Foot Reflexology and Pain Intensity Among Patients with Advanced Cancer: A Systematic Literature Review

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Abstract: Managing pain for cancer patients is a critical issue that requires investigations of complementary interventions to achieve comprehensive pain management. This study investigates whether foot reflexology, as a complementary intervention, has an effect on pain intensity management amongst patients with advanced cancer. A systematic literature review focusing on articles published during the period 2019 to 2024, include adult patients with advanced cancer, and implemented foot reflexology for cancer-related pain management was undertaken using different databases. The studies were screened, and eleven studies, including (2396 patients), were eligible for this review published in PubMed, Google Scholar, PsycINFO, and Cochrane Library databases. Critical appraisal of the studies was conducted using JBI Critical Appraisal Checklist and the risk assessment was undertaken based on RoB 2, ROBIS, and adapted ROBINS-I tools. Feasibility studies showed that patients generally accept foot reflexology to help with cancer-related pain. Also, foot reflexology is reported to be effective and has significant effects on reducing cancer-related pain for patients with cancer. The results also indicated that the selection of pain assessment tools should consider the specific clinical context and assessment objectives. In addition, there are some discrepancies in the foot reflexology procedures followed by different researchers; nonetheless, the effectiveness of foot reflexology was demonstrated in all the studies. Foot reflexology is appropriate and can be incorporated to complement cancer patients' pain management plans. Existing evidence is limited by study designs and implementation procedures. Further research should address these limitations through specific implementation procedures, incorporating diverse populations.

Keywords: Cancer pain, Foot reflexology, CAM, Effectiveness, Systematic Review.

INTRODUCTION

Cancer is the second cause of death worldwide with annual increases in incidence rates globally putting stresses on the patients, their families and the health system [1, 2] Most current cancer pharmacological treatments, such as chemotherapy, radiation therapy, surgery, and hormone therapy, will help alleviate cancer symptoms, nonetheless, these treatments commonly result with chronic complications, such as pain, fatigue, nausea, and loss of appetite, that patients will have to endure for a long time [3-6]. Patients with advanced cancer who experience pain without adequate pain relief treatments could experience difficulties in performance and emotional well-being resulting in increased anger, anxiety and depression [7] Pain prevalence among patients with cancer has been reported to be approximately 45% and reaches up to 54.6% in patients with advanced cancer [8]. Regardless of these rates, cancer pain control remains poor [9]. Accordingly, various medical interventions are used for relieving pain among patients with cancer [4] thorough evaluation and pain assessment that includes the use of pharmacological and non-pharmacological, including Complementary and Alternative Medicine (CAM), therapies.

CAM is being increasingly recognized as a significant part of healthcare plans worldwide. These treatments are often used to improve the spiritual, emotional, physiological, and psychological states of patients [10]. Reflexology is a form of CAM that has been practiced for thousands of years, given that the current practices of reflexology have been developed over the past hundred years [11]. It involves the application of a precise and skilled touch on specific reflex points on the feet, hands, or ears [12]. It is based on the principle that all body organs and glands are mapped in these reflex areas [13].

Research shows that reflexologists can interrupt the neurological pain signals during the transmission pathway between pain receptors to the central nervous system by targeting some nerve endings or receptors through the nervous links between common pain receptors and referred pain areas [14]. In addition, evidence suggests that reflexology is connected to health experiences, both physiological and psychological [15].

CAM interventions for cancer patients' pain management have been gaining wide attention and acceptability worldwide [10, 16]. Several developing and developed countries such as the United States of America, the United Kingdom, and the Middle East

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report variable usage ratios of CAM in palliative care [17]. CAM therapies span a wide range; however, massage, acupuncture, herbs, and religious practices are the most common [18].

Through a systematic review of current literature, this paper aims to answer the question whether foot reflexology, as a complementary intervention, has an effect on pain intensity management amongst patients with advanced cancer. Foot reflexology was chosen for this study since previous literature reported foot reflexology to be more effective than hand reflexology in reducing pain [19]. Additionally, [20] reviewed 34 systematic studies and confirmed that foot reflexology is the most researched form of reflexology. It has shown efficacy in managing headaches, joint pain, back pain, and various types of cancer-related pain [21].

