



Promoting mealtime function in people with dementia: A systematic review of studies undertaken in residential aged care



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ABSTRACT

Background: Dementia is one of the most prevalent conditions in older adults in residential aged care. Dementia has a significant impact on a person's ability to eat, drink and participate in mealtime activities. Dementia impacts memory, appetite, gross and fine motor skills, communication skills, mood and social behaviours, all of which can decrease the person's ability to engage in a meal.

Objectives: The objective was to review the literature on strategies to promote mealtime function in people with dementia living in residential aged care and assess their effectiveness. The review considered studies reporting outcome measures that related to nutritional status, communication, behaviour and eating skills and ability.

Design: Systematic review using the Joanna Briggs Institute review methods.

Data sources: Seven databases (MEDLINE, CINAHL, Cochrane Database of Systematic Reviews, EMBASE, Current Contents, PsycINFO and Allied and Complementary Medicine Database) were searched for research published 2000–2017 in English. Eligible studies included quantitative studies reporting a mealtime intervention delivered to people with dementia in residential aged care compared with standard care reporting nutritional, behavioural or functional outcomes, including observation studies with no comparator.

Review methods: Studies were screened and independently appraised by two reviewers using Joanna Briggs Institute (JBI) critical appraisal tools based on study design. Data was extracted from eligible studies using JBI extraction tables that assess study design, population characteristics, intervention and comparator, outcome measures and findings. Results related to mealtime function were tabulated and reported in narrative format.

Results: 136 studies were identified, of which 20 were eligible for inclusion. Studies reported strategies related to: food presentation; meal styles; environment adaptations; skills training; music therapy and animal-assisted therapy. Outcomes included measures of nutritional status, communication and behavioural and psychological symptoms of dementia. Low quality evidence suggested that playing music and introducing fish to the dining room may improve the food intake of people with dementia by a small amount. Montessori and spaced retrieval programs also demonstrated some positive impact on eating skills and nutritional intake. Animal-assisted therapy also demonstrated small statistically significant improvements in weight and body mass index.

Conclusion: There is insufficient evidence to highly recommend any specific intervention to improve mealtime functional ability in people with dementia. Further research is required through robust study designs using valid and reliable outcome measures to demonstrate clinically significant effects for mealtime interventions.

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What is already known about the topic?

- Numerous strategies are used in aged care to promote nutritional intake and mealtime culture. Interventions range widely in their accessibility, feasibility, cost, objective efficacy in promoting function in people with dementia.

What this paper adds

- This review identified mealtime interventions designed to improve nutritional status, modify mealtime behaviours and improve mealtime skills.
- Selection of a mealtime intervention should be made with consideration to the rationale and goals of care for the individual with dementia.
- Low cost, easily implementable interventions (e.g. animal therapy and music therapy), as well as training program (e.g. Montessori or space-retrieval) and environmental changes (e.g. increasing dining room lighting) all appear to be associated with small increases in food intake, but have generally not been shown to increase weight or body mass index.
- Evaluate mealtime interventions using outcome measures appropriate to the goals of the intervention and using reliable and valid tools.

1. Introduction

Dementia manifests as a decline in cognitive ability that interferes with normal daily life and encompasses a range of cognitive impairments that often present as behavioural and psychological symptoms (Gustafson, 1996). A recent systematic review on dementia in people aged above 65 years reported a wide range in prevalence of dementia in different ethnic groups, from a low of 6.5% to a high over 20% (Mehta et al., 2017). This is consistent with other reports of a prevalence of dementia of 8.8% in the United States (Langa et al., 2017) and Australia (Australian Institute of Health and Welfare, 2012) and 7.1% in Canada (Public Health Agency of Canada, 2017). Prevalence however varies across different populations, and is associated with a range of risk factors, including demographics (e.g. age, gender and race), as well as social, behavioural and medical variables (Langa et al., 2017). In aged care settings, dementia is one of the most common comorbidities (Australian Institute of Health and Welfare, 2012).

Dementia can have a significant impact on a person's functional ability to eat and drink and participate in mealtime activities (Kai et al., 2015). The disease can impair the person's ability to receive cognitive triggers that promote intake of food and drink, which can manifest as a decrease in appetite, eating too quickly or in excessive amounts, craving foods that were not previously eaten, or not being able to distinguish edible from non-edible items (Chang et al., 2008). The impact of dementia on memory can have a significant impact on the mealtime experience, as people with dementia progressively forget: mealtime customs and norms; how to use cutlery and crockery; the steps involved in eating (e.g. chewing before swallowing); food identification; and/or when they last ate (Allen et al., 2016; Alzheimers Society of Canada, 2012; Hallpike, 2008). These issues are compounded by the person's functional deterioration, for example a reduction in co-ordination (Allen et al., 2016). The behavioural and psychological symptoms of dementia such as anxiety, depression, and aggressive behaviour can also impact the quality of mealtimes for people with dementia, and negatively influence various functions of a meal, including food intake and social experience (Keller et al., 2016). As dementia progresses, it is not uncommon for people with dementia to have

changes in appetite, food preferences and eating habits and behaviours. Some individuals may have a loss of appetite or lose interest in eating altogether (Kai et al., 2015).

All these concerns can be a significant challenge to people with dementia and their caregivers (both paid and unpaid). Impaired mealtime functioning has numerous negative consequences, including inadequate nutritional intake leading to loss of weight and health complications (Cleary et al., 2012; Edwards et al., 2002). A significant proportion of people with dementia in aged care facilities are reported to be malnourished, placing them at greater risk for other health complications (Douglas et al., 2015; Hallpike, 2008; Keller et al., 2015; Watkins et al., 2017). However, a healthy nutritional intake for people with dementia not only promotes overall health, functional capacity and independence, but also improves social function and quality of life. Participation in a positive mealtime experience is considered important in promoting psychosocial health (Keller et al., 2015, 2016). People with dementia who are unable to participate in the activities that are expected at mealtimes are at risk of losing social contact and the enjoyment that humans generally obtain from food and eating rituals (Keller et al., 2015, 2016).

A recent consensus study highlighted the importance of interventions that promote mealtime function for individuals in residential aged care, noting that nutritional status is a determinant of health and wellbeing (Keller et al., 2015). A wide range of mealtime strategies are used within the aged care setting to encourage food and fluid intake, each focussing on addressing different factors that are recognised as influencing the nutritional status of people with dementia (Keller et al., 2015; Watkins et al., 2017). In a recent systematic review of qualitative research conducted in people with, and without, dementia, Watkins et al. (2017) categorised interventions being used in aged care to address care provision, agency of people with dementia, mealtime culture, and mealtime quality and enjoyment. Within these categories, numerous individual interventions are used within care facilities to promote nutritional status, functional capacity and quality of life for people with dementia.

The broad range of available interventions to assist with mealtime function, with their vastly different foci and goals, appear to be used with mixed success in aged care settings. A consensus process reported by Keller et al. (2015) identified that, despite a range of strategies being available, minimal research on their efficacy has been published. This consensus panel prioritised a future research agenda identifying areas in which new interventions could be focused (Keller et al., 2015). However, there is currently no synthesised evidence on the efficacy of mealtime interventions specifically for people with dementia living in aged care facilities that can be used by health professionals to promote quality care.

2. Aim

The aim of this systematic review was to report on the effectiveness of interventions designed to improve mealtime function for people with dementia. The review sought to address the PICO (participants, interventions, comparisons and outcomes) question:

Are interventions designed to improve the mealtime functional ability of people with dementia, including nutritional status, behaviours and mealtime skills effective in improving measures of mealtime function?

3. Methods

Primary research studies of quantitative design published in English between January 2000 and January 2017 were considered

Box 1. Primary MESH terms and keyword search strategy.

Dementia/ OR Dementia, Vascular/ OR Dementia, Multi-Infarct/ OR Dementia/ OR Frontotemporal Dementia/ OR Alzheimer's Disease.mp
 AND
 Homes for the Aged/ OR Nursing Homes/ OR Long Term Care/ OR Residential Home/ OR Elderly Care/ OR Residential Care/ OR Assisted Living Facility/ OR nursing home.mp. OR long term care.mp.
 AND
 Meals/ OR Feeding Method/ or dining.mp OR eating.mp OR feeding.mp OR meal time.mp OR mealtime.mp
 LIMITS
 English language, published January 2000 to January 2017

for this review. The review was conducted using the framework and methods published by the Joanna Briggs Institute (Joanna Briggs Institute, 2014a). Seven databases (MEDLINE, CINAHL, Cochrane Database of Systematic Reviews, EMBASE, Current Contents, PsycINFO and Allied and Complementary Medicine Database) were searched to identify relevant research. The search combined MESH terms and keywords synonymous with dementia, aged care, eating, feeding and meals (see Box 1). Reference lists of included papers were reviewed to identify additional studies. Studies were required to report on interventions designed to improve the mealtime function of older people with dementia (excluding nutrition-specific interventions such as oral supplements). Studies meeting the eligibility criteria were those reporting research conducted with individuals aged over 65 years with dementia (excluding delirium) who were living in any type of residential aged care setting. Included studies were required to report any quantitative outcome measure that was used to evaluate improved function in mealtime activities, including measures of food intake, eating skills, behavioural and psychological symptoms of dementia, or nutritional status. Studies that did not report relevant outcome measures, non-research papers and other systematic reviews were not eligible for inclusion.

Identified papers were screened based on title and abstract and appraised twice by a team of three independent reviewers (EH, MB and DF). Appraisal tools for quantitative research developed by the Joanna Briggs Institute (JBI) for appraising randomised controlled trials (RCTs)/pseudo-RCTs and descriptive/case series studies were used. The appraisal tool for RCTs/pseudo-RCTs evaluated randomisation, blinding, allocation concealment, management of study withdrawals, baseline comparability; outcome measurement and statistical analysis (Joanna Briggs Institute, 2014a). For descriptive/case series studies, the appraisal tool included appraisal evaluated

sample selection, identification and reporting of confounding factors, outcome measurement, analysis methods and reporting of study withdrawals (Joanna Briggs Institute, 2014a). Data was extracted using the standardised JBI data extraction tools and accuracy was checked by a second reviewer.

