.83, $P = .003$) (Figure 4).

Four studies that included cognitive training underwent a separate subgroup analysis. The results showed a statistically significant difference in QOL between the intervention and control groups (SMD = 0.77, $P < .001$) (Figure 4).

Two studies that included a combined cognitive training and social support intervention underwent a separate subgroup analysis. The results showed a statistically significant difference in QOL between the intervention and control groups (SMD = 0.57, $P < .001$) (Figure 4).

Meta-analysis of overall QOL after 14 weeks. Four studies (all published in English) included in the meta-analysis provided relevant QOL data. Funnel plots did not reveal statistically significant publication bias (Figure S4). A forest plot of the results from all of the articles (Figure 5) showed no statistically significant heterogeneity in QOL ($I^2 = 33.9\%$, $P = .209$). The results revealed statistically significant differences in QOL between the intervention and control groups (SMD = 0.54, $P = .003$) (Figure 5).

Three studies that included cognitive training underwent a separate subgroup analysis. The results showed a statistically significant difference in QOL between the intervention and control groups (SMD = 0.55, $P < .001$) (Figure 5).

Only 1 study that included a combined cognitive training and social support intervention underwent a separate

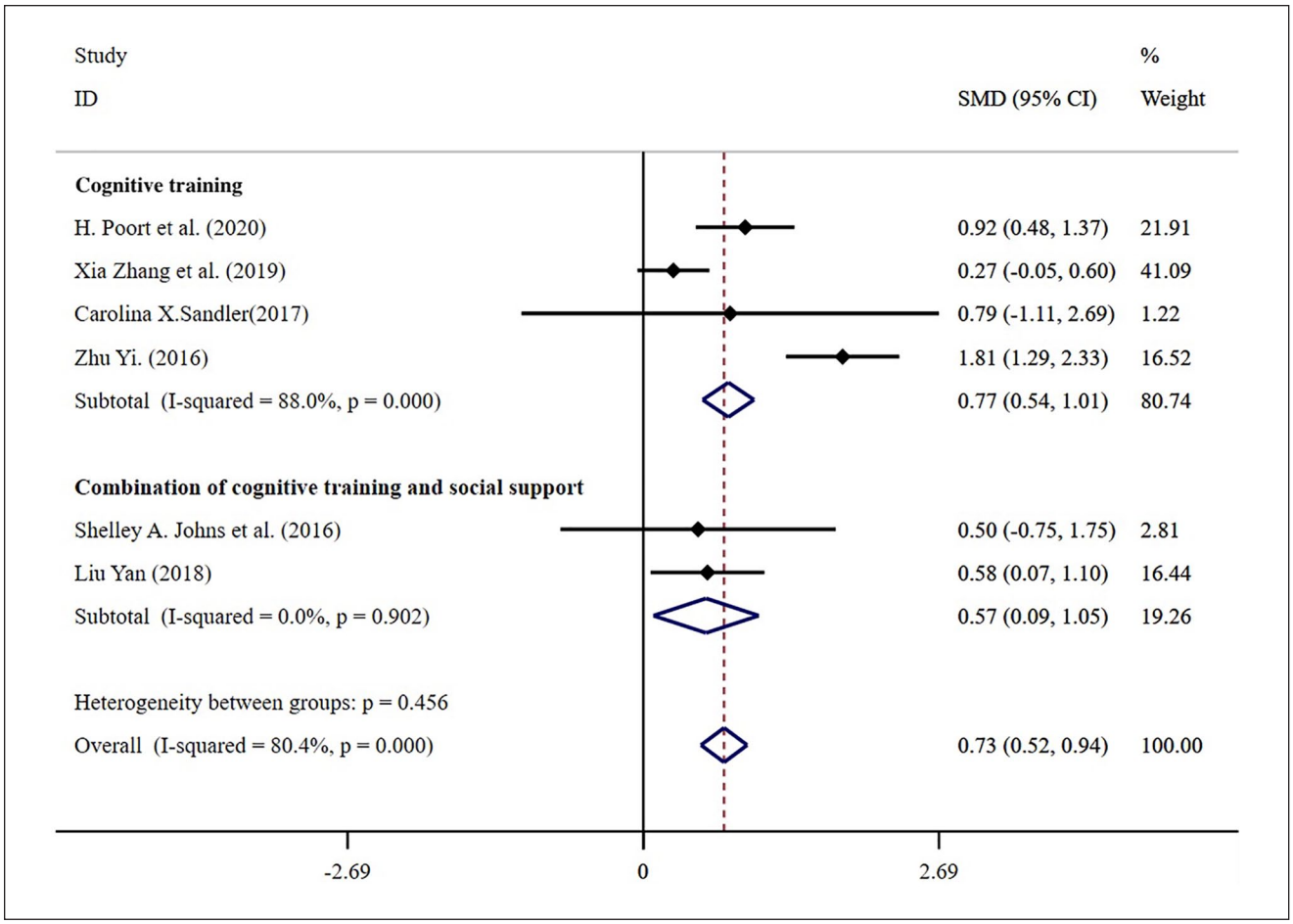

Figure 4. Forest plot showing SMDs for comparisons of overall quality of life within 14 weeks between the intervention and control groups.

subgroup analysis. The results did not show a statistically significant difference in QOL between the intervention and control groups (SMD = 0.50, $P = .435$) (Figure 5).