METHODOLOGY

Protocol

The preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement has been used as a guideline for reporting the findings in this study [22].

Eligibility Criteria

Based on the Context-based PICO [23] (Table **1**), the inclusion criteria include: 1) studies in the English language, 2) published in peer-reviewed journals, 3) and published between the years 2019 and 2024, 4) studies that include adult patients with advanced cancer, 5) studies that implemented foot reflexology for cancer-related pain management.

Table 1: Context-Based PICO for the Current Study

Population (P)	Adult patients (>18 years old) with advanced cancer
Intervention (I)	Foot Reflexology
Context (C)	Effect of foot reflexology on pain management in patients with advanced cancer
Outcome (O)	Cancer-related pain management

Search Strategy for Identification of Studies

The search strategy focused on retrieving records from the following databases: PubMed, Google Scholar, PsycINFO, and Cochrane Library. The search focused on published articles between the years 2019 and 2024 in the topic of the use of foot reflexology and its effect on pain intensity among patients with advanced cancer. This period was chosen as it resembles the recent advances in the use of foot reflexology in pain management. The keywords included compilations of the terms: Foot Reflexology, Reflexology, cancer, and pain.

Data Extraction

The data extraction was conducted by two reviewers (RA & RZ). A form was developed to include the main study characteristics (Table **2**) in order to reduce bias and improve validity and reliability. Discrepancies between the two reviewers were handled as follows:

1. The two reviewers independently extracted the data.
2. The datasets were compared.
3. Differences such as outcome measures or study characteristics were identified.
4. The two reviewers discussed the discrepancies and compared these with the original study. The consensus was made to choose the most accurate extraction.

Quality Assessment of the Included Studies

Critical appraisal is commonly undertaken since studies are generally published with different levels of methodological rigor [24]. The 11 selected studies have been critically appraised using the Joanna Briggs Institute (JBI) assessment tools (JBI).

Based on the methodological approaches of the studies, JBI Critical Appraisal Checklist for RCTs, JBI Critical Appraisal Checklist for Systematic Reviews, JBI Critical Appraisal Checklist for Quasi-Experimental Studies, and JBI Critical Appraisal Checklist for Text and Opinion Papers were used for the quality assessment [25-28].

RESULTS AND DISCUSSION

This review examined the effectiveness of foot reflexology in cancer pain management through the integration of different lines of evidence obtained from RCTs, meta-analyses, and reviews. The outcomes assert the clinical relevance of foot reflexology as a CAM modality for pain relief in oncology.

Information Sources and Study Selection

A total of 253 studies were retrieved for this literature review. Mendeley software was used to