Papers meeting the inclusion criteria were given a quality ranking using the JBI appraisal system by two reviewers. Differences of opinion were resolved through discussion. Using the JBI appraisal system, RCTs/pseudo-RCTs were ranked as high quality, with the quality ranking downgraded based on the level of bias risk (Joanna Briggs Institute, 2014b). Descriptive/case studies were ranked as being of low quality, with further down-grading of ranking based on the level of bias risk (Joanna Briggs Institute, 2014b).

4. Results

4.1. Included studies

After identifying 136 papers potentially of interest to the review, 87 were excluded based on review of the title/abstract because the designs of the studies did not meet the inclusion criteria. The remaining 49 studies were retrieved, and the full paper was reviewed. A further 29 studies were excluded, primarily because the study design did not meet inclusion criteria, or they did not report measures of mealtime function. This left 20 studies that met the inclusion criteria and provided evidence on the effectiveness of interventions to promote functioning of people with dementia during mealtime activities (see Fig. 1 PRISMA chart).

The results of the critical appraisal are reported in Table 1 (RCTs/pseudo-RCTs) and Table 2 (descriptive/case series). The body of evidence was of low quality. There was a high risk of bias for randomisation and allocation concealment, and few studies used

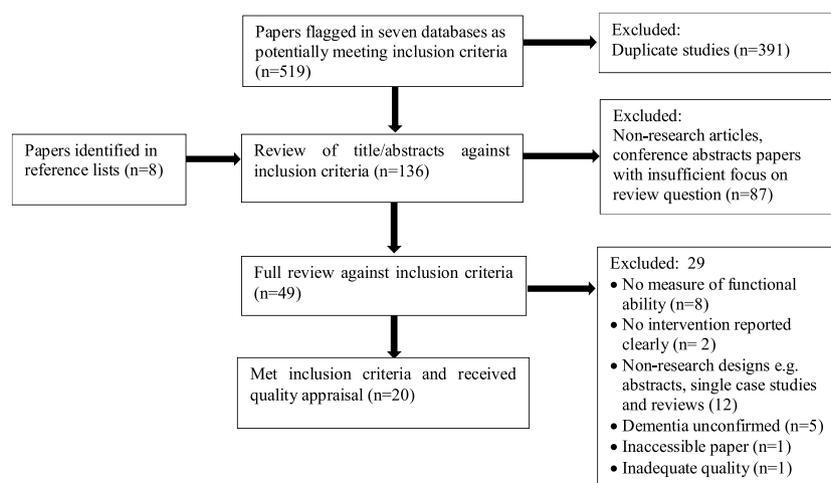


Fig. 1. PRISMA Chart.

Table 1
Critical appraisal of RCTs/quasi-RCTs.

	Randomisation	Allocation concealment	Blinded participants	Withdrawals reported and in analysis	Baseline comparability	Equivalence aside from intervention	Blinded outcome measurement	Reliable outcome measurement	Appropriate statistical analysis	JBI quality ranking
Allen et. al., 2014	○	●	●	○	○	●	●	●	○	M
Altus et. al, 2002	●	●	●	○	○	●	●	●	NA	L
Brush et. al., 2002	●	●	●	○	○	●	●	●	○	L
Chang & Lin, 2005	●	●	●	●	●	●	●	●	○	L
Charras & Frémontier, 2010	●	●	●	○	●	○	●	○	○	M
Dunne et. al., 2004	●	●	●	○	○	○	●	●	○	L
Edwards & Beck, 2002	●	●	●	●	○	●	●	○	●	L
Lin et. al., 2011	●	●	●	○	●	●	○	○	●	L
Lin et. al., 2010	●	●	●	●	●	●	●	○	○	L
Liu et. al., 2015	●	●	●	●	●	●	●	●	●	L
McHugh et. al., 2012	○	●	●	NA	○	○	●	●	NA	L
Richeson & Neill, 2004	●	●	●	NA	●	●	●	●	NA	L
Thomas & Smith, 2009	●	●	●	NA	○	○	●	○	○	M
Wu, Lin, Wu et. al., 2014	●	●	●	●	●	●	●	○	○	L
Wu, Lin, Su et. al., 2014	●	○	○	●	●	●	○	○	○	M

○ low risk of bias ● unclear risk of bias ● high risk of bias
H high quality **M** moderate quality **L** low quality

blinded participants or data collectors. Many studies used a potential non-comparable control group (e.g. a group in another aged care setting) or used data collection methods that were at unclear risk of bias. Participant selection methods and reporting of withdrawals was often unclear or there was a high risk of bias.

There was significant heterogeneity in terms of outcome measures, data collection strategies, duration of interventions and analysis techniques reported in the included studies. As such, a meta-analysis of the findings was not possible and findings are therefore reported in a narrative summary.

Table 2
Critical appraisal of studies with a descriptive/case series design.

	Randomised or pseudo-randomised sample	Inclusion criteria defined	Identification and management of confounding factors	Objective outcome assessment	Sufficient follow up period	Withdrawals described and included in analysis	Reliable outcome measurement	Appropriate statistical analysis	JBI quality ranking
Cleary et. al., 2008	●	○	●	○	●	●	○	NA	L
Cleary et. al., 2012	●	○	●	○	●	●	○	●	L
Edwards & Beck, 2013	●	○	○	○	○	●	○	○	L
Perivolaris et. al., 2006	●	○	●	○	●	○	●	○	L
McDaniel et. al., 2001	●	●	●	○	●	NA	●	●	L

○ low risk of bias ● unclear risk of bias ● high risk of bias
H high quality **M** moderate quality **L** low quality

4.2. Characteristics of the participants with dementia

The people with dementia who participated in the studies included in this review were primarily living in long term care/nursing homes (Allen et al., 2014; Brush et al., 2002; Charras et al., 2010; Cleary et al., 2012; Dunne et al., 2004; Liu et al., 2015; Perivolaris et al., 2006; Richeson et al., 2004; Wu et al., 2014a,b). Additionally, ten studies were conducted in dementia-specific care facilities (Altus et al., 2002; Chang et al., 2005; Cleary et al., 2008; Edwards et al., 2002, 2013; Lin et al., 2010, 2011; McDaniel et al., 2001; McHugh et al., 2012; Thomas et al., 2009) and two studies (Brush et al., 2002; Liu et al., 2015) included older people with dementia living in assisted living facilities. Most studies included participants with a mean age around 80 years, and across the studies, both men and women were well-represented. Few studies specifically reported the ethnicity of participants, but there was a diverse range of ethnicities across the studies where this demographic was reported. When reported, most studies reported samples with Alzheimer's Disease or unspecified types of dementia with either severe cognitive impairment or moderate-to-severe cognitive impairment. Only three studies (Allen et al., 2014; McHugh et al., 2012; Wu et al., 2014a) included individuals with classified with mild cognitive impairment or early-stage dementia. Table 3 provides a comprehensive description of the participants in each included study.

4.3. Interventions designed to improve mealtime function of people with dementia

The included studies, summarised in Table 3, reported six main types of intervention to improve the mealtime function of people with dementia:

- strategies related to the way in which food was presented (n = 2) (Allen et al., 2014; Dunne et al., 2004);
- meal styles with respect to seating and serving arrangements (n = 4) (Altus et al., 2002; Charras et al., 2010; Cleary et al., 2008, 2012);
- adaptations to the dining environment (n = 4) (Brush et al., 2002; Liu et al., 2015; McDaniel et al., 2001; Perivolaris et al., 2006);
- mealtime skills training for people with dementia (n = 4) (Lin et al., 2010, 2011; Wu et al., 2014a, b) or their carers (n = 1) (Chang et al., 2005);
- music therapy (n = 3) (McHugh et al., 2012; Richeson et al., 2004; Thomas et al., 2009); and
- animal-assisted therapy (n = 2) (Edwards et al., 2002, 2013).

Two studies (Allen et al., 2014; Dunne et al., 2004) reported interventions focused on the way food or fluid is presented to people with dementia. In one moderate quality RCT, the effectiveness of improving fluid intake by presenting drinks in a beaker versus a cup with straw was explored (Allen et al., 2014). A low quality times series study reported a comparison between high colour contrast plates/cutlery with white crockery/stainless-steel cutlery (Dunne et al., 2004).

Four interventions reported in moderate and low quality studies investigated different seating arrangements and meal styles (Altus et al., 2002; Charras et al., 2010; Cleary et al., 2008, 2012). A family-style meal in which communal serving dishes, frequent praising and opportunity for mealtime planning, was compared to providing plated meals in standard aged care dining room conditions (Altus et al., 2002). A staff-resident shared meal experience that involved a traditional social eating setting, specific attention to the appearance and quality of the food and staff sharing the table with people with dementia, was compared to a control intervention that involved engaging people with dementia

in environmental adaptations to the dining room and providing staff with dementia care training (Charras et al., 2010). Cleary et al. (2012) compared a standard aged care facility dining experience with two interventions – a social reminiscence experience tailored to the interests of people with dementia, and a protocol in which staff provided structured verbal cueing throughout the meal. In an earlier study, the same research team compared a routine seating plan, to allowing people with dementia to sit anywhere they choose in the dining room (Cleary et al., 2008).

