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REVIEW ARTICLE

Optimizing mealtime care and outcomes for people with dementia and their caregivers: A systematic review and meta-analysis of intervention studies

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Abstract

Interventions addressing modifiable personal and environmental factors are critical to optimize dementia mealtime care, caregiving, and outcomes. This review synthesized the characteristics and effects of non-pharmacological interventions on mealtime care and outcomes in people with dementia and their caregivers. Five databases were searched from January 2012 to October 2024. Eligible studies were accessed for study quality and graded for level of evidence. Meta-analyses were performed for studies within the same intervention type that tested the impact on same outcomes. 33 studies were identified and categorized into five intervention types. Five studies were strong, 7 moderate, and 21 weak in quality. The levels of evidence varied from very low to moderate, with most being very low to low. Meta-analyses showed "resident training/therapy" decreased eating difficulties and increased food intake; "Nutritional supplement" improved cognition and depression; "environmental/food modification" increased food intake. Further research using rigorous designs is needed to increase evidence quality and determine effects of multi-component interventions.

KEYWORDS
dementia, level of evidence, mealtime care, older adults, study quality, systematic review

Highlights

- Five intervention types were identified from the 33 included studies: nutritional supplements, resident training/therapy, caregiver training and/or mealtime assistance, environmental/food modification, and multiple component interventions.
- One-third of the included studies were strong to moderate, and two-thirds were weak in study quality.
- "Resident training/therapy" showed effects in reducing eating difficulties and increasing food intake.
- "Environmental/food modification" showed effects in increasing food intake.
- "Nutritional supplements" showed effects in improving cognitive function and depression.

1 | INTRODUCTION

1.1 | Mealtime in people with dementia

Eating is the most basic activity of daily living (ADLs) that ensures adequate hydration and nutrition, helps maintain function, and provides opportunities for enjoyment and social interactions.[1] Dementia is a major cause of dependency for ADLs.[2] People living with dementia often experience cognitive, behavioral, and functional challenges at mealtime and require assistance from families and/or professional caregivers.[3–5] Mealtime challenges include resistive behaviors and functional impairments that hinder food intake and enjoyment, such as distraction, disengagement, rejection, interruptions, and diminished eating abilities.[6] Challenges at mealtime hamper eating independence[3,7–9] and impede food intake,[10,11] which result in malnutrition, dehydration, and weight loss, and subsequently decreased quality of life and increased morbidity and mortality.[12–15] Among people with dementia, 74%–78% experience challenges during mealtime,[6,16] 32%–87% experience rapid declines in eating function,[2,3,17] 68%–70% experience low food intake,[18,19] 94% are at risk for malnutrition, and 44%–66.5% are malnourished.[10,15,20] Mealtime challenges are also associated with caregiver-, community-, and institutional-level outcomes such as higher stress, burden, turnover, and needs of caregiving workforce, resulting in increased care costs.[5,12,13]

1.2 | Multi-level factors of mealtime care and outcomes are targets of non-pharmacological interventions

Factors associated with mealtime care and outcomes can be understood using the Social Ecological Model, which provides a multilevel framework to examine factors of health outcomes at intrapersonal (individual-), interpersonal (caregiver-), and environmental/institutional levels.[5] Modifiable factors at these levels should be the targets of non-pharmacological interventions that aim to optimize mealtime care and outcomes in individuals with dementia.

At the intrapersonal level, individuals experience progressive changes in cognitive function (e.g., memory, language, orientation, problem-solving), biological and motor function (e.g., range of motion), sensory function (vision, taste, smell, hearing, touch), dietary habits and appetite, and oral health and hygiene (e.g., dental pain, dry mouth, denture problems), which impact mealtime performance.[3,4,12,21,22] These factors are compounded by medications and comorbidities, and lead to lack of alertness, dental function decline, and impaired ability to see, hear, communicate, plan, and perform complex mealtime activities, as well as to tolerate the texture of regular food, reinforcing eating dependence, low food intake, and risks of malnutrition and dehydration.[3,10,12,14,23–27]

At the interpersonal level, the quality of mealtime care interactions and relationships between people with dementia and their caregivers is critical for optimal mealtime care and outcomes. Quality mealtime care is especially warranted for individuals who require mealtime assistance, have chewing/swallowing difficulties, and eat slowly.[5,10,11,25,28–31] Caregivers provide daily care during mealtime and have the most opportunities to engage individuals in eating. Yet, direct care staff in residential care settings frequently miss opportunities to engage residents in eating, and often provide full assistance without considering resident abilities and motivation to eat.[5,26] Such full mealtime assistance discourages resident participation in eating and increases their dependence on care staff,[26,27,31] whereas providing high-quality mealtime care that includes continuous facilitation and appropriate guidance tailored to residents increases resident engagement and food intake.[26,27,31]

At the environmental/institutional-level, physical and social dining environments, routines, and institutional features show low-to-insufficient evidence on resident mealtime outcomes.[32–38] However, recent work acknowledges the role of a supportive physical dining environment and institutional infrastructure in fostering positive mealtime experiences and food intake.[39,40] Multiple social and physical elements of dining environments that consider resident preferences

RESEARCH IN CONTEXT

1. **Systematic review**: The authors reviewed articles on the effects of non-pharmacological mealtime-related interventions on mealtime care and outcomes in people living with dementia and their caregivers using five electronic databases (PubMed, CINAHL, AgeLine, PsycINFO, and Cochrane Library). Eligible studies were classified by intervention, assessed for quality using the QATQS, and graded for evidence using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) criteria. Meta-analyses were conducted for studies within the same intervention type that assessed the impact on the same outcomes.
2. **Interpretation**: This review synthesized qualitative and quantitative evidence regarding interventions that targeted multi-level factors (resident, caregiver, and physical/social environment). While current evidence is based on research primarily of moderate to weak quality, findings support the effectiveness of resident training/therapy in improving mealtime behaviors, environmental/food modifications in increasing food intake, and nutritional supplements in improving cognition and depression. These results provide directions for clinical practice and future research.
3. **Future directions**: Future interventions should consider integrating resident training/therapy with environmental/food modifications using rigorous designs to maximize the effects on mealtime behaviors and food intake. Further research is necessary to determine the clinically significant effects of different types of non-pharmacological mealtime interventions.

(e.g., diet type, eating place, eating with staff and/or other residents, adequate eating time, illuminance level, sound volume level) were associated with mealtime outcomes.[22] High-quality dining environments (i.e., highly specific physical and social stimuli including positive dyadic interactions tailored to resident needs and preferences) are associated with improved resident engagement in eating, decreased resistive behaviors, and increased eating function and food intake.[4,26,27]

1.3 | Existing reviews of mealtime interventions and gaps

Multiple systematic reviews with different foci have synthesized non-pharmacological interventions to improve mealtime-related outcomes in people living with dementia in the past decades. One group of reviews focused on interventions that modify factors at a single level (rather than multi-level). For example, one review reported that direct training for people with dementia and indirect feeding support from care staff resulted in fewer mealtime difficulties in people with dementia.[41] Several reviews focused on modification of food options, including isolated nutrient supplementation,[42] oral nutrition supplements,[43,44] texture-modified food and fluids,[45] as well as high-calorie supplements, appetite stimulants, assisted feeding, and modified foods.[46] These interventions showed (1) low to moderate evidence to promote fluid and protein intake[43] and body weight,[46] (2) some evidence on reducing energy and fluid intake by texture-modified food and fluids,[45] and (3) lack of evidence on clinical manifestations or neuropathology of Alzheimer's Disease (AD),[42] neuropsychiatric symptoms,[44] cognition,[43] function,[43,46] as well as aspiration pneumonia, nutrition, hydration, morbidity, and mortality.[45,46]