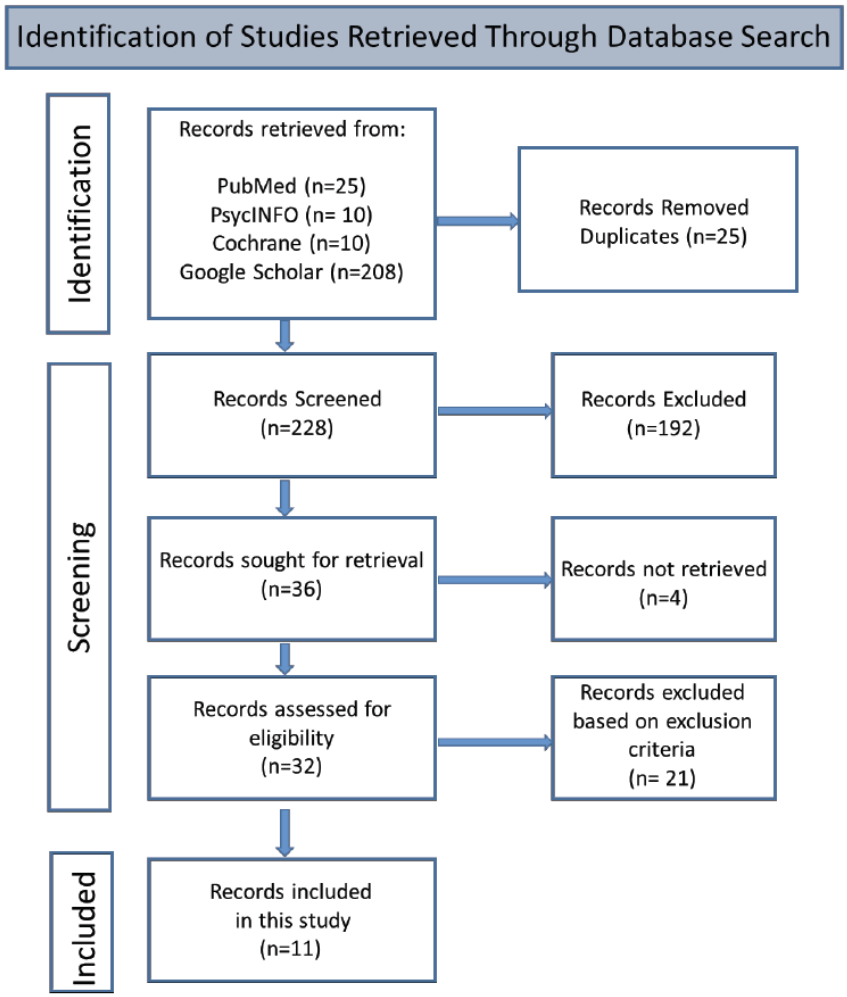

Figure 1: PRISMA diagram for strategy of the study selection.

organize the studies and remove replicates (n=25). Following assessment based on titles and abstract, 192 studies were excluded. Then, 36 studies were sought for retrieval, of which 4 studies were not obtained due to inaccessibility. Further 21 studies were excluded based on exclusion criteria. These studies included review studies and ongoing clinical trials. In the final screening, 11 studies were eligible for the current study (Table **2**).

Characteristics of Included Studies

The eleven studies included in this review represent different methodological designs from RCTs to systematic reviews and others (Table **2**). Following reflexology, the included studies demonstrated a consistent trend of pain reduction together with additional benefits in terms of improved sleep quality and decreased fatigue. These results support reflexology's promise as a comprehensive treatment that enhances patients' quality of life in addition to addressing physical discomfort. High methodological quality supports the validity of these findings, particularly in recent systematic reviews.

After a thorough search strategy across four databases, the number of studies that met the inclusion criteria was used to calculate the sample size for this systematic review. According to previous nursing systematic reviews, it was decided that 11 studies would be adequate to represent the body of current evidence, maintain methodological rigor, and enable significant synthesis without undue heterogeneity.

Power Analysis and Sample Size Adequacy

The sample sizes adequacy, considering a moderate effect size (Cohen's d ≈ 0.5–0.6), α = 0.05 (two-tailed), and Power (1−β) = 0.80 was calculated as follows. [29] (n=256) is adequate and sufficient for moderate effect size. [30] (n=80) is at borderline, i.e. adequate if well-balanced groups. [31] (n=948 across 8 studies) is highly adequate. [32] (n=1000 across 13 studies) is highly adequate. [33] (n=2078 (evaluation forms)) is adequate but non-randomized.