Four primarily environmental adaptations were reported in low quality studies (Brush et al., 2002; Liu et al., 2015; McDaniel et al., 2001; Perivolaris et al., 2006). One study focussed only on increasing lighting and reducing contrast between the brightest and darkest parts of the dining area. The intervention was implemented in two facilities with varying degrees of success, although neither facility attained the optimal lighting brightness (50 foot candles) that the researchers were targeting (Brush et al., 2002). Liu et al. (2015) implemented a comprehensive intervention, Functional Focused Care for the Cognitively Impaired (FFC-CI), that was based on environmental and policy changes and individualised goals for people with dementia. Components of the intervention included attention to food appearance, providing adaptive utensils and optimising seating. A homelike dining environment with small home-like tables, bright décor, a menu board and courses delivered to the table, was compared to a standard aged care dining space. In the second phase of the intervention, people with dementia were also provided with verbal cueing to encourage engagement in the meal experience (Perivolaris et al., 2006). Finally, McDaniel et al. (2001) compared the impact of eating in two differently designed dining rooms. One was a cafeteria-style dining room with slate floor, pedestal tables, ceiling fans, a television and a busy medication round during the meal. The second was an 'Alzheimer's specific' dining room with low lighting, low gloss floor, tables without legs (tables lowered from the roof), no television, fan, or staff activities, and classical music playing (this second dining room had significantly more noise).

Five moderate and low quality studies (Chang et al., 2005; Lin et al., 2010, 2011; Wu et al., 2014a, b) reported interventions designed to improve skills of either people with dementia or the staff assisting them at mealtimes. Two of these interventions were designed to promote skills of people with dementia—Montessori programs (Lin et al., 2010, 2011; Wu et al., 2014b) and spaced retrieval programs (Lin et al., 2010; Wu et al., 2014a, b). These programs had different foci across the studies, were either standard or individualised, or, were compared to each other. Control groups undertaking regular activities, or different variations of the same type of program were compared. Montessori programs focused on improving hand-eye co-ordination, squeezing, pouring, cutting, matching and differentiating food, while spaced retrieval programs included activities to promote memory retrieval (Lin et al., 2010, 2011; Wu et al., 2014a, b). The fifth study that focused on skills training explored an intervention directed at care staff and was designed to promote knowledge of dementia, difficulties assisting people with dementia with meals and improve the ability of staff to assist people with dementia with meals (Chang et al., 2005).

Three moderate and low quality studies (McHugh et al., 2012; Richeson et al., 2004; Thomas et al., 2009) reported efficacy of music therapy in improving the mealtime experience. Two of the studies focused on the playing of music during mealtime—quiet relaxation music in one study (Richeson et al., 2004) and music reflecting the broad musical style preferences of the people with dementia as determined using a music assessment form in the second study (Thomas et al., 2009). In the third study, the music intervention consisted of active music sessions conducted for

Table 3
Summary of studies included in the review.

Paper	Setting and participants	Intervention	Outcome measurement	Findings
<p>Food presentation strategies Allen et. al., 2014</p>	<p>Randomised controlled trial (RCT) with individuals from 11 long term care facilities and hospitals in the UK (n = 45)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> Primarily female Mean age 86.7 years (SD 7.4) 100% at risk of, or with, malnutrition Mean Mini-Mental State Examination score (MMSE) 14 (SD 8) Described as having dementia with mild cognitive impairment 	<p>Participants received oral nutritional supplement (ONS) three times daily in a container with either a:</p> <ul style="list-style-type: none"> straw (n = 19) or beaker (n = 26) 	<p>Evaluation after each meal by weighing food by non-blinded researchers</p>	<p>Number of drinks received No significant difference between the straw group versus the beaker group 8.1 (standard deviation [SD] 3.1) versus 7.0 (SD 3.0), p = 0.347</p> <p>Proportion of drinks given by staff No significant difference between the straw group versus the beaker group, 88.3% (SD 15.7%) versus 79.2% (SD 18.2%), p = 0.061</p> <p>Consumption There was a trend for the beaker group to have higher energy (p = 0.052) and higher protein (p = 0.051) intake</p>
Dunne et. al., 2004	<p>Time series study with participants recruited in long term care units in US (n = 9 participants)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> All male mean age 82.7 years (range 72–89) mean education 13.3 years (range 12–20) mean MMSE score 2.9 (range 0–8) Described as having advanced Alzheimer's Disease 	<p>Intervention group (n = 9)</p> <ul style="list-style-type: none"> Phase one: (baseline phase, 10 days): white plates, white cups and stainless-steel cutlery Phase two: (intervention phase, 10 days): high-contrast red plates, red cups and red cutlery Phase three: (follow-up phase, 10 days) return to white Phases coincided with menu changes 	<ul style="list-style-type: none"> Food intake as per cent of meal based on weight Liquid intake as per cent of meal based on weight 	<p>Percent change in food intake</p> <ul style="list-style-type: none"> There was a significant increase in mean per cent change in food intake between baseline to intervention: 71.2% (SD 26.8) versus 86.7% (SD 19.3), p < 0.001 There was a significant decrease in mean per cent change in food intake between intervention and follow-up: 86.7% (SD 19.3) versus 73.5% (SD 24.1), p < 0.001 89% participants exhibited ≥10% increase in food intake No difference in findings for lunch and dinner <p>Percent change in liquid intake</p> <ul style="list-style-type: none"> There was a significant increase in mean per cent change in liquid intake between baseline to intervention: 54.4% (SD 36.6) versus 87.7% (SD 22.1), p < 0.001 There was a significant decrease in mean per cent change in liquid intake between intervention and follow-up: 87.7% (SD 22.1) versus 74.1% (SD 31.2), p < 0.001 89% participants exhibited ≥10% increase in liquid intake No difference in findings for lunch and dinner

Meal style with respect to seating/serving arrangements

Altus et. al., 2002

Times series study with participants in one dementia care unit in US (n=6, with one withdrawal due to death, making n=5)

Participant characteristics:

- All women
- Mean age 80 (range 76–87)
- Mean MMSE 8 (range 3–16)
- Able to eat independently or with minimal assistance
- Participants had diagnosis of dementia or Alzheimer's disease with moderate to severe cognitive function impairment

Intervention group (family style meal, n=5)

- Phase one (10 days): prepared plates – meals prepared and plated in the kitchen by the cook and delivered to the unit on a trolley
- Phase two (5 days): family style meal –lunch time food was placed in communal serving dishes
- Phase three (5 days): return to prepared plates
- Phase 4 (5 days): family style meals plus CNA education and hands-on training in graduated prompting, offering frequent praise and providing opportunity for involvement in the meal

- Type of participation measured with non-validated checklist of 22 behaviours
- Resident communication and staff praise measured via observation over 30 second intervals
- Two observers were trained to measure outcomes, with high (>90%) inter-rater reliability reported for all outcome measures

Praise delivered by staff

There was more praise delivered to residents in the family with praise meal style (14.2 praise/meal) compared to family meal style (7.2/meal) or plated meal style (0.2/meal)

Resident participation

There was higher participation in the family with praise meal style (65%) compared to family style meal (24%) or for plated meals (10%)

Communication

- There was more appropriate conversation in the family with praise meal style (17.9%) compared to family style meal (10.6%) or for plated meals (5.5%)
- There was less inappropriate conversation in the family with praise meal style (1.4%) compared to family style meal (4.1%) or for plated meals (3.9%)

Charras and Frémontier, 2010

Non-randomised trial in with a convenience sample from two special care units in two nursing homes in France (n=18)

Participant characteristics:

- Mean age 85.19 (SD6.48) years
- Mean MMSE 7.46 (SD 5.62)
- No significant difference in weight between intervention (52.94 kgs, SD 8.74) and control (61.9 kgs, SD12.18) groups ($F(1,16)=3.08, p<0.09$)
- Described as having Alzheimer's like dementia with severe cognitive impairment

Control group (n=10)

- 12-h training session in dementia delivered to staff
- Involvement in environmental design intervention that entailed changes to furniture, linen etc. in the dining rom

Intervention group (shared meal, n=8)

- 12-h training in dementia delivered to staff
- Involvement in environmental design intervention that entailed changes to furniture, linen etc. in the dining rom
- Staff-resident shared meal intervention: lunch provided as a joint experience with staff eating at the same table as residents in a traditional social setting. Tables set as per a social meal, staff did not wear uniforms, a 4-course lunch was served and attention was paid to appearance and quality of food and dining experience
- Intervention was for 6 months

- Weight measured at baseline and 6 months by non-blinded caregivers
- Resident behaviour measured by staff observation
- No interrater reliability reported

Changes in body weight

- The control group experienced a significant mean decrease in weight (-2.22 kgs) over the 6-month study period (61.9 kgs [SD12.18] versus 57.78 kgs [SD12.28], $p<0.024$)
- The intervention group experienced a significant mean increase in weight (3.37 kgs) over the 6-month study period (52.94 kgs [SD 8.74] versus 58.95 [SD11.14], $p=$ not reported)
- There was no significant differences in change in body weight between the control and intervention groups ($F(1,17) <1.0, p=$ ns)

Resident behaviours

- Control group often refused food due to not having money
- Intervention group were less inclined to be concerned about food bill, more autonomous and engaged with meal preparation and completion and less likely to wander
- Staff-resident interaction quality improved for intervention group
- Staff were more able to check quality of food and understand resident experience of food in the intervention group

Table 3 (Continued)