The other group of reviews focused on interventions that target multi-level factors but synthesized evidence of these interventions on limited (rather than a variety of) mealtime-related outcomes. For example, one review focused on feeding difficulty and eating performance showed that (1) training programs for older adults with dementia (Montessori methods and spaced retrieval) had some evidence in decreasing feeding difficulty; (2) mealtime assistance offered by nursing staff (e.g., verbal prompts and cues, positive reinforcement, appropriate praise and encouragement) had some evidence in improving eating performance; and (3) there was lack of evidence of environmental modifications and multicomponent interventions to improve eating performance.[33] One review focused on swallowing difficulties showed the use of diagnostic tests, the effect of postural changes, modification of fluid and diet consistency, behavioral management, and the possible use of medications had limited evidence.[47] One review focusing on behavior symptoms showed the use of music, changes to food service, dining environment alteration, and group conversation had limited evidence.[48] One review focusing on nutritional outcomes (oral food and drink intake, nutrition, and hydration status) showed the use of oral nutrition supplementation, food modification, dysphagia management, and eating assistance had limited evidence, except that interventions that support the social element of eating and drinking had some promising evidence in improving quality of life in people with dementia.[28] Another review focused on mealtime function and nutritional outcomes (food intake, weight, body mass index, BMI) showed that modified food presentation, meal styles, environment adaptations (introducing fish), resident skills training (Montessori methods and spaced retrieval), music therapy, and animal-assisted therapy had insufficient evidence.[49]

Liu et al[32] first synthesized the impact of multi-level interventions on a variety of mealtime-related outcomes in a systematic review of literature published between 2004 and 2012. This review found that (1) nutritional supplements had moderate evidence to increase food intake, body weight, and body mass index (BMI); (2) training/education programs targeting people with dementia and/or their caregivers had moderate evidence to increase eating time and decrease feeding difficulty; (3) both training/education programs and feeding assistance were insufficient to increase food intake; (4) environment/routine modification had low evidence to increase food intake and insufficient to decrease agitation; and (5) evidence was sparse on nutritional status, eating ability, behavior disturbance, behavioral and cognitive function, and level of dependence. A recent umbrella review provided recommendations for mealtime care practice but was based on systematic reviews and primary research published between 2016 and 2021, which may not fully represent evidence from literature in this field.[50] In addition, many of the reviews as noted above did not perform assessments of the level of evidence and/or meta-analysis, and none of the existing reviews have synthesized the effects of interventions on outcomes at the caregiver-, dyadic-, and/or environmental levels. To understand the state of science and obtain updated evidence on the impact of multi-level interventions on outcomes at both personal and environmental levels, an updated systematic review of literature published since 2012 is needed.

1.4 | Objectives

This review, therefore, was conducted to (1) describe characteristics of non-pharmacological mealtime interventions targeting people living with dementia in any care setting, their caregivers, and/or the dining environment in any care setting; and (2) synthesize the effects of these interventions on mealtime care quality and outcomes at the individual, caregiver, dyadic, and/or environmental levels.

2 | METHODS

2.1 | Study design

A systematic review and meta-analysis were conducted and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA Statement.[51]

2.2 | Inclusion and exclusion criteria

To thoroughly identify eligible studies and keep the review within focus, the PICOTS framework (Populations, Interventions, Comparator, Outcomes, Timing, Settings) was used to frame the research ques-

TABLE 1 PICOTS framework of the research question.

Populations of interest	Adults (≥19 years) with ADRD (any type, any stage) and caregivers of people living with ADRD
Interventions of interest	Any non-pharmacological mealtime intervention in which the study analyzed its effect on the mealtime-related outcome(s) of interest
Comparator	Any comparator, or none at all (e.g., placebo, no therapy, another active therapy, or no control)
Outcomes of interest	• Outcomes for persons living with ADRD, such as mealtime behaviors, eating ability/independence, chewing/swallowing ability, food intake amount, percent, pace, body weight, BMI, and nutrition status • Outcomes for caregivers, such as caregivers' knowledge, motivation, perceptions, self-efficacy, attitude, skills, and behaviors in providing mealtime care • Dyadic-level outcomes, such as quantity and quality of mealtime care interactions • Environmental-level outcomes, such as quality of physical, social, and/or cultural dining environment including food/fluid options
Timing	Duration of interventions and follow-up periods: unlimited. Publication period (publication dates of studies): January 1, 2012, to May 30, 2023
Setting	Any setting (e.g., outpatient primary care, inpatient, clinic, long-term care, assisted living, nursing homes, community-based, home-dwelling)

Abbreviations: ADRD, Alzheimer's disease and related dementia; BMI, body mass index; PICOTS, populations, interventions, comparator, outcomes, timing, settings.

TABLE 2 Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
• Persons living with ADRD • Non-pharmacological, mealtime related interventions (oral eating only) • For nutritional supplements, included if (1) supplements were part of a meal AND (2) outcomes focused on mealtime-related nutrition and/or function, in addition to cognition changes. • Mealtime-related outcomes at individual-, caregiver-, dyadic-, and/or environmental levels • Human • In English	• Interventions focusing on persons with MCI or probable AD, or persons at risk of dementia at recruitment but without a dementia diagnosis, no matter whether participants progressed into any stage of dementia during the study period. • Studies that reported combined results for persons with MCI and persons with ADRD, and results for persons with ADRD were not separately reported. • Interventions in general and not specific to diet or mealtime, (e.g., palliative care, ADL in general or mixed components including diet, exercise, and psychological components) • Interventions focusing on feeding tubes, drugs, and pharmacology. • Not primary research (e.g., commentary, reviews, editorials) • Intervention study protocols (no reports of results of the trial; however, protocols were used to search publications that reported findings/results of the trials, if any) • Case studies or case series studies where intervention was implemented for one or a few cases. • Studies that did not report outcomes of interest specific to mealtime, such as those only focusing on cognition changes. • For nutritional supplements, excluded if the supplements were provided/consumed between mealtime, or drug- and/or nutrient-based supplements.

Abbreviations: AD, Alzheimer's disease; ADL, activities of daily living; ADRD, Alzheimer's disease and related dementia; MCI, Mild Cognitive Impairment.

tion (Table 1). The populations of interest were adults aged 19 years or above with a diagnosis of Alzheimer's disease and related dementias (ADRD) of any type and at any stage, and their family/informal/unpaid and/or professional/formal/paid caregivers. The interventions of interest were non-pharmacological, mealtime-related interventions. The outcomes of interest were individual-level outcomes (e.g., mealtime behaviors, eating ability, nutrition), caregiver-level outcomes (e.g., mealtime caregiving related knowledge, skills, self-efficacy, and behaviors), dyadic-level outcomes (e.g., quality of dyadic mealtime care interactions), and environmental-level outcomes (e.g., physical, social, and/or cultural dining environment). The publication period was limited to January 1, 2012, to October 2, 2024, to ensure retrieval of more recent interventions to compare with an existing systematic review from our team,[32] which had the same objectives and PICOS criteria. Length of interventions, follow-up periods, comparators, and settings of care were not limited to further broaden the scope of search.

The inclusion and exclusion criteria (Table 2) were developed based on the PICOTS framework. Studies were included if they reported characteristics of non-pharmacological interventions targeting populations of interest and examined the effects of such interventions on mealtime-related outcomes of interest at individual, caregiver, dyadic, and/or environmental levels. We excluded studies that were published in languages other than English, used animal models, were not primary research, or had a focus not related to the research question (e.g., interventions in general rather than specific to mealtime, pharmacological interventions, outcomes unrelated to mealtime, other populations without an ADRD diagnosis).

2.3 | Search strategies

We searched five databases including PubMed, CINAHL, AgeLine, PsycINFO, and Cochrane Library for records published between Jan-

TABLE 3 The QATQS tool.