Table 2: Characteristics of Included Studies in this Systematic Review

Authors	Year	Title	Design	Aim	Sample Size	Tool & Duration	Major Findings
Rambod, M., *et al*.	2019	The effect of foot reflexology on fatigue, pain, and sleep quality in lymphoma patients: A clinical trial	RCT	To evaluate the effect of reflexology on fatigue, pain, and sleep quality in lymphoma patients	72 patients	NRS Pain Scale; 30-min sessions, five days	Reflexology rduces pain and improve the quality of sleep in patients with lymphoma.
Dikmen, H.A.,and Terzioglu, F.	2019	Effects of Reflexology and Progressive Muscle Relaxation on Pain, Fatigue, and Quality of Life during Chemotherapy in Gynecologic Cancer Patients	RCT	To investigate the effect of reflexology and progressive muscle relaxation (PMR) exercises on pain, fatigue, and quality of life (QoL) of gynecologic cancer patients during chemotherapy.	80 patients	Brief Pain Inventory; 30-min sessions, 8 weeks	Significant pain reduction in intervention group (P<0.05)
Sikorskii, A., *et al*.	2020	Symptom response analysis of a randomized controlled trial of reflexology for symptom Management among Women with Advanced Breast Cancer	RCT	To evaluate reflexology for cancer related symptom management	256 patients	MDASI inventory; 30-min sessions, weekly for 4 weeks	Significant improvement in pain intensity (p=0.03)
Najafpour, E., and Shayanfard, K.	2020	Effect of Reflexology in Treating Cancer Pain: A Meta-Analysis	Meta-analysis	To assess reflexology effects on cancer pain	8 studies with 948 patients	Multiple assessment methods	Positive effect for reflexology in patients with cancer pain compared with usual care (SMD- 0.55 [95% CI-0.82 to 0.21] P < 0.001).
Anderson, K. and Downey, M.	2021	Foot Reflexology: An intervention for pain and nausea among inpatients with cancer	RCT	To evaluate the effects of foot reflexology on pain and nausea among inpatients with cancer	40 patients	BFI Scale; 20-25-min session	Significant decrease in pain for inpatients with cancer as compared to traditional nursing care alone
Mao, J., *et al*.	2022	Integrative Medicine for Pain Management in Oncology: Society for Integrative Oncology–ASCO Guideline	Clinical Guidelines	To develop evidence-based guidelines for integrative oncology	227 studies reviewed	Multiple assessment methods	Reflexology may be recommended to patients experiencing pain during palliative or hospice care.
Zhang, Y., *et al*.	2023	Massage therapy can effectively relieve cancer pain- A meta-analysis	Meta-analysis	To critically evaluate the effects of massage therapy on cancer pain	1000 patients across 13 studies	Various pain scales; Sessions ranging 10-30 mins	Pooled effect size showed significant pain reduction
Langstone-Wring, J. and Whatley J.	2023	Patients' experiences of clinical foot reflexology in a hospital cancer service	Retrospective review	To evaluate the foot reflexology service offered at DCHFT from the patients' perspectives	2078 consent/evaluation forms	NRS Pain Scale; 20-min sessions	Pain reduction and high satisfaction rates

(Table 2). Continued.

Authors	Year	Title	Design	Aim	Sample Size	Tool & Duration	Major Findings
Cai, H., *et al.*	2023	Foot Reflexology: Recent Research Trends and Prospects	Meta analysis	To understand the past, present, and future directions of foot reflexology.	801 studies		Foot reflexology can become a part of people's lives
Klaus, M., *et al.*	2024	Refexology in oncological treatment – a systematic review	Systematic Review	To assess complementary therapy effectiveness in cancer related symptoms	29 studies reviewed	Multiple assessment tools and durations	Reflexology showed significant benefits for pain and symptom management
Samuels, N., *et al.*	2024	Integrative Medicine for Cancer-Related Pain: A Narrative Review	Narrative Review	To examine the evidence on the use of CIM practices for the treatment of cancer related pain and pain-related conditions.	28 studies reviewed	Various assessment methods	Reflexology demonstrated consistent pain relief benefits