Paper	Setting and participants	Intervention	Outcome measurement	Findings
Cleary et. al., 2012	<p>Times series study in three Canadian care facilities with a convenience sample of residents (n = 11)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • 71% females • Age range 80–92 years • Global deterioration scale for dementia stages range 5–7 • MMSE range 2–14 • Considered moderately-severely cognitively impaired 	<ul style="list-style-type: none"> • Each phase considered of three meals (the same meal of either lunch or dinner on non-consecutive days) • Phase one (3 meals): Baseline conditions: normal eating condition with normal staff assistance but no conversation or cueing • Phase two (3 meals): social reminiscence protocol: Structured conversation protocol carried out by a trained researcher. Intervention based on principles of reminiscence using meaningful life information from remote past established through staff interviews. Study participant sat with up to 4 other non-participating residents and the facilitator, who used questions with 5 prompts each. • Phase three (3 meals): Structured verbal cueing protocol: Facilitator provided verbal cues if resident did not take a bite of food within 15 seconds. Scripted verbal cues were positive or neutral. If three cues did not result in eating, scripted cueing was ceased for 5 min then recommenced. • Phase four (3 meals): repeat baseline conditions • Phase five (3 meals): repeat structured verbal cueing protocol • Phase six (3 meals): repeat social reminiscence protocol 	<ul style="list-style-type: none"> • Amount of food eaten by weight in grams averaged over each phase measured before and after each meal and reported as per cent of available food weight • No interrater reliability reported 	<p>Per cent of available food eaten</p> <ul style="list-style-type: none"> • Over the two baseline condition phases, the average food consumed was 43.28% of available food; however, some participants had very different values between the two baseline phases • Over the two social reminiscence protocol phases, the average food consumed was 45.52% of available food, with similar values in the two phases • Over the two structured verbal cueing protocol phases, the average food consumed was 40% of available food, with similar values in the two phases • There was a difference between the two interventions of 5.07% in average percent of available food eaten (p = not reported)
Cleary et. al., 2008	<p>Times series study in one Canadian dementia-specific facility with a convenience sample of residents (n = 4 commenced, n = 3 completed and analysed)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • Aged 88–97 years • Length of stay 4–43 months • MMSE range 5–14 • Range of dietary requirements • Described as having moderate, severe and very severe dementia 	<ul style="list-style-type: none"> • Phase one (3 days): Routine seating plan: residents always sat in same position in dining room. Residents were led to their position and sat in it for three days before measurements were taken. • Phase two (3 days): Regular seating arrangement: residents sat anywhere in dining room they chose. • Phase three (three days): repeat routine seating plan intervention • Phase four (3 days): repeat regular seating arrangement 	<ul style="list-style-type: none"> • Amount of food and fluid eaten by weight in grams averaged over each phase measured before and after each meal and reported as reported as per cent of available food weight • Time spent waiting for meal • Time spent to complete meal • Interrater reliability ranged from 74% to 100% 	<p>Per cent of available food eaten</p> <ul style="list-style-type: none"> • All 3 participants had an increase in food eaten during the first treatment phase and this was generally maintained into the first non-treatment phase. • In the second treatment phase one resident had a further increase in food eaten, one resident decrease food eaten and one maintained food eaten. <p>Average time spent waiting for meal</p> <p>There was a reduction in average waiting time for food associated with the routine seating intervention (9.11 min.) compared to regular seating arrangement (26.55 min.)</p> <p>Average time spent to complete meal</p> <p>There was no substantial difference in average time taken to complete the meal between routine seating intervention (33–34 mins) compared to regular seating arrangement (35–36 mins)</p>

Environmental adaptations

Brush et. al., 2002

Pre-test/post-test study conducted in a nursing home (n = 11) and an assisted living facility (n = 14) in the US

Participant characteristics:

- Aged > 70 years
- Primarily female
- Classified as having severe cognitive impairment

- Phase one: Baseline condition: lighting conditions at the normal for the facility
- Phase two: Increased lighting: lighting was increased as much as possible with an attempt to decrease the difference in lighting from the brightest to darkest part of the room

- Caloric intake measured as per cent of meal eaten and reported as average 3 day calorie count
- Meal Assistant Screening Tool (MAST) measures 8 functional areas including seating issues, type of diet, type of assistance, challenging behaviour, eating problems, alertness, intake (higher score = more severe problems)
- Communication Outcome Measure of Functional Independence (COMFI) measures 20 items in 4 areas – psychosocial interaction, communication, mealtime independence and cognition (higher score = higher functioning)
- Measures taken at baseline and four weeks later, with scores based on 9 consecutive meals

Changes in lighting in facilities

- In one facility, baseline lighting was at 24.68 foot candles with ratio 12:1 from lightest to darkest parts of room. In the intervention period, this increased to 35.05 foot candles with ratio 3:1.
- In second facility, baseline lighting was at 4.82 foot candles (also reported as 8.2) with ratio 21:1 from lightest to darkest parts of room. In intervention period, this increased to 22.96 candles with ratio 13:1

Caloric intake

- In facility one there was a non-significant increase in average three day caloric intake (+ 1061 cal, p = 0.16)
- In second facility, there was a significant increase in average three day caloric intake (+ 904 cal, p = 0.013)

MAST scores

- Neither facility showed any significant change

COMFI scores

- One facility showed a significant increase in COMFI score (+20, p = 0.018), with significant changes on individual items
- Second facility showed no significant changes in COMFI score (+28, p = 0.115), with significant changes on some individual items

Eating performance as mean (standard error [SE])

- At baseline, the control group was significantly more independent than the intervention group (p = 0.002)
- At 3 months, there was no significant difference between the two groups (p = 0.067)
- At 6 months, there was no significant difference between the two groups (p = 0.094)

Liu et. al., 2015

Retrospective cluster-RCT with participants from four nursing homes and 4 assisted-living facilities in US (n = 706 eligible, n = 199 met inclusion criteria)

Participant characteristics:

- 73.9% female
- Average age 84 years (SD 8.72)
- Mean comorbidities 8.04 (SD 3.15)
- Mean length of stay 2.5yrs (SD 2.19)
- At baseline intervention group had significantly less depression than control group (p = 0.018)
- Most classified as severe cognitive impairment

Intervention group (n = 101)
Functional Focused Care for Cognitively Impaired (FFC-CI) intervention: a philosophical care intervention that focuses on environment and policy assessment to meet individualised goals including optimising appeal of food, access to food, adaptive utensils, appropriate chair height etc. Staff and residents received education in the philosophy and strategies to maximise food intake. In each facility a FFC champion was available on the ward 10 h/week for hands-on support. The FFC-CI intervention was an overall intervention addressing all care and function (i.e. not specific to eating).

Control group (n = 98)
Regular care

Table 3 (Continued)

Paper	Setting and participants	Intervention	Outcome measurement	Findings
Perivolaris et. al., 2006	<p>Times series study conducted in long term care facility in Canada (n = 11)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • 73% male • Mean age 84.6 years (range 77 to 93) • Mean MMSE 13.9 • Mean duration of stay 2.4 years • Average number co-morbidities 5 • Alzheimer's disease, unspecified-type dementia, vascular dementia • Classified as moderate to severe dementia 	<p>Intervention (n = 11)</p> <ul style="list-style-type: none"> • Enhanced Dining Program: A two stage intervention • Phase one (6 weeks): environment altered by converting 2 large dining rooms into 3 smaller rooms creating a homelike environment, bright and warm, home table settings, menu board, courses delivered one at a time, greater meal choice. • Phase two (6 weeks): Staff received education in verbal cueing and engaging residents in food-related activity (e.g. table setting). 	<ul style="list-style-type: none"> • Caloric intake • Level of retained feeding ability measured using Feeding Abilities Assessment (FAA) • Pittsburgh Agitation Scale (PAS) • Resident survey measuring satisfaction related to taste, amount; temperature; mealtime assistance; time to eat; (score 0 to 4) • Outcomes at baseline, 6 and 12 weeks 	<p>Mean caloric intake</p> <p>There was a significant increase from baseline (mean 490 cal) to 6 weeks (mean 663, $t = -3.640$, $df = 10$, $p = 0.005$)</p> <p>There was a non-significant increase from 6 weeks (mean 663 cal) to 12 weeks (mean 677, $t = -2.117$, $df = 10$, $p = 0.060$)</p> <p>FAA</p> <p>73% sample had constant score throughout trial</p> <p>PAS</p> <p>Insufficient symptoms present on assessment to make a meaningful comparison</p> <p>Mean resident satisfaction score</p> <p>Satisfaction increased gradually from baseline (mean 3.13) to 6 weeks (mean 3.25) and at 12 weeks (mean 3.38)</p> <p>Caloric/food/fluid intake</p> <ul style="list-style-type: none"> • There was no significant difference in caloric or protein intake at breakfast time • There was significantly greater breakfast time fluid intake in the Alzheimer's unit dining room (64.81 fl oz versus 74.91, $p < 0.002$) • There was no significant difference in lunch time caloric, protein or fluid intake. <p>Mean time for meals</p> <p>There was no significant difference in time taken for meals.</p>
McDaniel et. al., 2001	<p>Times series study conducted in an Alzheimer's Disease specific facility in US (n = 17)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • Age range 61–81 years • Primarily males • MMSE range 0–24 • 76% required no assistance to eat • 100% able to ambulate • Alzheimer's disease with severity not reported but appears to be a wide range 	<ul style="list-style-type: none"> • Extended care dining room (5 days): residents attended extended care dining room with cafeteria-style serving for ambulatory patients (participants were not served this way). Dining room had quarry tile floor, ceiling fans, pedestal tables with 4 legs, television on and medication round during meal. • Alzheimer's unit dining room (5 days): residents attended Alzheimer's unit dining room that had significantly less lights ($p < 0.01$), significantly more noise ($p < 0.02$), a low gloss vinyl floor, no ceiling fans, tables recessed into ceiling and lowered by the staff, not television or medication round, Mozart music. • Interventions had the same menus 	<ul style="list-style-type: none"> • Measurements were taken at breakfast and lunch for 5 consecutive days for each intervention • Mean breakfast calories (kcal) • Mean lunch calories (kcal) • Mean breakfast protein intake (g) • Mean lunch protein intake (g) • Mean breakfast fluid (fl oz) • Mean lunch fluid (fl oz) • Mean time for meals 	<ul style="list-style-type: none"> • There was no significant difference in caloric or protein intake at breakfast time • There was significantly greater breakfast time fluid intake in the Alzheimer's unit dining room (64.81 fl oz versus 74.91, $p < 0.002$) • There was no significant difference in lunch time caloric, protein or fluid intake. <p>Mean time for meals</p> <p>There was no significant difference in time taken for meals.</p>

Music therapy

Thomas and Smith, 2009

Non-randomised trial conducted in an Alzheimer's unit in the US (n = 12)

Participant characteristics:

- Mean age 83.5 years
- Primarily female
- Diagnosed with middle-stage Alzheimer's disease
- Self-feeding

Music intervention period (n = 12)

- 4 weeks of music played in dining room on alternate weeks
- Music was selected using a music assessment form designed to determine broad preferences in musical styles.
- Music style preferable to participants selected, with most popular tunes in styles being played.