Components	Criteria for component ratings of study	Overall quality
Selection bias	Sample representativeness of target population	Strong: no weak component ratings
	Participation rates	
Study Design	Design	Moderate: one weak component rating
	Randomization	
	Description of randomization method	
	Appropriateness of randomization method	
Confounders	Presence of important differences between groups	Weak: two or more weak component ratings
	Percentage of confounders controlled	
Blinding	Assessor blinded to intervention or exposure status	
	Participants blinded to research question	
Data collection methods	Validity of data collection tools	
	Reliability of data collection tools	
Withdrawals and drop-outs	Reports of withdrawals and drop-outs numbers and/or reasons	
	Percentage of participants completing the study	
Intervention integrity	Percentage of participants received the intervention or exposure of interest	
	Measurement of intervention consistency	
	Potential contamination or co-intervention	
Analysis	Unit of allocation and analysis	
	Appropriateness of statistical methods	
	Intention-to-treat analysis	

Abbreviation: QATQS, Quality Assessment Tool for Quantitative Studies.

uary 1, 2012, and October 2, 2024, limiting to English language, human, and peer-reviewed articles. Boolean operators "AND/OR" were combined with keywords and matched subjects or MeSH terms related to dementia, AD, mealtime, and intervention. Reference lists of eligible studies as well as literature reviews relevant to our research question obtained from initial search results were reviewed for additional studies. Detailed search strategies from the five databases are shown in Table S1.

2.4 | Study selection and data extraction

Studies were selected based on inclusion and exclusion criteria as noted above using Rayyan, a web-based semi-automated screening software tool, following two steps: (1) screening by title and abstract, and (2) assessing full texts for eligibility. At each step, two reviewers (H.S. and G.N.), who were not blinded to information of study records, worked independently; their decisions were compared, and discrepancies were resolved through discussion among the two reviewers and the first author (W.L.). Eligible full-texts were classified by intervention type. The Social Ecological Model was used to guide the categorization of existing interventions. Data from each eligible full-text including author(s) and publication year, study location, study population, intervention (components and duration), comparator, study duration, outcome measures, and main findings were extracted using a self-developed structured tool by two co-authors (H.S. and K.L.) and confirmed by the first author (W.L.).

2.5 | Assessment of study quality

Study quality was assessed independently by two co-authors (H.S. and K.L.) using the Quality Assessment Tool for Quantitative Studies (QATQS).[52] The standardized guidelines and dictionary were referenced. Each study was assessed on eight components: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity, and analysis (Table 3). Each of the first six components was rated as strong, moderate, or weak, and together resulted in an overall study quality rating. The last two components are not rated. Both individual components and overall ratings were compared, and discrepancies between the two co-authors (H.S. and K.L.) were resolved through discussion among all authors.

2.6 | Assessment of level of evidence

The level of evidence for each main outcomes was rated by the second author (K.L.) using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE; Table 4) Working Group tool reviewed by the first author (W.L.).[53] If two or more studies that were categorized in the same intervention type reported the same outcome,

TABLE 4 The grade criteria.

Criteria	Rating	
Rating down		
1. Study limitations	−1	Most information is from studies at moderate risk of bias (lack of allocation concealment, lack of blinding, incomplete accounting of patients and outcome events, selective outcome reporting bias, other limitations and bias)
	−2	Most information is from studies at high risk of bias
2. Inconsistency of results	−1	Variation in effect; if meta-analysis is available, confidence intervals showing no or minimal overlap, significant heterogeneity detected by a test for heterogeneity ($p < 0.05$), and large I^2 value (50%~75%).
	−2	Very large variation in effect; if meta-analysis is available, confidence intervals showing no overlap, significant heterogeneity detected by a test for heterogeneity ($p < 0.05$), and very large I^2 value (> 75%).
3. Indirectness of evidence	−1	Differences in population, interventions, outcome measures (surrogate outcomes), or indirect comparisons
	−2	Very large differences and serious indirect comparisons
4. Imprecision	−1	Sample size is less than 400; if meta-analysis is available, the sample size is met and the 95% CI of the pooled effect includes no effect but fails to exclude appreciable benefit or harm (i.e., SMD of under 0.5 or over 0.5)
	−2	Very few samples and, if meta-analysis is available, 95% CI of the pooled effect that includes both appreciable benefit and harm.
5. Publication bias	−1	If publication bias is strongly suspected: all results come from small studies or most of those small studies are industry-sponsored.
Rating up		
Magnitude of an effect	+1	Moderate effect size > 0.8 with no plausible confounders for outcomes
	+2	Large effect size > 1.2 with no major threats to validity
Dose-response gradient	+1	If there is evidence of a dose-response gradient
Plausible confounding	+1	If there is evidence that the influence of all plausible confounding would reduce a demonstrated effect.
	+1	If there is evidence that the influence of all plausible confounding would suggest a spurious effect when results show no effect.
Final level of evidence	High: high confidence in the effect estimate Moderate: moderately confidence in the effect estimate Low: little confidence in the effect estimate Very low/insufficient: very little confidence in the effect estimate	

Abbreviations: CI, confidence interval; GRADE, Grading of Recommendations, Assessment, Development, and Evaluation; SMD, standardized mean difference.

these studies were grouped for evidence grading. A baseline level of evidence was initially assigned as high, moderate, or low based on study design. The baseline level of evidence was rated as high if there were at least two randomized controlled trials (RCTs), or one RCT and more than one high-quality non-RCT study. The baseline level of evidence was rated moderate if there were at least one RCT or more than two high-quality non-RCTs. The baseline level of evidence was low if there were fewer than three high-quality non-RCTs.[32,54] To determine the final level of evidence for each outcome, eight aspects of studies in each intervention group, including five downgrading factors (risk of bias, inconsistency of results, indirectness of evidence, imprecision of results, risk of publication bias) and three upgrading factors (large magnitude of effect, dose-response gradient, influence of residual plausible confounding), were evaluated. The baseline level of evidence was rated down or up by one or two levels based on these eight aspects. The final level of evidence was graded as high, moderate, low, or very low/insufficient. A high rating indicates strong confidence in the effect estimate, with confidence decreasing progressively from high to very low/insufficient.

2.7 | Meta-analysis

Meta-analysis was conducted if at least two studies within the same intervention type reported sufficient data on the same outcome, including pretest/posttest data of all treatment groups, to compute effect sizes. Studies having only posttest data of the groups or data of the intervention group without a comparator were not included in the analysis. Standard mean differences were obtained utilizing changes in each outcome from baseline to posttest of each treatment group.