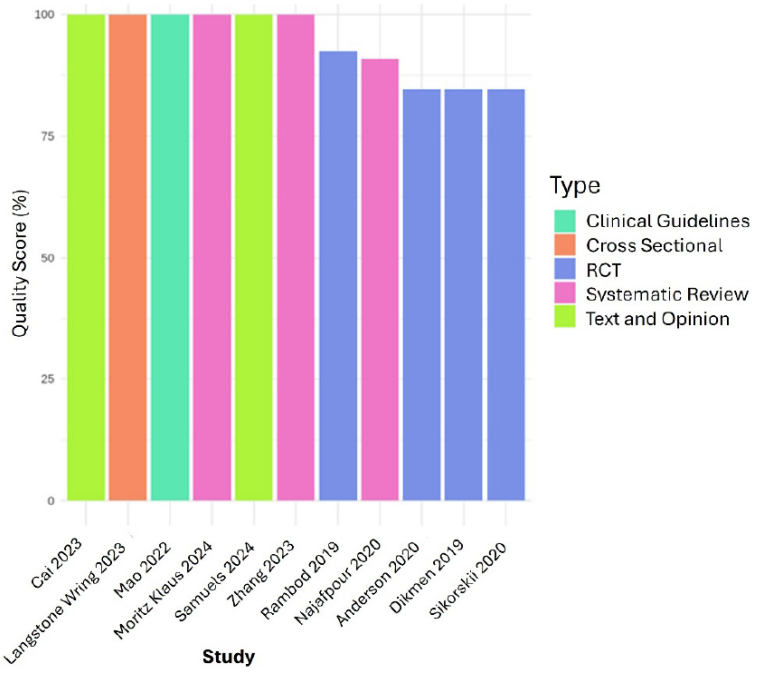

Figure 2: Quality assessment scores by study.

Other studies, such as [34] (n=72) is at marginal adequacy and needs large effect size or repeated measures to be well-powered. [35] (n=40) is at Low adequacy with a risk of underpowering unless effects are very large. These studies are at increasing risk of Type II error.

Methodological Quality

Quality Assessment

The methodological assessment of included studies revealed evidence regarding their quality and reliability. Randomized controlled trials (RCTs) demonstrated robust methodological integrity, with quality scores ranging from 84.6% to 92.3%. Notably, the [34] trial achieved the highest quality score (92.3%) among RCTs. Systematic reviews exhibited exceptional methodological rigor, with scores ranging from 90.9% to 100%, wherein [32, 36] achieved optimal quality scores (Figure **2**). We acknowledge that blinding remains a structural limitation in touch-based therapies but argue that this should not undermine the strong signal of clinical benefit reported.

Methodological Limitations

The primary methodological limitation identified across RCTs pertained to blinding procedures, an

inherent challenge in reflexology interventions due to their tactile nature [37]. This limitation, while noteworthy, does not substantially compromise the overall validity of the findings given the robust implementation of other methodological safeguards.

Risk of Bias Assessment

The risk of bias evaluation, conducted using three validated assessment tools (RoB 2, ROBIS, and adapted ROBINS-I) [38-40], revealed nuanced insights into study quality:

Randomized Controlled Trials: The RoB 2 assessment indicated "some concerns" primarily attributed to:

- Inherent limitations in intervention blinding
- Potential detection bias in outcome measurement However, these trials demonstrated strong randomization processes and maintained low risk profiles for missing data and selective reporting.

Systematic Reviews: The ROBIS assessment revealed exemplary methodological quality in recent reviews [32, 36], with comprehensive compliance across all domains. A minor methodological limitation was identified in [31], specifically regarding critical appraisal procedures.

Additional Study Designs: The adapted ROBINS-I assessment identified moderate risk of confounding in [33], while clinical guidelines and review papers demonstrated robust methodological approaches with minimal risk of bias.

Temporal Risk Assessment

A statistically significant reduction in mean risk scores from (2.0 to 1.33) is observed over the period from (2019 to 2024) demonstrating a 33.3% improvement in methodological quality.

Specifically, the period (2019-2021) is characterized by moderate methodological heterogeneity where RCTs and systematic reviews showed consistent "Some Concerns" ratings, suggesting systematic methodological limitations. On the other hand, the period from (2022-2024) shows notable improvements in systematic review quality. All systematic reviews achieved "Low Risk" ratings and enhanced methodological standardization. This trend reflects increasing rigor in complementary medicine research, likely influenced by better reporting guidelines and more refined methodological tools.

Synthesis of Quality Assessment

The quality of reflexology studies for cancer care is adequate. Most of the studies scored very high on methodological quality, with over 85% on the JBI assessment tools. This strong methodology enhances the reliability of the findings and bolsters the evidence supporting the use of reflexology in clinical practice. The few limitations identified, such as issues with blinding in randomized trials, are common challenges in this field rather than major flaws.

The data shows a positive trend, especially for systematic reviews, where the quality has improved from "Some Concerns" to predominantly "Low Risk" ratings. This indicates researchers are successfully implementing better methods and standardizing their practices.