Control period (n = 12)

4 weeks of no music playing in dining room on alternate weeks

Both periods

Food was served in individually determined portions on a plate at the table in the same seated arrangement

Intervention group (n = 8)

- Participants attended 30-min active singing session immediately before lunch.
- Songs consisted of music well known in the period that residents grew up and music that they had been exposed to in the facility.
- Sessions were led by a music therapist with guitar or keyboard and involved active singing.

Control group (n = 7)

Regular dining experience with no singing

Both groups

Meal served in a dining room at 2-4 seated tables with the same seating arrangement each day

- Average lunchtime caloric intake
- Lunchtime caloric intake through carbs, protein and fat
- All data was collected by non-blinded dietitians by estimating the per cent of food eaten from plate (no interrater reliability reported)

Average lunchtime caloric intake

- There was a 20% greater caloric intake during the music intervention compared with control (797 versus 667)
- Caloric intake from carbohydrates was higher with the music intervention compared to control (62 versus 50)
- Caloric intake from protein was lower with the music intervention compared to control (10 versus 18)
- Caloric intake from fat was lower with the music intervention compared to baseline (28 versus 32)

Observations from staff

Participants stayed in dining room longer, were more socially engaged and were absorbed in the music

McHugh et. al., 2012

Cluster RCT conducted in a memory support unit in a care facility in US (n = 15)

Participant characteristics:

- Mean age 86-87 years (range 78-98)
- Primarily female
- Primary diagnosis of Alzheimer's disease or dementia
- MMSE ranged from 12 -24
- Approximately 50% had potential or definite depression
- Stage of dementia not reported but appear to be mild-moderate cognitive impairment

- Baseline data collection for 12 days, treatment data collection for 12 days.
- Per cent of meal eaten collected at the end of the lunch by non-blinded staff with use of a software package
- No interrater reliability reported

Per cent meal eaten at baseline

- In the music group, 25% participants were eating >90% of the meal, 62.5% were eating >80% of the meal, 62.5% eating >70% of the meal
- In the control group, 28.7% were eating >90% of the meal, 57% were eating >80% of the meal, 86% eating >70% of the meal

Per cent meal eaten in intervention period

- In the music group, 50% participants were eating >90% of the meal, 62.5% were eating >80% of the meal, 62.5% eating >70% of the meal
- In the control group, 57% were eating >90% of the meal, 57% were eating >80% of the meal, 86% eating >70% of the meal

Intake adjusted for baseline period

The control group had greater intake than the music group (4.18 versus 2.68)

Table 3 (Continued)

Paper	Setting and participants	Intervention	Outcome measurement	Findings
Richeson and Neill, 2004	<p>Times series study conducted in a nursing home in the UK (n = 27)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • Mean age 87 (range 67–94) • Primarily female • Primarily Caucasian • Severity of dementia not reported 	<p>Intervention period (4 days)</p> <ul style="list-style-type: none"> • Dinnertime meal served on trays to residents seated at tables of 4–5 • Quiet relaxation music playing at a volume just above background noise during the evening meal • Intervention designed to reduce sundowning and improve oral intake <p>Control period (4 days)</p> <ul style="list-style-type: none"> • Dinnertime meal served on trays to residents seated at tables of 4–5 	<ul style="list-style-type: none"> • Cohen Mansfield Agitation Instrument (CMAI) and its four subscales modified to a dichotomised 1 (present) or 0 (absent) scale for each item measured by non-blinded researchers during mealtime • Per cent food eaten taken from nursing notes 	<p>CMAI sub-scales</p> <ul style="list-style-type: none"> • Mean number of agitated behaviours decreased in intervention period from baseline (105 vs 133) • Physically nonaggressive behaviours decreased 17.9% during intervention period compared with baseline • General restlessness decreased 56% during intervention period compared with baseline • Verbal agitation decreased 6% during intervention period compared with baseline • Aggressive behaviours decreased 25% during intervention period compared with baseline <p>Per cent food eaten</p> <p>Food eaten increased by 8.6% from baseline (63.65%) during the intervention period (69.12%)</p>
<p>Animal-assisted therapy</p> <p>Edwards and Beck, 2002</p>	<p>Quasi-RCT with individuals in three dementia-specific nursing home units in US (n = 62)</p> <p>Characteristics:</p> <ul style="list-style-type: none"> • Mean age 80.1 years • Primarily males • Mean length of stay 47.8 months (range 1–379 months) • Primarily Caucasian • No significant difference between facilities for length of stay, level education, previous pet ownership. • No information given on baseline weight and diet, but food intake did not differ between facilities at baseline 	<p>Both groups</p> <p>Weeks 1-2: normal dining room conditions with baseline data collection</p> <p>Intervention group (fish tank, n = 45 in 2 facilities)</p> <p>Weeks 3-10: a 76 x 50 cm fish tank with colourful fish placed in the dining area</p> <p>Control group (n = 17 in one facility)</p> <ul style="list-style-type: none"> • Weeks 3-4: a scenic ocean picture placed in the dining room • Weeks 5-6: washout period returning to normal dining room conditions • Weeks 7-8: normal dining room conditions with baseline data collection • Weeks 9-16: fish tank intervention 	<ul style="list-style-type: none"> • Body weight measured at start of each month, commencing 3 months prior to intervention period and continuing for 4 months after intervention • Food intake measured as food in grams eaten from meal tray 	<p>Food intake</p> <ul style="list-style-type: none"> • Intervention group had mean increase in food intake (21.1% across facilities) • Intervention group had mean increase in food intake (27.1% from baseline to six weeks post treatment) • Intervention group had a mean increase in food intake (4.9% in follow-up period i.e. 4 months after intervention) • 87% intervention group had increase in food intake and 9.7% had no change • Control group showed no significant difference in food intake from pre-scenic picture to post scenic picture phases (t = -0.882, p = 0.40) • Control group showed no significant difference in food intake between the two baseline periods (weeks 1-2 and weeks 7-8, t = 1.513, p = 0.150) <p>Body weight</p> <ul style="list-style-type: none"> • 87% participants had a mean decrease (-794 g) in weight over the 3 months prior to the intervention • Intervention group showed a mean increase in weight (+245 g) from baseline to intervention period and a mean increase (+748 g, p < 0.0001) over full study period • 9.7% had weight loss (but were on calorie restricted diet) • 4.8% had no weight change

Pre-test/post-test study with individuals in three dementia-specific long-term care settings in US (n=70)

Characteristics:

- Mean age 82.2 (range 59–99)
- Primarily female
- 72% Caucasian, included a diverse range of ethnicities
- Mean LOS 46.8 months
- Mean MMSE 5.57 (range 0–20)
- No visual blindness
- Described as severe dementia

Resident or caregiver training interventions

Lin et. al., 2010

Cluster-RCT with individuals from 15 dementia-specific units in Taiwan (n=82)

Participant characteristics:

- Mean age 81.18 ± 6.37 years
- Primarily female
- Mean time since diagnosis 25–37 months
- Mean MMSE 10–13
- Mean Barthel Index score 48–69, with Montessori group significantly higher mean score, p=0.13
- Severity not described, but participants had mid-range MMSE scores

Intervention (n=70)

- Weeks 1–2: normal dining room conditions with baseline data collection
- Weeks 3–4: a 76 x 50 cm fish tank with eight fast-swimming fish placed in the dining area so all tables had a view
- Weeks 5–10: maintained aquarium intervention but reduced data collection

Facilities were randomised to one of three groups:

- **Control** group: Routine activity sessions of 35–40 mins, 3 times/week for 8 weeks (n=24)
- **Montessori** group: Montessori activity sessions at same regimen as control group, conducted by a trained researcher and including Montessori-based activities focused on hand-eye coordination, scooping, pouring and squeezing (n=29)
- **Spaced retrieval** group: Spaced retrieval at same regimen as control group, conducted by a trained researcher and including activities focussed on eating procedure and eating behaviours using timed interval trials to train participants (n=32)

- Food intake in grams using a measuring scale before/after meal by trained staff
- Body weight obtained from chart reviews
- Food measured 3 times daily, 7 days/week, except in weeks 5–10 when only measured 1 day/week

- Length of self-eating time measured using a stop watch and averaged over 3 meals
- Food intake as a proportion of food provided and averaged over 3 meals
- Edinburgh Feeding Evaluation in Dementia (EdFED, higher score = greater difficulty)
- BMI and body weight
- Mini Nutritional Assessment
- Assistance required with feeding, including physical and verbal
- Outcomes collected at baseline and completion of program (8 weeks) by blinded research assistants

Food intake

- Sex, facility, age, cognitive status had no effect on food intake
- The effect of intervention phases on food intake was significant (+ 196.9 g, 25% increase, F=85.7, p < 0.001)
- There was a significant increase (+ 121.6 g, p = significant) in food intake from baseline to intervention
- There was a non-significant increase (+ 75.3 g) in food intake from intervention to maintenance phase

Body weight

- There was significant increase in body weight from baseline to intervention (mean increase from baseline + 0.99 kgs)
- 11.4% experienced a weight loss

EdFED

Spaced retrieval group (−1.72, p < 0.05) and Montessori group (−1.54, p < 0.05) both had significantly lower scores at baseline compared with control group but no significant effect compared with control over time

Food intake

- Montessori group had significantly less intake compared with control at baseline (10.08%, p < 0.05) but no significant change compared with control over time
- Spaced retrieval group no significant difference compared with control at baseline or over time

Self-eating time

Both groups were significantly slower eating than control group at baseline, and Montessori group remained significantly slower than control group over time (p < 0.05)

Nutritional status

- Spaced retrieval group improved significantly in MNA score compared to control over time (p < 0.01)
- No differences for group over time for BMI and body weight.