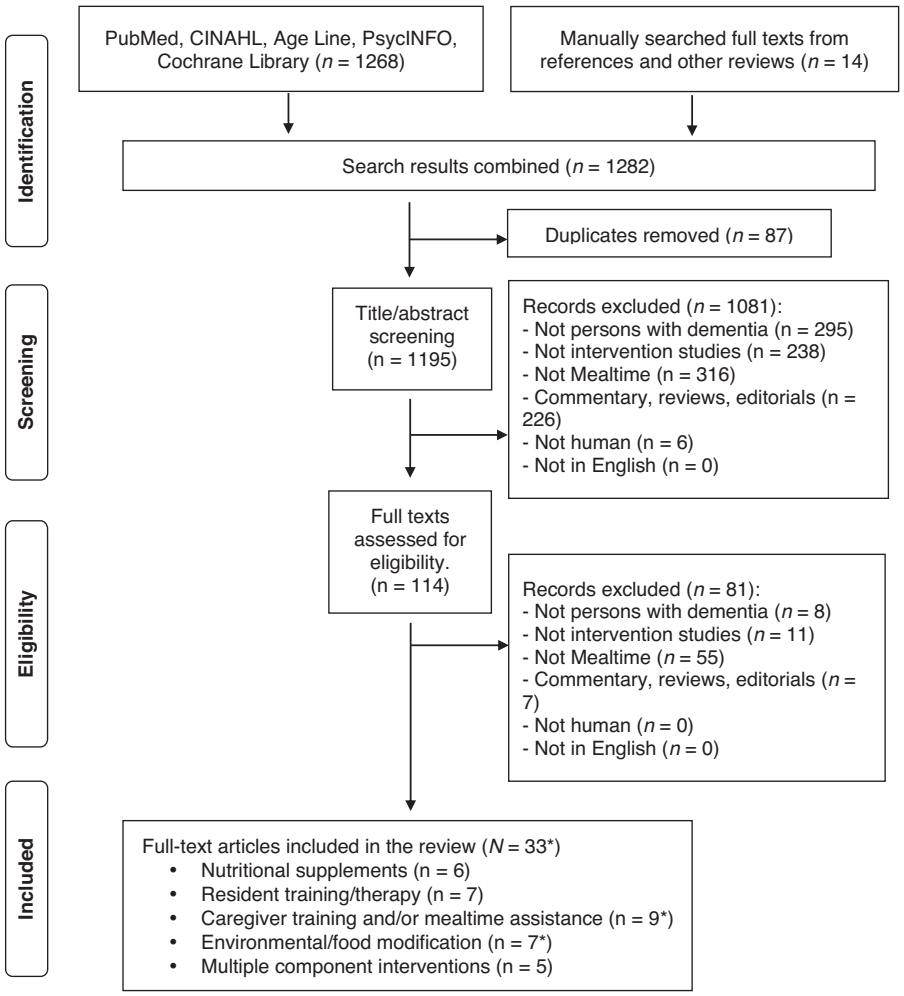


FIGURE 1 Flow diagram of literature search. *The Cleary et al. (2012) study tested two different interventions—cueing intervention and conversation intervention—which were categorized as caregiver training and/or mealtime assistance and environmental/food modification, respectively. This study was counted once time in each of the two intervention types as noted above.

When standard deviations (SD) of changes were missing in the study, the SD of changes were imputed using the formula[55] in which the pre- and post-intervention correlation (*r*) was conservatively estimated at 0.5[56] following guidance from the Cochrane handbook. Review Manager software 5.4.1 was used to produce forest plots and funnel plots. Funnel plots were generated to visually assess potential publication bias. Statistical heterogeneity was assessed using the chi-squared and I^2 statistics. A fixed-effects model was initially used, and a random-effects model was used if I^2 values were greater than 50% which may represent substantial heterogeneity based on the rule of thumb.[55]

3 | RESULTS

3.1 | Search results

Figure 1 shows the literature search, screening, and categorization process. A total of 1268 records were yielded from database searches and 14 records were yielded from reference lists, resulting in a total of 1282 records. After duplicates were removed, 1195 articles were screened by title and abstract, of which 1081 articles were excluded. Out of the 114 full texts assessed for eligibility, 81 were excluded, resulting in a total of 33 articles that were eligible and included in the systematic review.

3.2 | Study characteristics

Table S2 shows the characteristics of the included studies, including study design, sample and setting, intervention, comparator, duration, outcomes, and study quality. Interventions, based on components and nature, were categorized into five types: nutritional supplements, resident training/therapy, caregiver training and/or mealtime assistance, environmental/food modifications, and multiple component interventions.

The 33 studies included 15 RCTs, 3 controlled clinical trials (CCTs), 7 cross-over studies, and 8 cohort studies. The primary reasons for weak study quality included lack of discussion surrounding confound-

ing variables, lack of blinding, and lack of participant withdrawal reporting. The samples of the 33 studies included a total of 1813 adults with ADRD, 232 family caregivers (home settings), and 39 direct care staff caregivers (66 nursing homes and 7 hospitals with outpatient memory or geriatric clinics). Studies were conducted in the USA,[57–64] Canada,[65–68] France,[69,70] China,[71,72] Taiwan,[73–77] South Korea,[78] Italy,[79] Japan,[80,81] Portugal,[82,83] Germany,[84] Finland,[85] the United Kingdom,[86] the Netherlands,[87,88] and Turkey.[89]

Resident outcomes included physical/biological outcomes (e.g., appetite, oral moisture), cognitive and functional outcomes (e.g., recall performance, cognitive function, eating compliance, eating challenges, swallowing difficulties, self-feeding time, ADL, grip strength), behavioral and psychological symptoms (e.g., eating difficulties, hyperphagic behaviors, agitation, depression), nutritional outcomes (e.g., food intake, body weight, BMI, body composition, nutritional status, metabolic status), and other adverse outcomes (e.g., overall survival, fall rate). Caregiver outcomes included knowledge, attitude, behaviors, and caregiver burden. No environmental outcomes were reported in the included studies.

3.2.1 | Nutritional supplements

Six studies (four RCTs, two cohort studies) reported effects of ketogenic diet,[63] oral nutritional supplements,[82,84,86] DHA-enriched meals,[80] and black mulberry.[89] One study[80] was strong, one[82] was moderate, and four[63,84,86,89] were weak in quality.

3.2.2 | Resident training/therapy

Seven studies (six RCTs, one CCT) reported effects on hand exercise,[72] spaced retrieval,[74–77] doll therapy,[79] and music therapy.[62] Three studies[75–77] were strong, and four[62,72,74,79] were moderate in quality.

3.2.3 | Caregiver training and/or mealtime assistance

Nine studies (two RCT, seven cohort studies) reported effects on feeding interventions,[71] comparisons of handfeeding techniques,[60] therapeutic communication training,[58] family caregiver training,[59] dementia dietary education,[73] stakeholder engagement practice change,[67] meal assistant training,[78] verbal cueing,[66] and diet and stress-reduction coaching.[61] One study[61] was moderate and the other studies[58–60,66,67,71,73,78] were all weak in quality.

3.2.4 | Environmental/food modification

Seven studies (one RCT, six cohort studies) reported effects on food odor exposure,[69,87] color contrast manipulation,[65] animal-assisted therapy,[57] reminiscence therapy,[66] flavor enhancement,[70] and the display of video recorded chewing.[88] All studies[57,65,66,69,70,87] were weak in quality except for one strong RCT.[88]

3.2.5 | Multiple component interventions

Five studies (two RCTs, two CCTs, one cohort study) reported effects of targeted diet recommendations,[68] nutritional guidance,[85] psychomotor rehabilitation in combination with nutritional supplements,[83] comprehensive geriatric assessment with multidisciplinary interventions,[81] and staff management and quality improvement system.[64] One study[68] was moderate and four[64,81,83,85] were weak in quality.

3.3 | Assessment of level of evidence

Evidence for nine main outcomes, including food intake, body weight, BMI, eating difficulty, cognitive function, hyperphagic behavior, nutrition, ADL function, and depression were graded (Table 5).

3.3.1 | Food intake

Changes or group differences in food intake were assessed in six "environmental/food modification" studies (zero RCT) at 15 min–12 weeks after interventions or tests, five "caregiver training and/or mealtime assistance" studies (one RCT) at 2 days–3 months, five "resident training/therapy" studies (four RCTs) at 3 weeks–6 months, and two "nutritional supplements" studies (zero RCT) throughout a week to 3 months. Food intake was measured by weighing food on a tray, calculating calories, or calculating the percentage of food consumed. Level of evidence was low for "resident training/therapy" in increasing food intake, and very low in the other three intervention types.

3.3.2 | Body weight and BMI

Two "environmental/food modification" studies (zero RCT) and two "nutritional supplement" studies (one RCT) reported weight changes or differences at 3 months, and two "nutritional supplement" studies (one RCT) and four "multiple components intervention" studies (three RCTs) reported BMI changes or differences at 3–6 months. The level of evidence was very low to low on body weight and low to moderate on BMI in all intervention types.

3.3.3 | Eating difficulties and hyperphagic behaviors

Four "caregiver training and/or mealtime assistance" studies (zero RCT) and four "resident training/therapy" studies (two RCTs) reported

TABLE 5 Level of evidence for main outcomes.