Then, the Benjamini–Hochberg FDR results showed that for CRF and QoL < 14 weeks and ≥14 weeks, $P <$- c (.000, .003, .000, .000) > P.adjust (P, method = "BH") .000, .003, .000, .000.

This is compared with the stated significance level of .05. Clearly, all are still statistically significant.

Discussion and Conclusions

Fatigue is a prevalent and highly distressing symptom in cancer patients and cancer survivors, and it may persist for years after completion of treatment.[45,46] Cognitive behavioral therapy is more effective at reducing the primary complaint of fatigue than simple education,[38] and therapy for insomnia may be clinically effective and feasible in real-world practice.[38] Peer support was associated with relatively higher adjuvant chemotherapy adherence in one study.[47] Facilitated peer support programs positively influence patient expectations and their ability to cope with the diagnosis and treatment, which affect adherence to postoperative chemotherapy.[47] Therefore, we concluded that cognitive interventions and social support are beneficial for improving physiological symptoms, QOL and therapeutic effects.

Overall, both distinct cognitive training and the combination of social support and cognitive interventions exert significant effects on cancer-related fatigue both within 14 weeks and after 14 weeks, suggesting that the provision of social-cognitive intervention in a timely manner may help alleviate fatigue in both cancer patients and cancer survivors as long as the intervention frequency and intensity are maintained. Based on the findings from some exploratory studies, mindfulness-based stress reduction may exert positive effects on the cognitive outcomes of survivors of cancer experiencing fatigue by compensating for cancer-related cognitive impairment.[48] Therefore, distinct cognitive training has a great effect on the short-term and