Assistance required

- Spaced retrieval group showed significant improvement compared with baseline at 8 weeks (p < 0.05)
- Montessori group was significantly different with control at baseline (p < 0.01), but not significantly different over time

Table 3 (Continued)

Paper	Setting and participants	Intervention	Outcome measurement	Findings
Lin et. al., 2011	<p>Crossover trial with individuals from 2 dementia-specific units in Taiwan (n = 29)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • Mean age 82.9 years (SD 5.96) • 58.6% males • Mean time since diagnosis 25 months (SD 19.3) • 48% had moderate dementia (MMSE 10–17) and 41% had severe dementia (MMSE \leq 9) 	<ul style="list-style-type: none"> • Cross over trial with individuals acting as own control. • Each intervention for 10 weeks, with 2 week washout • Control group: Routine typical daily routine (n = 14) • Montessori group: Montessori activity sessions for 30 min., 3 days/week for 8 weeks delivered by a registered nurse and including Montessori-based activities focused on eye co-ordination, scooping, pouring and squeezing, matching and differentiating foods. Each domain had 4–5 specific activities (total 24 activities) for practicing skills associated with eating. The intervention was preceded with music for sensory stimulation (n = 15) 	<ul style="list-style-type: none"> • Length of meal averaged over 3 meals • Eating Behavior Scale (EBS), 6 items that assess functional eating ability (higher score = greater independence) • Edinburgh Feeding Evaluation in Dementia (EdFED, higher score = greater difficulty) • BMI and body weight • Mini Nutritional Assessment • Outcomes collected at baseline, week 10 (completion first phase), week 13 (completion washout) and week 22 (completion second phase) 	<p>EdFED</p> <p>Montessori activity was associated with significant improvement in EdFED score over time (p = 0.01) and with a significantly better score than the routine activities (3.54 \pm 1.77 versus 4.61 \pm 2.64, p = 0.008)</p> <p>EBS</p> <p>Montessori activity associated with a significantly better EBS score than the routine activities (16.79 \pm 1.85 versus 14.68 \pm 4.80, p = 0.025)</p> <p>Assistance required</p> <ul style="list-style-type: none"> • Both Montessori intervention (p = 0.006) and routine activities (p = 0.029) were associated with significant improvement over time for self-feeding frequency, with the Montessori activity associated with a significantly better outcome than the routine activities (3.00 \pm 0.00 versus 2.15 \pm 1.29, p = 0.006) • No significant difference between interventions for physical assistance (p = 0.21) or verbal assistance (p = 0.26) required <p>Nutritional status</p> <ul style="list-style-type: none"> • There was no significant difference in BMI between groups or over time • The routine activities were associated with a significant decrease in MNA score (p = 0.027) but there was no significant differences between group (p = 0.129) over time <p>Eating time</p> <p>Not significantly different over time or between groups.</p> <p>Change in food intake</p> <ul style="list-style-type: none"> • Spaced retrieval/errorless learning group had a significant increase in food intake (mean increase 14.6% \pm 23.2, effect size [ES] 0.65, 95% confidence interval [CI] 0.14 to 1.16) • Spaced retrieval group: had an increase in food intake (mean increase 4.8% \pm 10, ES 0.47, 95% CI –0.05 to 0.99) • The spaced retrieval/errorless learning group showed significantly greater improvements in intake than the spaced retrieval only group (t-test 2.14, p = 0.038) <p>Per cent of recall errors and longest recall</p> <ul style="list-style-type: none"> • Both measures favoured spaced retrieval/errorless learning group (p < 0.001)
Wu, Lin, Su, et. al., 2014	<p>RCT conducted in 4 special care units in Taiwan (n = 61)</p> <p>Participant characteristics:</p> <ul style="list-style-type: none"> • Mean age 79.2 years • Mean Barthel Index score 70.3 (SD25) • Equal sample of people with mild, moderate and severe dementia 	<ul style="list-style-type: none"> • Spaced retrieval/errorless learning group: Sessions of 35–40 mins, 3 times/week for 8 weeks. Individuals were presented with 8 learning tasks associated with eating activities designed to help develop and retrieve a memory by giving accumulated cues until memory retrieval occurs. Three-step graded cues were used for each retrieval trial. • Spaced retrieval group: Individuals presented with 8 learning tasks associated with eating activities designed to help develop and retrieve a memory. Each activity was given a prompt to prompt memory retrieval. 	<ul style="list-style-type: none"> • Food intake as a proportion of food presented • Recall performance measured as per cent of errors across trials and longest recall interval (in minutes) • Outcomes collected after the interventions for 3 meals by blinded research assistants 	<p>Not significantly different over time or between groups.</p> <p>Change in food intake</p> <ul style="list-style-type: none"> • Spaced retrieval/errorless learning group had a significant increase in food intake (mean increase 14.6% \pm 23.2, effect size [ES] 0.65, 95% confidence interval [CI] 0.14 to 1.16) • Spaced retrieval group: had an increase in food intake (mean increase 4.8% \pm 10, ES 0.47, 95% CI –0.05 to 0.99) • The spaced retrieval/errorless learning group showed significantly greater improvements in intake than the spaced retrieval only group (t-test 2.14, p = 0.038) <p>Per cent of recall errors and longest recall</p> <ul style="list-style-type: none"> • Both measures favoured spaced retrieval/errorless learning group (p < 0.001)

Quasi-experiment (pseudo-RCT) conducted in 4 nursing homes in Taiwan (n = 90)

Participant characteristics:

- Mean age 82–83 years
- Primarily moderate–severe dementia
- Mean MMSE 12–14
- Primarily moderate to severe dementia

- **Control group:** Routine activity sessions of 35–40 mins, 3 times/week for 8 weeks (n = 27)
- Standard Montessori group: Standardised Montessori activity sessions at same regimen as control group, conducted by a trained researcher and including Montessori-based activities focused on hand-eye coordination, scooping, pouring and squeezing (n = 25)
- Individualised Montessori and spaced retrieval group: Sessions of 35–40 mins on an individualised timetable based on needs and adapted to individual skill in ability to recall the activity (range 10–35) (n = 38)

- Food intake as a proportion of food based on food type eaten and averaged over 3 meals (e.g. if given 5 food types and 2 eaten, recorded as 20%)
- Edinburgh Feeding Evaluation in Dementia (EdFED, higher score = greater difficulty)
- BMI and body weight
- Outcomes collected at baseline, post-test, 1, 3 and 6 months by blinded research assistants

EdFED

- Standard Montessori group EdFED score decreased significantly over time compared to control (0.39 SD 0.14, p = 0.007)
- Individualised Montessori group EdFED score decreased over time compared to control (0.30 SD 0.13, p = 0.02)

Food intake

- Standard Montessori group food intake increased significantly over time compared to control (5.80 SD 1.38, p < 0.001)
- Individualised Montessori group food intake increased significantly over time compared to control (3.37, SD 1.25, p < 0.007)

Body weight

- The standard Montessori group weight increased significantly over time compared to control (0.99 SD 0.24, p < 0.001)
- Individualised Montessori group weight increased significantly over time compared to control (0.72 SD 0.22, p < 0.001)

EdFED

- Intervention group had greater feeding difficulties (t = 2.1, p < 0.05)
- Eating difficulties in intervention group increased after training possibly due to better assessment by staff

Eating time

t = 2.7, p < 0.05 favouring intervention group (longer eating time suggesting individuals were allowed more time to eat and to self-feed)

Food intake

No difference between the groups in food intake (t = 0.8, p = 0.49)

Cluster-RCT with two dementia-specific long-term care facilities in Taiwan randomly assigned to groups Nurses (n = 67) in study identified residents (n = 20) with dementia and eating problems

Participant characteristics:

- Intervention group significantly older than control group (84.2 years versus 72 years)
- Severity of dementia not reported

Intervention group

- Three hour in-service on aetiology of feeding behaviours, managing feeding, problems in feeding
- One hour hands-on demonstration and assistance in feeding (n = 31 nurses included, n = 20 observed in only one phase, n = 12 observed in two phases)

Control group

No intervention (n = 36 nurses included, n = 16 observed in one phase, n = 8 observed in two phases)

Table 4
Outcomes measures reported in the literature.

	Outcomes related to nutrition			Outcomes related to mealtime behaviour		Outcomes related to mealtime specific skills			
	Anthropometric measures	Nutritional status	Food/drink/nutrition intake	Communication skills	BPSD	Time to eat	Assistance required with meals	Mealtime skills (e.g. cutlery skills)	Participation in the meal
Food presentation strategies									
Allen et. al., 2014			0						
Dunne et. al., 2004			★						
Interventions related to meal style with respect to seating/serving arrangements									
Altus et. al., 2002				★					★
Charras and Frémontier, 2010	0								
Cleary et. al., 2012			0						
Cleary et. al., 2008			0			0			
Environmental adaptation interventions									
Brush et. al., 2002			★	?			0		
Liu et. al., 2015							0		
Perivolaris et. al., 2006			★					0	
McDaniel et. al., 2001			0			0			
Music therapy									
Thomas and Smith, 2009			★						
McHugh et. al., 2012			★						
Richeson and Neill, 2004			★		★				
Animal-assisted therapy									
Edwards and Beck, 2002	★		★						
Edwards and Beck, 2013	★		★						
Resident or caregiver training interventions									
Lin et. al., 2010		★	★			0	?	0	
Lin et. al., 2011	0	0				0	★	★	
Wu, Lin, Su et. al., 2014			★						
Wu, Lin, Wu et. al., 2014	★		★					★	
Chang et. al., 2005			0			★		0	

Key: ★ - improvement reported for outcome measure; 0 - no improvement reported for outcome measure; ? - variable results reported.

minutes prior to the meal. These consisted of participatory singing and well-known music from the time periods in which people with dementia grew up (McHugh et al., 2012).