Interventions	Baseline evidence	Total Subjects	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Factors for rating up	Overall quality of evidence
Food intake									
Environmental/food modification ($n = 6$) Sulmont-Rossé et al., 2018; Verwijs et al., 2022; Donnelly et al., 2020; Edwards and Beck, 2013; Pouyet et al., 2014; Cleary et al., 2012 (Reminiscence vs. control)	Low	311	Not serious	Serious (−1)	Direct	Serious (−1)	Unlikely	No	Very low
Caregiver training and/or mealtime assistance ($n = 5$) Chen et al., 2015; Batchelor-Murphy et al., 2017 (OH vs. DH); Batchelor-Murphy et al., 2017 (UH vs. DH); Cleary et al., 2012 (verbal cues vs. control); D'Avolio et al., 2023	Moderate	122	Serious (−1)	Serious (−1)	Direct	Serious (−1)	Unlikely	No	Very low
Resident training/therapy ($n = 6$) Chen et al., 2018; Wu, Lin, Wu, et al., 2014, (Standardized vs. Control); Wu, Lin, Wu, et al., 2014, (Individual vs. Control); Wu, Lin, Su, et al., 2014; McHugh et al., 2012	High	240	Serious (−1)	Not serious	Direct	Serious (−1)	Unlikely	No	Low
Nutritional supplements ($n = 2$) Taylor et al., 2018; Allen et al., 2013	Low	36	Not serious	Very serious (−2)	Direct	Serious (−1)	Unlikely	No	Very low
Body weight									
Environmental/food modification ($n = 2$) Verwijs et al., 2022; Edwards and Beck, 2013	Low	115	Not serious	Very serious (−2)	Direct	Serious −1)	Unlikely	No	Very low
Nutritional supplements ($n = 2$) Taylor et al., 2018; Stange et al., 2013	Moderate	87	Not serious	Not serious	Direct	Serious (−1)	Unlikely	No	Low
BMI									
Nutritional supplements ($n = 2$) Taylor et al., 2018; Stange et al., 2013	Moderate	87	Not serious	Not serious	Direct	Serious (−1)	Unlikely	No	Low
Multiple components ($n = 4$) Suominen et al., 2015; Shatenstein et al., 2016; de Sousa et al., 2017 (NSG vs. control); de Sousa et al., 2017 (NSPRG vs. control)	High	262	Not serious	Not serious	Direct	Serious (−1)	Unlikely	No	Moderate
Eating difficulties									
Caregiver training and/or mealtime assistance ($n = 4$) Jung et al., 2020; Chen et al., 2015; Batchelor-Murphy et al., 2017 (OH vs. DH); Batchelor-Murphy et al., 2017 (UH vs. DH)	Low	113	Serious (−1)	Not serious	Direct	Serious (−1)	Unlikely	No	Very low
Resident training/therapy (n = 4) Chen et al., 2018; Wu, Lin, Wu, et al., 2014, (Standardized vs. Control); Wu, Lin, Wu, et al., 2014, (Individual vs. Control); Cantarella et al., 2018	High	193	Serious (-1)	Not serious	Direct	Serious (-1)	No	No	Low

(Continues)

TABLE 5 (Continued)

Interventions	Baseline evidence	Total Subjects	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Factors for rating up	Overall quality of evidence
Cognitive function									
Resident training/therapy (n = 3) Wu, Lin, Su, et al., 2014; Kao et al., 2016 (SR group vs. control); Kao et al., 2016 (SR + Montessori group vs. control)	High	246	Not serious	Not serious	Direct	Serious (-1)	No	No	Moderate
Nutritional supplements (*n* = 5) Hashimoto et al., 2016; de Sousa and Amaral, 2012; Taylor et al., 2018; Stange et al., 2013; Gucer Oz et al., 2024	High	226	Not serious	Serious (−1)	Direct	Serious (−1)	No	No	Low
Hyperphagic behavior									
Resident training/therapy (*n* = 3) Hsu et al., 2016; Kao et al., 2016 (SR group vs. control); Kao et al., 2016 (SR + Montessori group vs. control)	High	280	Not serious	Serious (−1)	Direct	Serious (−1)	No	No	Low
Nutrition									
Nutritional supplements (*n* = 2) de Sousa and Amaral, 2012; Stange et al., 2013	High	112	Not serious	Serious (−1)	Direct	Serious (−1)	No	No	Low
ADL function									
Nutritional supplements (*n* = 2) de Sousa and Amaral, 2012; Stange et al., 2013	High	112	Not serious	Not serious	Direct	Serious (−1)	No	No	Moderate
Multiple components (*n* = 2) de Sousa et al., 2017 (NSG vs. control); de Sousa et al., 2017 (NSPRG vs. control)	High	122	Not serious	Not serious	Direct	Serious (−1)	No	No	Moderate
Depression									
Nutritional supplements (*n* = 2) Hashimoto et al., 2016; Stange et al., 2013; Gucer Oz et al., 2024	High	182	Not serious	Not serious	Direct	Serious (−1)	No	No	Moderate
Grip strength									
Multiple components (n = 3) de Sousa et al., 2017 (NSG vs. control); de Sousa et al., 2017 (NSPRG vs. control); Shatenstein et al., 2016	High	184	Not serious	Serious (-1)	Direct	Serious (-1)	No	No	Low

Abbreviations: ADL, Activities of Daily Living; BMI, body mass index; DH, Direct Hand techniques; NSG, Nutritional Supplementation Group; NSPRG, Nutritional Supplementation Psychomotor Rehabilitation Group; OH, Over Hand techniques; SR, Spaced Retrieval; UH, Under Hand techniques.

effects on eating difficulties at 2 days–6 months, and three "resident/training/therapy" studies (three RCTs) reported effects on hyperphagic behaviors during mealtime at 1 week–6 months. Level of evidence was very low to low on eating behaviors and hyperphagic behaviors in all intervention types.

3.3.4 | Cognitive function

Three "resident training/therapy" studies (three RCTs) and five "nutritional supplements" studies (four RCTs) reported nonsignificant changes and/or differences in cognitive function at 1 month–3 months. All the included studies used Mini-Mental State Examination (MMSE) to measure cognition. The level of evidence was moderate for "resident training/therapy" and low for "nutritional supplements" in changing cognitive function.

3.3.5 | Nutrition

Nutritional status, as measured by MNA, was reported in two "nutritional supplements" studies (two RCTs) at 3 months. There was a low

level of evidence in "nutritional supplements" for improving nutritional status.

3.3.6 | ADL function

Two "nutritional supplements" studies (two RCTs) reported nonsignificant group differences in ADL function at 3 months. The other two "multiple components interventions" studies (two RCTs) reported nonsignificant changes and group differences on ADL function at 21-, 90-, and 180-days post intervention. ADL function was consistently measured by the Barthel Index. The quality of evidence was moderate in the two intervention types.

3.3.7 | Depression

Three "nutritional supplements" studies (three RCTs) reported nonsignificant changes and group differences in depression at 12 weeks to 6–12 months. Zung Self-Rating Depression Scale (SDS) was used to assess depression in two studies, and Geriatric Depression Scale (GDS) in one study. The quality of evidence was moderate.

3.3.8 | Grip strength

Three "multiple components intervention" studies (one RCT) reported nonsignificant changes or significant decreases in grip strength in both the intervention and control groups after 6 months from baseline. Two studies showing no changes used Smedley's dynamometer (measured in kgf) to assess grip strength, while one study showing a significant decrease used Martin Dynamometer (kPa). There was a low level of evidence.