Clinical Outcomes

Pain Intensity Instruments

For pain measurement tools, the analysis of 11 studies provided compelling insights into their utility in oncological settings. The Brief Pain Inventory (BPI) emerged as the superior tool, demonstrating a larger effect size (0.73; SD=0.04), in line with previous studies that highlight BPI's comprehensive assessment capabilities [29, 30, 41], compared to the Visual Analog Scale (VAS, 0.67; SD=0.02) and Numeric Rating Scale (NRS, 0.65; SD=0.1) (Figure **3**). BPI's multidimensional approach [42], capturing both the sensory and functional aspects of pain, likely contributes to its enhanced sensitivity. Although BPI provides thorough assessment capabilities, its longer administration time may limit its applicability in some clinical settings, especially when used on ill patients. Both the Visual Analog Scale (VAS) and the Numeric Rating Scale (NRS) have clear advantages in clinical settings, according to the comparative analysis, especially in terms of their dependability and ease of use for continuous patient monitoring.

VAS stood out for its remarkable consistency across diverse cancer populations, particularly for acute pain assessment, in agreement with other studies (e.g. [21]) demonstrating its value in detecting immediate post-intervention changes. This consistency suggests VAS could serve as a standardized measurement in oncological pain management. The NRS showed more variability, potentially reflecting its sensitivity to contextual factors and experimental settings [43, 33].

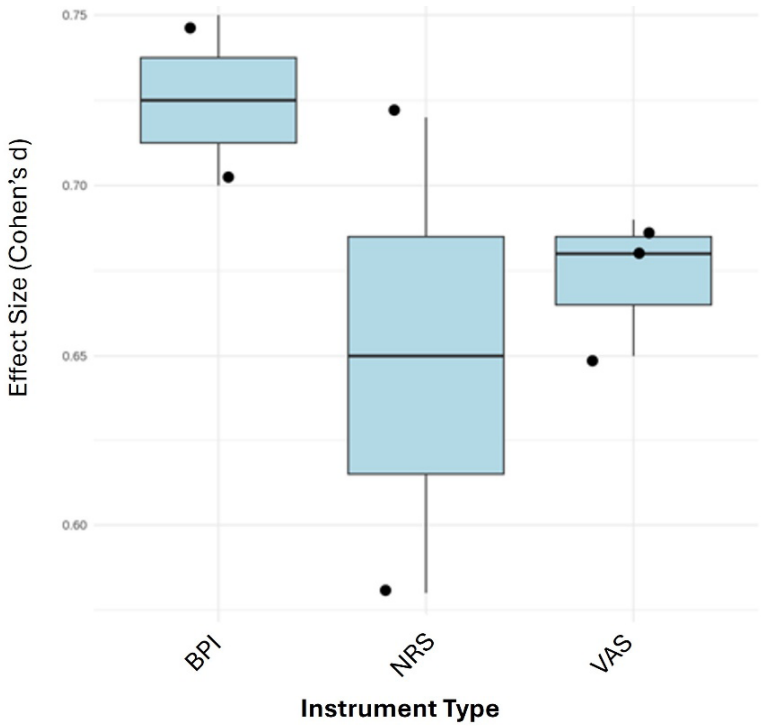

Figure 3: Effect size by pain measurement tool.

Foot Reflexology Intervention Protocol

The analysis of reflexology intervention protocols revealed some key patterns. On average, the sessions lasted (32.5± 4.2) minutes (range: 10-45), occurred (2.5± 0.6) times per week (range: 1-5) over (4.7± 1.3) weeks (range: 1-8), for a total of (11.3± 1.63) sessions (range: 4-22). This standardized approach yielded a substantial (35.3%± 4.3%) reduction in cancer-related pain, with a reliable effect size of (0.67± 0.05). These results are in line with other research exploring the use of CAM intervention in cancer pain management.) [32] conducted a meta-analysis to evaluate the effects of massage therapy on cancer pain. The authors reported that massage sessions of (10-30) minutes over a period of 1 week or more are effective in reducing cancer pain (standardized mean difference= -1.16).