The two low quality studies (Edwards et al., 2002, 2013) exploring animal-assisted therapy were both focused on the efficacy of promoting oral intake by placing a large fish tank with fast moving tropical fish into the facility dining room.

4.4. Impact of interventions on mealtime function of people with dementia

The included studies reported a wide range of outcome measures that we categorised as being related to nutrition, mealtime behaviour or mealtime-specific ADL skills. The outcome measures are summarised in Table 4, including an indication of interventions that were reported to show improvements in function for people with dementia at mealtimes.

4.4.1. Outcomes related to nutrition

Seventeen studies (see Table 4) reported outcome measures associated with volume of food or fluid intake, most often reported as change in per cent of food consumed. In most studies, the determination of nutritional intake were estimates made by facility staff, with no explicit reporting on the equivalence of the

amount of food served to participants during different study phases. Thus, the reliability of the outcome measurement was frequently subject to biases. Few studies reported interrater reliability for subjective evaluation of behaviour or of the percent food consumed (Altus et al., 2002; Cleary et al., 2008). Some studies measured nutritional intake as mean caloric intake; and although the accuracy of measuring oral intake may be increased through use of an objective outcome measure, it was generally unclear if the volume of food served was equivalent in all study phases in the included studies. However, many studies reported that the menu items were matched, indicating that the same food selection was probably offered.

Using high-contrast coloured crockery was associated with a statistically significant 15% increase (71.2%±26.8 versus 86.7%±18.3, $p < 0.001$) in mean per cent of food eaten compared to plain white plates (Dunne et al., 2004). In the same low quality study (Dunne et al., 2004), there was an increase of over 30% (54.4%±36.6 versus 87.7%±22.1, $p < 0.001$) in mean fluid intake associated with the use of red cups. In a moderate quality study, changing from beakers to straws had no influence on either the number of drinks offered to individuals ($p > 0.05$), or the proportion of fluid consumed ($p > 0.05$) (Allen et al., 2014). Clinical relevance was hard to evaluate as the volume of food/fluid served was not reported and there was no evaluation of impact on the participants' weight.

None of the low (Altus et al., 2002; Cleary et al., 2008, 2012) or moderate (Charras et al., 2010) quality studies that explored different meal styles reported significant changes in nutritional intake. In a low quality times-series study (Cleary et al., 2012), a social reminiscence protocol was associated with an approximate 5% increase in food intake ($p = \text{not reported}$) compared with a structured verbal cueing protocol; however, this equated to only 2% more food consumed than in baseline conditions. In a low quality times-series study (Cleary et al., 2008), an increase ($p = \text{not reported}$) in quantity of food eaten by people with dementia was reported when they were seated in the same location every meal was used compared to regular seating (sitting anywhere). However, there was no objective measurement reported and results were not consistent in repeated implementations of the routine seating intervention although there was an increase in body weight over six months (mean +3.37 kgs) for people with dementia engaged in a shared staff-resident meal intervention reported in a moderate quality non-randomised trial (Charras et al., 2010), this was not statistically significant ($p > 0.05$) compared to a control group eating in a regular aged care facility dining situation.

Environmental adaptation interventions had mixed impact on food intake. A low quality pre-test post-test study (Brush et al., 2002) reported that changing dining room lighting levels had no impact on calorie intake in one facility ($p > 0.05$), while the second facility in the study reported a statistically significant increase in mean three day calorie intake (+904 calories, $p = 0.013$). A low quality times-series study (McDaniel et al., 2001) reported that eating in a dementia-specific dining room (low lighting, low noise) was not associated with any statistically significant differences in food, caloric or protein intake (all $p > 0.05$) compared to eating in a standard aged care facility dining room. However, a second low quality times-series study (Perivolaris et al., 2006) found that a homelike dining area was associated with increased mean daily intake (+490 calories, $p = 0.005$), compared to a standard aged care facility dining room experience. The difference was no longer statistically significant by 12 weeks ($p > 0.05$) and is unlikely to be clinically significant.

All three studies (McHugh et al., 2012; Richeson et al., 2004; Thomas et al., 2009) reporting music-based interventions found an increased nutritional intake, ranging from an 8% increase in the percent of the meal eaten (Richeson et al., 2004) to a 20% increase in lunchtime caloric intake (Thomas et al., 2009) (no p values reported). Without an indication of the size of the meals and the impact on weight, it is hard to determine if this is clinically significant.

Both studies reporting animal-assisted therapy both reporting fish tanks in the dining area) reported significant intake in food (Edwards et al., 2002, 2013). The low quality times series study (Edwards et al., 2002) reported a 21% increase during the initial intervention phase across three different facilities, with a 5% increase reported four months after the intervention was introduced. The low quality RCT (Edwards et al., 2013) reported a significant increase in volume of food eaten (+197 g, $p < 0.001$), with a further increase of 75 g in the maintenance phase. Both these studies also reported statistically significant improvements in body weight for people with dementia: +748 gs ($p < 0.0001$) in one study (Edwards et al., 2002) and +990 g in the second study (Edwards et al., 2013). The clinical relevance of changes in weight are questionable, and there was no evaluation of the sustainability of changes.

Effects of interventions designed to train people with dementia or care staff in mealtime skills, primarily reported a positive impact of the interventions on food intake. Montessori training programs were reported to increase food intake in two studies, a low quality RCT (Lin et al., 2010) and a low quality pseudo-RCT (Wu et al.,

2014b). Mean increase in food intake of between approximately 3% (+3.37%±1.25, $p < 0.007$) (Wu et al., 2014b) and 10% (+10.08, no confidence interval reported, $p < 0.05$) (Lin et al., 2010). Lin et al. (2010) also reported statistically significant improvements ($p < 0.001$) compared to a standard care group in nutritional status measured using the Mini Nutritional Assessment, although body weight and body mass index (BMI) showed no statistically significant change in the eight-week study period ($p > 0.05$ for both). In contrast, both a standard Montessori training program (+0.99 g, $p < 0.001$) and an individualised Montessori program (+0.72, $p < 0.001$) were associated with statistically significant increases in mean weight in the pseudo-RCT by Wu et al. (2014b). Finally, implementation of a standard Montessori program reported by Lin et al. (2011) showed no statistically significant difference for nutritional status measured with the Mini Nutritional Assessment ($p = 0.129$) or for BMI ($p = \text{not reported}$), compared to a control group receiving routine care. A spaced retrieval/errorless learning intervention increased food intake by about 15% (effect size 0.65, 95% confidence interval [CI] 0.14–1.16) (Wu et al., 2014a) and a spaced retrieval intervention increased food intake by a mean of 5% (effect size 0.47, 95% CI –0.05 to 0.99) (Wu et al., 2014a). One intervention designed to improve staff skills in feeding had no statistically significant influence on food intake ($p = 0.49$) (Chang et al., 2005).

4.4.2. Outcomes related to mealtime behaviour

Few studies reported outcome measures related to mealtime behaviour. Impact of interventions on communication skills was reported in two studies (Altus et al., 2002; Brush et al., 2002). Outcomes were measured using the previously validated Communication Outcome Measure of Functional Independence (COMFI) tool in one low quality pre-test post-test study (Brush et al., 2002). The second study, a low quality times series study (Altus et al., 2002), measured behaviours based on observation by two researchers using a non-validated checklist that was reported as having high interrater reliability. The intervention investigated by Brush et al. (2002), which was increased lighting in the dining area, was associated with an increase of 20 points in mean COMFI score (from 54 ± 20 to 72.09 ± 11 , $p = 0.018$) for people with dementia in one facility, indicating improved psychosocial interaction and communication. However, individuals in the second facility in the same study (Brush et al., 2002) displayed no difference on mean COMFI scores ($p = 0.115$). In the study by Altus et al. (2002), family style meals that included active praise given to people with dementia by staff were rated by observers as being associated with lower levels of inappropriate communication than family style meals without added praise, or a usual dining room experience with pre-plated meals (1.4% of interactions versus 4.1% and 3.9% respectively, $p = \text{not reported}$).

One low quality times series study (Richeson et al., 2004) reported the impact of a mealtime intervention on behavioural and psychological symptoms of dementia as mean change in scores on the four sub-scales of the valid and reliable Cohen Mansfield Agitation Instrument. In this study, playing quiet relaxation music during the evening meal for four days was associated with a 17.9% reduction in physically non-aggressive behaviours, a 6% reduction in verbal agitation, 56% reduction in general restlessness and a 25% reduction in physically aggressive behaviours (no p values or confidence intervals reported) (Richeson et al., 2004).

4.4.3. Outcomes related to mealtime specific skills

Ten studies reported at least one measure of skills specific to mealtimes, with these types of outcomes being most commonly reported in evaluations of mealtime skills training interventions for people with dementia or their carers and in studies reporting environmental adaptations. Outcome measures included

participation in the meal, mealtime eating skills (e.g. ability to use cutlery, scoop food or pour drinks), assistance required with the meal and time to complete the meal. A range of measurement strategies were used to evaluate improvement in mealtime skills, including the previously validated (Watson et al., 2002) Edinburgh Feeding Evaluation in Dementia score range 0–20, with higher score indicating more difficulty eating) and the Eating Behaviour Scale (higher score indicating more independence) or observation by researchers, the reliability of which was not always reported.