3.4 | Meta-analyses

Of the 30 included studies, 14 studies that reported pre- and post-intervention measurements or mean changes from baseline for both intervention and control groups were included in the meta-analyses. Figure 2 shows the forest plots of six outcomes. Food intake showed a significant increase through "environmental/food modification" (two studies, standardized mean difference [SMD] = 0.38, 95% CI = 0.15–0.61, $p = 0.001$, $I^2 = 48\%$) and "resident training/therapy" (five studies, SMD = 0.52, 95% CI = 0.27–0.78, $p < 0.001$, $I^2 = 0\%$). The effect of "multiple components interventions" in increasing BMI was not significant (four studies, SMD = -0.02, 95% CI = −0.27–0.24, $p = 0.90$, $I^2 = 0\%$). There was a significant decrease in eating difficulties through "resident training/therapy" (four studies, SMD = −0.74, 95% CI = −1.24 to −0.25, $p = 0.003$, $I^2 = 65\%$). The effect of "nutritional supplements" in improving cognitive function was significant with large heterogeneity (three studies, SMD = 0.48, 95% CI = 0.13–0.83, $p = 0.007$, $I^2 = 85\%$), and the effect in decreasing depression was also significant (two studies, SMD = −2.41, 95% CI = −3.26 to −1.57, $p < 0.001$, $I^2 = 62\%$). There was no effect of "multiple component interventions" in improving ADL function based on two studies with no heterogeneity (SMD = 0.16, 95% CI = −0.24–0.55, $p = 0.44$, $I^2 = 0\%$). The effect of "multiple component interventions" in increasing grip strength was not significant (three studies, SMD = −0.09, 95% CI = −0.40–0.23, $p = 0.59$, $I^2 = 0\%$). The visual assessment of funnel plots with adequate symmetry indicated little possibility of publication bias for all outcome (Figure S1).

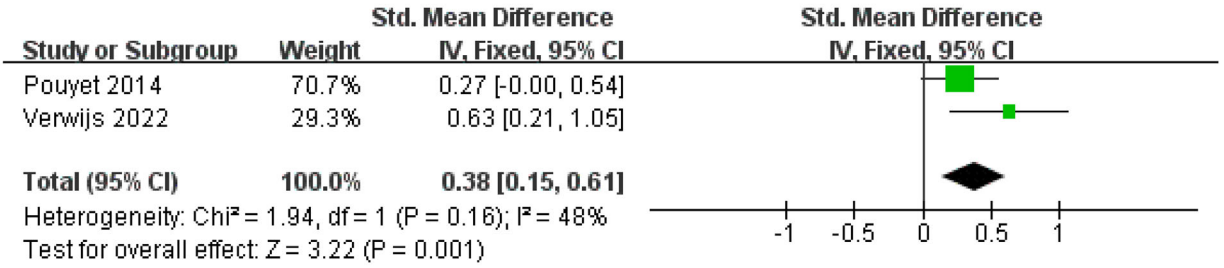
4 | DISCUSSION

This review synthesized the characteristics and effects of recent non-pharmacological mealtime-related interventions on mealtime care and outcomes in people living with dementia and their caregivers. This review provided updated evidence on existing mealtime interventions targeting intrapersonal, interpersonal, and/or environmental/food-level factors based on the assessment of the level of evidence and meta-analyses using rigorous tools and methodologies. Compared to our earlier systematic review on this topic that included 22 studies (9 RCTs) published between 2004 and 2012,[32] this review included 33 studies (15 RCTs) published between 2012 and 2024, indicating the steadily increasing efforts in this field over the past 2 decades (Table 6). Particularly, the number of studies testing resident training/therapy, caregiver training and/or mealtime assistance, and multiple component interventions have increased dramatically, indicating the rise in attention surrounding these interventions as potential ways to improve mealtime care and outcomes in people with dementia and their caregivers. However, the overall quality of studies has dropped dramatically: only 12 (out of 33 studies, 36%) in this review, compared to 19 (out of 22 studies, 86%) in the Liu et al. 2014 review, had moderate or strong quality, using the same quality of study assessment tool. Findings indicate the majority of the recent studies have some limitations in study designs, methodology, and reporting. Future intervention studies should employ more rigorous designs and methodologies with minimized selection bias, randomization, concealment of allocation, control of confounders, double blinding, adequate sample size, validated data collection methods, and rigorous reporting to determine the efficacy and facilitate the implementation of the interventions.

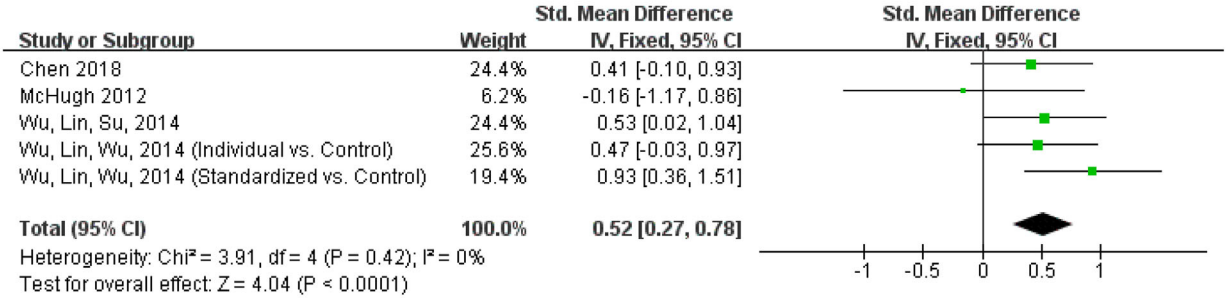
"Nutritional supplements" had very low levels of evidence in increasing food intake and low evidence in increasing body weight, BMI, and nutritional status. Findings were consistent with a prior review that reported limited evidence on improving oral food and drink intake, nutrition, and hydration status by oral nutrition supplementation in people with dementia,[90] and was inconsistent with other reviews that reported (1) low to moderate evidence to promote body weight by high-calorie supplements[46] and to improve fluid and protein intake by oral nutrition supplements,[43] and (2) moderate level of evidence supporting the impact of nutritional supplements in increasing food intake, weight, and BMI.[32] In addition, there was a moderate level of evidence showing that "nutritional supplements" did not improve ADL function.

1. Food intake

Environmental/food modification (n = 2)

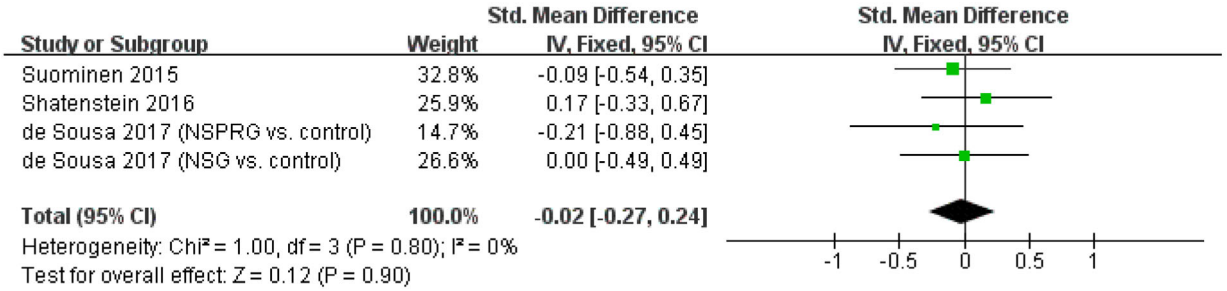


Resident training/therapy (n = 5)



2. BMI

Multiple components (n = 4)



3. Eating difficulties

Resident training/therapy (n = 4)