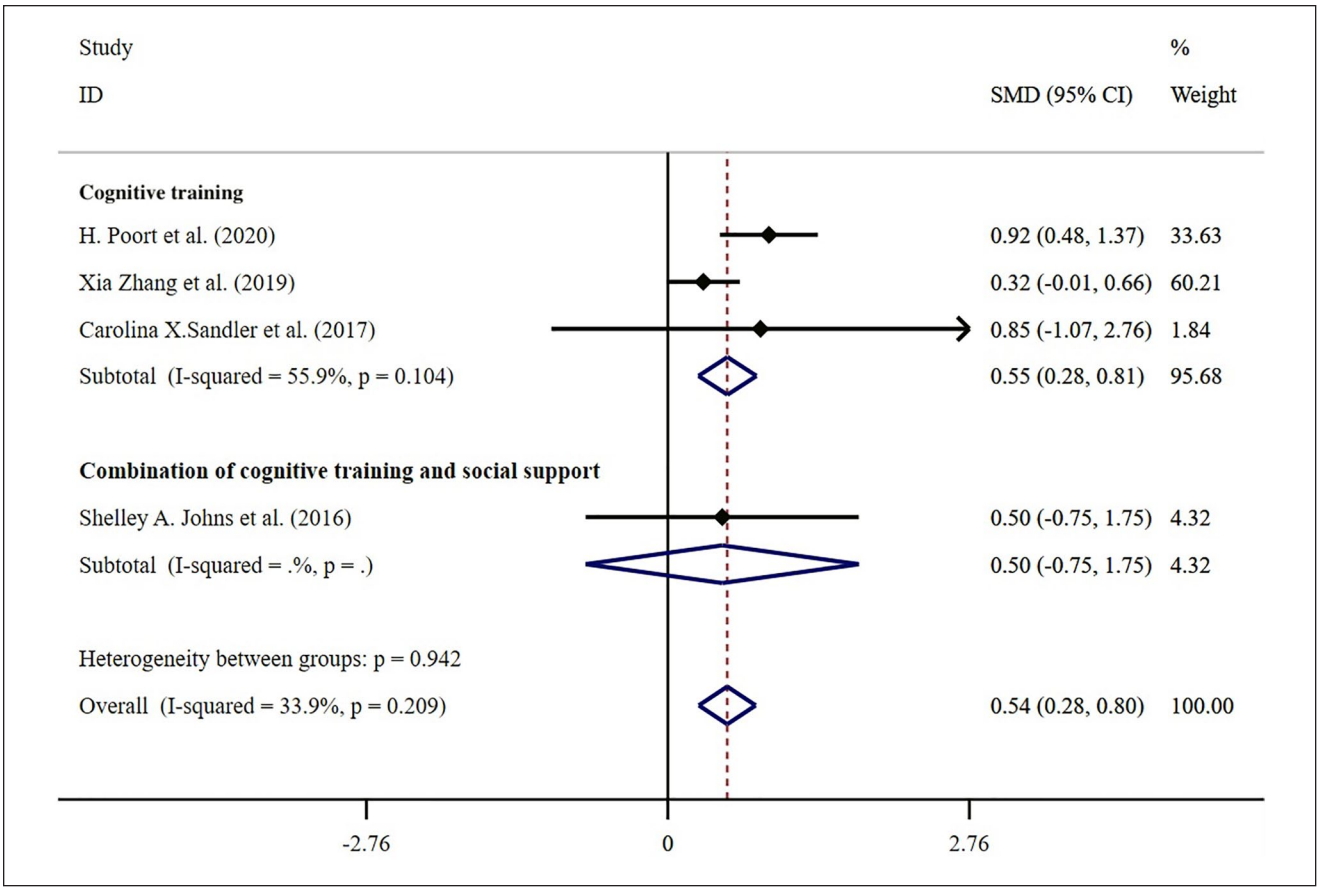

Figure 5. Forest plot showing SMDs for comparisons of overall quality of life after 14 weeks between the intervention and control groups.

long-term cancer-related fatigue of cancer patients and cancer survivors. Sharing experiences and interacting with other cancer patients and cancer survivors may contribute to patients' perception of validation, a factor critical to helping adjust during treatment or survivorship.[49] In addition, social support and cognitive training may alleviate stressors and regulate the HPA axis.[50,51] Therefore, we inferred that both distinct cognitive interventions and the combination of social interaction and cognitive stimulation can improve fatigue related to colorectal cancer by influencing the underlying physical and psychological mechanisms. However, the exact mechanism of action requires further study.

Colorectal cancer survivors and patients tend to experience physiological, psychological, social, and emotional changes due to surgical stress, radiation, the side effects of chemotherapy, and lifestyle changes.[37,52] Therefore, the QOL of patients with colorectal cancer and cancer survivors is often substantially affected. Distinct cognitive intervention improved both short-term and long-term QOL. Social support and cognitive interventions exerted a statistically significant effect on short-term overall QOL in the present study. One possible explanation for this finding is that social support and cognitive interventions may effectively reduce fatigue symptoms and adverse physiological reactions experienced by cancer survivors and patients and help them be better equipped to deal with the side effects of cancer treatment.[53] The goal of social-cognitive intervention is not necessarily to decrease symptom severity but to enhance survivors' and patients' ability to live with their symptoms in a nonreactive way, thereby reducing symptom-related interference with quality of life.[48] In addition, remission of CRF is also conducive to improving QOL with the progress of treatment. However, when social support was combined with a cognitive intervention, the effect on long-term QOL was not obvious. The result is different from some studies. The possible reason is that when social support is combined with cognitive intervention, it may dilute the impact of cognitive training. Alternatively, social support activities combined with cognitive interventions may place too much burden on patients so that they cannot concentrate on either cognitive or social elements. In addition, long-term overall quality of life is also affected by physical activity, living conditions, personal beliefs and so on.[29] The influencing

factors have changed, but the intervention measures have not changed, which may lead to a reduction in the intervention effect. Therefore, other influencing factors and how to formulate a better targeted social cognitive intervention program according to the specific cognitive and physiological status of patients should be further explored.

The present study had limitations. Each index contains less than 10 studies. The measures of the intervention group included cognitive training and social support, and most intervention measures centered on cognitive training. Therefore, the effects of cognitive training and social support on CRF should be further studied. The results indicated that clinical studies on cognitive psychological interventions in colorectal cancer patients and cancer survivors have not been widely performed, and the subjects included in the study included cancer patients and cancer survivors. Future studies on targeted cognitive psychological intervention should be performed in colorectal cancer survivors or cancer patients.

In summary, distinct cognitive interventions and a combination of cognitive and social support interventions can help to alleviate long-term and short-term CRF. Short-term cognitive and social support interventions improved the QOL of colorectal cancer patients and cancer survivors. However, the combined intervention of cognitive training and social support had no significant effect on long-term QOL. Further in-depth studies are needed to better formulate social cognitive intervention programs and examine the physical and psychological mechanisms of the effects of cognitive training and social support on QOL and CRF in cancer survivors and patients and to determine the specific effective duration, frequency and intensity of interventions.

Authors' Contributions

All authors participated in the design of the study, interpretation and analysis of the data and review of the manuscript. Wu Xian-Yi performed the study, and Liu Dun and Huang Si-Ting wrote the manuscript.

Availability of Data and Material

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Code Availability

Codes generated or used during the study appear in the submitted article and its supplementary information files.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Approval

This study involved the analysis of previously published papers and did not involve studies with animals or people. Therefore, the approval of an ethics committee was not needed.

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Supplemental Material

Supplemental material for this article is available online.

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