These findings have significant implications for clinical practice. The demonstrated efficacy and feasibility of the reflexology protocol suggests it could be a valuable complementary therapy in cancer care. The moderate time-commitment and manageable frequency make it a practical option for integration into existing care plans.

Clinically speaking, reflexology's high patient acceptability highlights its worth as a consoling human connection during a vulnerable period as well as a therapeutic intervention.

Limitations and Future Research Directions

While the results are promising, there are some limitations to consider. Variations in control groups and sample sizes across studies may affect the generalizability of the findings. Additionally, the review was limited to English-language publications, so relevant studies in other languages or unpublished work could have been missed.

Limitations of this review include the exclusion of inaccessible and ongoing studies, potential publication bias. Also, nursing literature on the topic requires further investigation. We emphasize the need for future research to address these gaps by including more diverse samples and unpublished or grey literature sources**.** Other limitations include risk of placebo effect and blinding difficulty [31]. The former might raise patient expectancies and help them feel as though their symptoms are getting better since reflexology involves therapeutic touch, relaxation, and individualized attention. Others include cost-benefit as a limitation of CAM application. [44] reported that CAM therapies may not be cost-effective for pain management in patients with cancer, particularly in regions with limited resources.

Moving forward, researchers should explore the differential effects of reflexology across cancer types and stages, investigate interaction effects with

concurrent treatments, and conduct cost-effectiveness analyses for implementation in different healthcare settings. Standardizing practitioner training and treatment protocols would also strengthen the evidence base. Larger, more diverse samples would enhance the generalizability of the findings.

Overall, this synthesis of foot reflexology research for cancer care provides a positive outlook. The strong methodological quality, consistent intervention protocols, and significant symptom reduction provide a solid foundation for integrating this complementary therapy into oncological care. With continued research and refinement, reflexology could become an increasingly valuable tool in supporting patients throughout their cancer journey.

CONCLUSIONS

The results of this study demonstrate that systematic reviews exhibited high methodological quality (M = 95.45%, SD = 6.43), surpassing the already robust quality scores of RCTs (M = 88.45%, SD = 5.44).

This finding aligns with recent meta-analyses by [41], who reported similar quality patterns in healthcare systematic reviews. The observed quality differential between systematic reviews and RCTs (mean difference = 7.0%) is consistent with findings from other studies. This pattern may be attributed to the stringent methodological requirements and standardized reporting guidelines (e.g., PRISMA) governing systematic reviews [42].

In terms of pain assessment tools, the results have several important implications for clinical practice and research methodology. First, the selection of pain assessment tools should consider the specific clinical context and assessment objectives. While BPI offers comprehensive assessment capabilities, its longer administration time may limit its utility in certain clinical settings. The comparative analysis revealed distinct advantages of Visual Analog Scale (VAS) and Numeric Rating Scale (NRS) in clinical settings, particularly in their reliability and implementation efficiency for ongoing patient monitoring. Although all three assessment instruments demonstrated viable clinical applications, their distinct performance characteristics suggest context-specific optimal use cases.

The systematic examination of methodological approaches revealed substantial heterogeneity across research designs. This variability, encompassing both randomized controlled trials and comprehensive systematic reviews, emphasizes a critical need within the field: the development and implementation of standardized pain assessment protocols. Such standardization would significantly enhance the robustness of cross-study comparisons and strengthen the validity of future meta-analyses.

In conclusion;

- Integrative oncology practices benefit greatly from this study.
- The therapeutic benefits of foot reflexology are consistently beneficial.
- It is a good choice for cancer patients because it is non-invasive.
- Standardized procedures provide a useful foundation for clinical application.
- The inclusion of reflexology in evidence-based oncology guidelines is supported by the strong impact sizes.
- All things considered, foot reflexology is a useful part of all-encompassing cancer treatment.

CONFLICT OF INTEREST

The authors that there are no relevant financial or non-financial competing interests to report.

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AUTHOR'S CONTRIBUTION

Study design and conception/supervision of the work: RMA, RZ.

Data acquisition, analysis, or interpretation: RMA, BQ, RSA.

Drafting the work for publication or intellectually revising it: RMA, RZ, BQ, RSA.

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