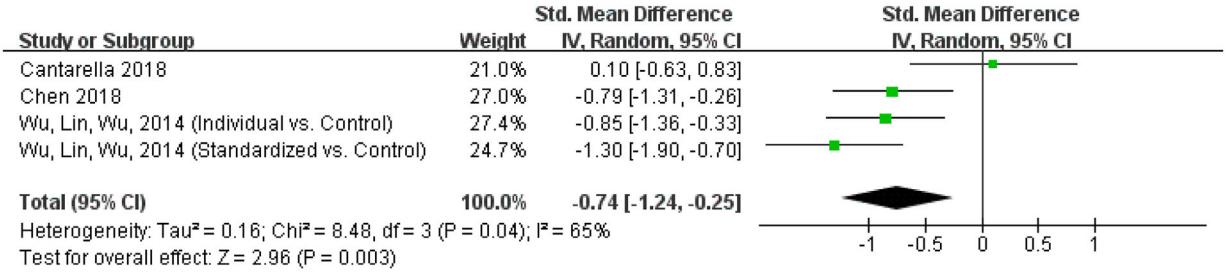


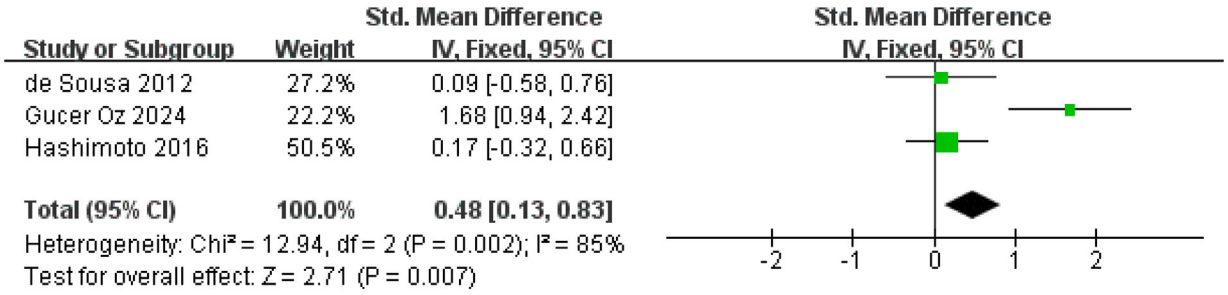
FIGURE 2 Forest plots of main outcomes by interventions. NSG, nutritional supplementation group; NSPRG, nutritional supplementation psychomotor rehabilitation group.

Findings were consistent with prior reviews that reported a lack of evidence on function,[43,46] confirming the insignificant role of nutritional supplements on ADL. While current evidence shows that nutritional supplements have insufficient to low evidence in enhancing nutrition and function in people with dementia, the generalization of evidence is limited due to the small number of studies and the types, dosages, nutrients, and durations of supplements varied across studies. Further research with larger, diverse samples is needed to establish more reliable evidence.

"Nutritional supplements" had low level of evidence in increasing cognitive function. The pooled effect from three RCTs was significant yet small with high heterogeneity among studies due to the small

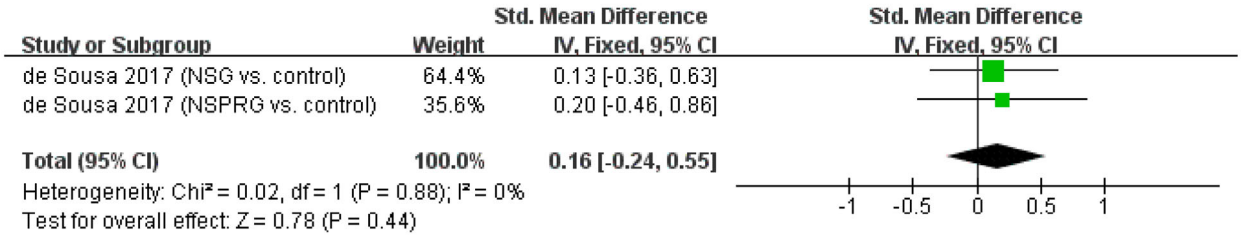
4. Cognitive function

Nutritional supplements (n = 3)



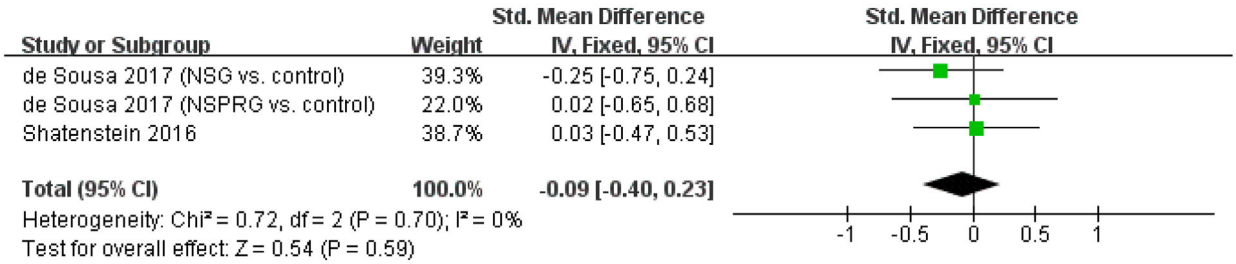
5. ADL function

Multiple components (n = 2)



6. Grip strength

Multiple components (n = 3)



7. Depression

Nutritional supplements (n = 2)

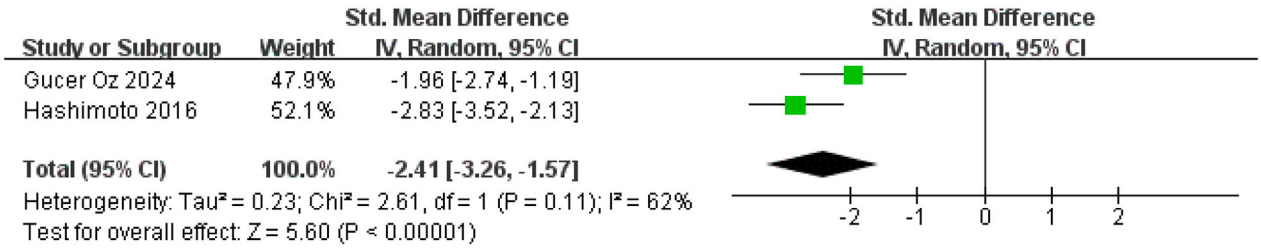


FIGURE 2 Continued

effect sizes in two studies, where changes in cognitive decline were not large and significant in either treatment or control groups. The level of evidence in decreasing depression with "nutritional supplements" was moderate, showing a large and significant pooled effect from two RCTs with moderate heterogeneity. These findings do not align with prior reviews that reported the insignificant role of nutritional supplements on cognitive function[42,43] and dementia-related behavioral symptoms;[44] a meta-analysis of polypeptide and B vitamin supplementation in individuals with AD[42] found no significant effects on cognitive function, nor did a systematic review of oral nutrition supplements in those with dementia and mild cognitive impairment.[43] Neuropsychiatric symptoms were also not improved with nutritional supplements

TABLE 6 Comparisons of included studies across two similar reviews

Parameter	Liu et al's 2014 review (*N* = 22 studies)[32]	This review (*N* = 33 studies)
Intervention types		
Nutritional supplements	7	6
Resident training/therapy	2	7
Caregiver training and feeding/mealtime assistance	5	8
Environmental/routine/food modifications	6	7
Mixed or multiple component intervention	2	5
Study quality		
Weak	3	21
Moderate	11	7
Strong	8	5

in a prior meta-analysis.[44] However, current evidence on cognitive function and depression shows substantial variability among studies likely due to differing dietary supplement types, indicating a need for more research with stronger, more robust study designs in larger and homogeneous populations.

"Resident training/therapy" had low levels of evidence in increasing food intake and reducing eating difficulties and hyperphagia. However, our meta-analysis of randomized and controlled trials indicated significant, medium-pooled effects on both food intake and eating difficulties. The difference between level of evidence and size of effect is likely due to the studies with weak study designs that were only included in the level of evidence assessment (versus meta-analysis). Prior reviews had inconsistent findings: (1) some reviews showed that resident skills training, music therapy, and animal-assisted therapy had insufficient evidence to improve mealtime function, food intake, weight, and BMI, similar to our level of evidence findings;[49] (2) some showed that training programs targeted at older adults with dementia showed moderate evidence for reducing feeding difficulties, similar to our meta-analysis findings.[32,33,43] The review by Liu et al.[32] also reported that training/education programs had moderate levels of evidence in increasing eating time for older adults with dementia, while this review did not identify sufficient studies on eating time. Resident training and therapy, including spaced retrieval and exercise for dementia patients, help increase sensory and cognitive focus and reinforce memory recall and retention of skills, strength, and coordination necessary for completing mealtime tasks.[62,74] In addition, resident therapy using music and dolls may help satisfy psychological needs, increasing engagement during meals.[62,79] Based on current findings and an increased level of evidence, resident training/therapy programs play a significant role in improving mealtime behaviors and meal intake and have great implementation potential in clinical practice.

"Caregiver training and/or mealtime assistance" showed very low levels of evidence in increasing food intake and reducing eating difficulties. Findings on food intake were similar to some reviews, which showed that staff training programs and/or feeding assistance had insufficient evidence in increasing food intake[28,32] and nutrition and hydration status.[28] Findings on eating difficulties were inconsistent with some reviews showing that mealtime assistance offered by nursing staff showed some evidence in improving eating performance and mealtime difficulties,[33,91] and that training and education programs targeted at nursing professionals showed moderate evidence for reducing feeding difficulties,[32] which had a stronger level of evidence than findings from this review. Possibly, most studies of this intervention type in this review used weaker study designs and small sample sizes and reported inconsistencies in results due to the use of different measures as well as varied dementia severity and symptoms of the samples.

Caregiver training and mealtime assistance is critical to improve caregivers' knowledge, self-efficacy, beliefs, skills, and capabilities to provide optimal mealtime care, which are fundamental in promoting quality of care and mealtime experiences for residents, particularly residents with advanced dementia who require partial to full assistance. Studies showed that the quality of staff care such as interaction and mealtime assistance skills were associated with higher fluid and food intake and lower decline in functional independence of residents. Current caregiver training/mealtime assistance interventions primarily focused on mealtime assistance, feeding skills, verbal cueing, and more generic training such as therapeutic communication, diet, and stakeholder engagement practice. None of the interventions delivered or tested person-centered mealtime care programs to caregivers and/or persons with dementia. A recent review emphasized that staff training interventions to manage mealtime difficulties in people with dementia should be more systematically developed to address training needs of nurses and care staff, help staff deal with uncertainty, include strategies, skills, and knowledge of person-centered care, and create the right environment.[92] Person-centered care is highly recommended by the 2023 National Plan to Address AD to enhance care quality and efficiency for populations facing care challenges by building a workforce with skills to provide high-quality care[93] as well as by the Alzheimer's Association as one of the fundamental Dementia Care Practice Recommendations for quality care and outcomes.[94]

"Environmental/food modification" had very low levels of evidence in increasing food intake and body weight. A small but significant pooled effect on increasing food intake was indicated by the meta-analysis of two crossover studies that implemented odor dispersion before mealtime and served flavor-enhanced food. Findings were consistent with prior reviews that reported insufficient to low evidence of modifications to environment, routines, and/or food options on improving food intake,[32] oral food and drink intake, nutrition and hydration status,[28] mealtime function, food intake, weight, and BMI.[49] While this review did not identify the adverse effects of "environmental/food modification" on nutritional outcomes, a prior review indicated some evidence of reduced fluid intake

with texture-modified food and fluids.[45,95] The inconsistencies of findings may be due to the variety of modifications to the social and physical dining environments, dining routines/styles, as well as food options. Adaptation of dining areas and ambiance have been targeted as modifiable environmental factors along with staff variables to alleviate behavioral symptoms and improve dietary intake.[96] While our review did not identify sufficient studies that reported change on behavioral symptoms, prior reviews found that environmental/routine modification had an insufficient level of evidence in decreasing behavioral symptoms[48] and agitation,[32] with music being the only intervention that had cumulative or lingering effects on agitated and aggressive behaviors.[48] However, current available evidence still remains insufficient, indicating a need for a larger body of research testing interventions that target modifiable social and physical environmental factors on mealtime care and outcomes including nutritional outcomes and behavioral symptoms with well-controlled designs.

"Multiple component interventions" had very small, nonsignificant pooled effects on BMI and ADL function with moderate levels of evidence. These findings may be due to the limited number of studies that evaluated multiple component interventions, limiting the generalizability of meta-analysis findings. However, there was an increase in the diversity and scope of multiple component interventions (e.g., diet, nutritional guidance/supplements, psychomotor rehabilitation, comprehensive/multidisciplinary geriatric assessment, staff management and quality improvement system, and so forth), compared to that in the earlier review (e.g., routine change, feeding assistance, music/environmental modification, training).[32]

4.1 | Strengths

This review included interventions that targeted multi-level, modifiable factors to improve mealtime care and outcomes at the individual and caregiver levels following the SEM model. Existing evidence of the past decade was synthesized qualitatively and quantitatively through the level of evidence assessment and meta-analyses using rigorous tools and methodologies.

4.2 | Limitations

At the review level, we included only peer-reviewed scholarly records published in English, and excluded those that were not peer-reviewed and/or published in other languages. While rigor and quality of scholarly records were ensured, such inclusion/exclusion criteria may result in selection bias. At the study level, the included studies were heterogeneous in designs, sample characteristics, settings, interventions (e.g., contents, intensity, and duration), comparisons, and outcome measures. In addition, the quality of studies varied and the number of high-quality studies was limited, resulting in a varied number and quality of studies for assessment of the level of evidence and meta-analysis of intervention effects.

4.3 | Future directions for research

This review points out four directions for future research. First, existing mealtime interventions primarily focus on people living with dementia as well as their care providers (nursing professionals, family caregivers) in long-term care settings and/or hospital inpatient clinics. Current evidence and recommendations were generated from and thus more applicable to residential and hospital care practice, and need to be adapted in consideration of individual wishes and preferences and professional advice, before applying them to individuals with dementia and their paid/unpaid caregivers in home care settings.[50] Future research should focus on other care settings (e.g., home care and community) as well as paid caregivers (e.g., home care aids) and unpaid caregivers (e.g., family, friends, relatives) who provide care to people living with dementia in these settings.

Second, while this review aimed to include mealtime-related outcomes at individual, caregiver, dyadic, and environmental levels, existing interventions mostly examined outcomes in people with dementia, including biological/physical, cognitive and functional, behavioral and psychological, nutritional, and other adverse outcomes. Moreover, existing interventions primarily focused on cognitive, functional, and nutritional outcomes. Evidence was sparse on the changes of other outcomes, including physical/biological outcomes (e.g., appetite, oral moisture) and other adverse outcomes (e.g., overall survival, fall rate) in persons with dementia. Future studies may consider including these outcomes to examine impact of interventions.

Third, when mealtime behaviors and interactions were examined as an outcome, existing interventions primarily focused on mealtime challenging (versus positive) behaviors and interactions in people with dementia and their caregivers. It is equally important to manage challenging behaviors and interactions as well as improve positive behaviors and interactions among dyads during mealtime care. Future research will need to evaluate the impact of interventions on positive aspects of mealtime interactions.

Fourth, a few studies included in this review included caregiver-related outcomes (e.g., knowledge, attitude, behaviors, and caregiver burden) and no study examined dyadic-, environmental-, or institutional-level outcomes, which does not allow for assessment of level of evidence or meta-analysis. Future research is needed to expand investigation of caregiver-level outcomes, as well as dyadic-, environmental-, and institutional-level outcomes.

5 | CONCLUSION

Mealtime is an important daily activity to ensure nutrition and social interaction, as well as enjoyment of food for people with dementia. Using effective non-pharmacological interventions that target the modifiable intrapersonal-, interpersonal-, and environmental-level factors is critical to optimize mealtime care quality and outcomes for people with dementia and their caregivers in a variety of care settings. This review evaluated studies from the past decade, provided updated evidence for research and practice, and offered directions for

future research in the field of dementia mealtime care. Existing evidence is based on a body of literature with moderate to weak quality and methodological limitations. Future research will need to conduct more rigorous intervention studies and develop and implement interventions in care settings other than nursing homes, particularly among people with dementia and their family caregivers in home and community settings.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest. Author disclosures are available in the Supporting Information.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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