The studies on interventions designed to train people with dementia or care staff in mealtime skills reported mixed results for mealtime specific skills (Chang et al., 2005; Lin et al., 2010, 2011; Wu et al., 2014b). In one low quality cluster-RCT (Lin et al., 2010), a standard Montessori training program had no significant impact ($p > 0.05$) on eating ability evaluated using the Edinburgh Feeding Evaluation in Dementia compared with control over time. However, a low quality cross-over trial (Lin et al., 2011) and a low quality pseudo-RCT (Wu et al., 2014b) reported absolute improvements in mean Edinburgh Feeding Evaluation in Dementia scores of 1.07 (3.4 ± 1.77 compared to standard care 4.61 ± 2.64 , $p = 0.008$) (Lin et al., 2011) and 0.39 (SD 0.14 compared with baseline, $p = 0.007$) (Wu et al., 2014b) for a standard Montessori program. An individualised Montessori program was also associated with significant Edinburgh Feeding Evaluation in Dementia score improvement of 0.30 over time (SD, 0.13, $p = 0.02$) (Wu et al., 2014b). In the cross-over trial, a standard Montessori was also associated with significantly better performance on the Eating Behaviour Scale (mean difference 2.11, $p = 0.025$) compared to routine care (Lin et al., 2011). The cluster-RCT also reported that a spaced-retrieval program also showed no significant impact on Edinburgh Feeding Evaluation in Dementia evaluations compared to routine activities (Lin et al., 2010).

Only the standard Montessori program implemented by Lin et al. (2011) in the cross-over trial was reported to have a positive impact on the amount of assistance people with dementia require to complete a meal. Individuals who participated in the Montessori intervention had significant improvement over time in their self-feeding ability ($p = 0.006$). While the control group engaging in routine activities also showed significant improvement in self-feeding ability ($p = 0.029$), people with dementia exposed to the Montessori program displayed statistically significantly better improvement over time ($p = 0.006$). However, this result was not consistent with an earlier study by the same team that found no statistically significant impact of a Montessori program on ability to feed oneself (Lin et al., 2010). In this earlier study, the space-retrieval program was significantly associated with improved self-feeding (Lin et al., 2010). In these two studies (Lin et al., 2010, 2011), neither the Montessori program or the spaced retrieval program was associated with significant changes in the time to complete the meal, and improved feeding skills was not associated with improvements in weight or BMI.

The intervention designed to improve staff feeding skills that was trialled in a low-quality cluster-RCT was associated with significantly poorer performance by people with dementia as measured using the Edinburgh Feeding Evaluation in Dementia ($p < 0.05$), although the authors suggested that this result may have indicated improved staff assessment of eating difficulties (Chang et al., 2005). Training of care staff was also associated with longer eating times ($p < 0.05$), but no difference in overall food intake ($p = 0.49$) (Chang et al., 2005).

5. Discussion

Losing weight and/or a nutritional deficit is a significant concern for people with dementia, particularly those living in aged care facilities (Douglas et al., 2015). A significant finding in this

review was the inconsistent findings for different outcome measures, and the failure of studies to demonstrate that improvements in food intake or mealtime specific skills, lead to any significant improvement in body weight. This finding is consistent with similar reviews on this topic (Abbott et al., 2013).

In a review that explored mealtime interventions to improve nutritional outcomes for older adults in aged care, Abbott et al. (2013) found some interventions were associated with nutrition-related outcome measures, including interventions that focused on: improving the food quality; interventions that improved assistance provided to aged care residents; environmental improvements; and improving staff nutritional knowledge. This finding contrasts with the current review, which was limited to studies conducted with people with dementia. In our review, interventions focussing on improving mealtime quality or the physical eating environment, had limited clinically significant effects on outcome measures related to the nutrition of people with dementia.

Small studies on animal-assisted therapy (Edwards et al., 2002, 2013) and music therapy (McHugh et al., 2012; Richeson et al., 2004; Thomas et al., 2009) reported that these interventions were related to an increase in food intake, and the studies on animal-assisted therapy further demonstrated that the increase in dietary intake led to improved anthropometric outcomes (Edwards et al., 2002, 2013). Programs designed to improve dexterity, coordination and memory (Lin et al., 2010, 2011; Wu et al., 2014a, b) showed mixed results in improving these skills, and although the majority of the studies on these interventions demonstrated improvements in oral intake, there was no consistent demonstration that improving oral intake led to improvements in weight.

Despite the negative impact of the behavioural and psychological symptoms of dementia on the nutrition of people with dementia (Prince et al., 2014; Volkert et al., 2015), few studies explored the impact of interventions on mealtime behaviours, even when this was directly related to the rationale for the intervention. In a previous systematic review, Whear et al. (2014) specifically explored the effect of mealtime interventions on behavioural and psychological symptoms of dementia. The reviewers (Whear et al., 2014) found that people with dementia receiving mealtime interventions generally demonstrated some positive outcomes on measures of behavioural and psychological symptoms of dementia, although the included studies in the review (Whear et al., 2014), most of which were published earlier than the inclusion dates for the current review, were of low quality and the body of evidence was too small to draw strong conclusions.

The various interventions included in the current review approached mealtime function with goals of improving different aspects of the mealtime experience. As discussed in the introduction, interventions related to the mealtime experience can be conceptualised as addressing mealtime quality and enjoyment, mealtime culture, agency of people with dementia and care provision (Watkins et al., 2017). The interventions reported in this review addressed all these conceptual components of the mealtime experience. However, selection of outcome measures did not always reflect the primary goals of interventions. For example, Edwards et al. (2002) discussed the therapeutic nature of animal-assisted therapy and its positive impact on the behaviour of people with dementia. Despite this goal of animal-assisted therapy, the researchers did not evaluate the impact of the fish tank intervention on behavioural and psychological symptoms of dementia. Likewise, interventions designed to promote the social aspect of mealtimes (Brush et al., 2002; Liu et al., 2015; McDaniel et al., 2001; Perivolaris et al., 2006) generally did not evaluate communication skills or participation in the mealtime experience. Careful consideration of the goals of mealtime interventions and evaluating interventions using outcome measures that reflect that

goal, may be more informative to nursing practice focused on person-centred care and improving the life experience of people with dementia. Indeed, more of the interventions reported in this review may have demonstrated either statistically or clinically significant results had more appropriate outcome measures been selected and larger sample sizes had been used. Additionally, effectiveness of interventions requires evaluation with valid and reliable assessment methods, which was addressed poorly in many studies included in this review.

In two other related reviews (Abdelhamid et al., 2016; Bunn et al., 2016), interventions that directly and indirectly impact nutritional intake in people with dementia in all clinical settings are reported. In the first review that included studies conducted in community-based settings (Abdelhamid et al., 2016), the direct impact studies primarily focus on dietary interventions (e.g. supplements and fortified foods); however, some studies also included interventions with social elements. Similar to the findings of our review, Abdelhamid et al. (2016) found that there is insufficient evidence that social mealtime interventions improve nutritional intake for people with dementia in all settings, although the review highlighted that these aspects of the meal experience are likely to be important for quality of life in people with dementia in residential or community care. We noted in our review that the available evidence did not report the impact of interventions on measures of quality of life of people with dementia or their caregivers. Similar conclusions were established in the Bunn et al. (2016) review of interventions that have an indirect impact on nutritional intake. Bunn et al.'s (2016) review included many interventions reported in the current review delivered in facilities or in the community for people with dementia. Once again, only low quality evidence for small improvements of questionable clinical significance were identified, and the reviewers were unable to recommend any specific mealtime intervention (Bunn et al., 2016). It is evident that both these reviews (Abdelhamid et al., 2016; Bunn et al., 2016) concur with the conclusion of this current review that while some mealtime interventions may improve social interaction and mealtime enjoyment, there is a priority need for high quality research in this field before conclusions can be established about which interventions show the most promise and provide guidance on the most appropriate intervention to address the specific functional deficits of a person with dementia.

Although the research was of low quality, the current reviewers concur with Abdelhamid et al. (2016) that there is a need to provide whatever limited practical guidance can emerge from a review of the current evidence, because impaired mealtime function remains a clinical issue in the daily lives of people with dementia and the caregivers. Interventions that required minimal organisational investment, including music interventions and incorporating a fish tank in the dining room design, showed some improvements in food intake, but few studies trialing these interventions measured mealtime behaviours or eating skills (Edwards et al., 2002, 2013; McHugh et al., 2012; Richeson et al., 2004; Thomas et al., 2009). Interventions that required significant changes to the dining environment, including changes to lighting, furnishings and décor, did not appear to have substantial impact on mealtime functional skills or level of assistance required, although most of these studies (Brush et al., 2002; Perivolaris et al., 2006) showed small improvements in food quantity intake. Interventions that changed the way in which meals were prepared and delivered, and those that required staff to change uniforms and join the meal, failed to demonstrate an impact on nutrition outcomes (Altus et al., 2002; Charras et al., 2010; Cleary et al., 2008, 2012). Small improvements in communication skills and mealtime participation were noted in one intervention but these need to be weighed against the substantial impact these types of interventions can

have on the daily routine of a facility (Altus et al., 2002). Montessori and spaced retrieval programs also demonstrated some positive outcomes with respect to nutritional intake and some mealtime skills (Lin et al., 2010; Wu et al., 2014a, b) It remains unclear whether the improvements reported in these studies are clinically relevant, and whether the changes are substantial enough to warrant the extensive time and large financial investment some of these interventions require.

This review had several limitations. The review was limited to studies published in the past 17 years in the English language. It was also limited to studies involving people with dementia who were living in aged care facilities. Studies that included mixed populations (e.g. those with, and without, dementia) and studies that were not clearly set in aged care facilities were excluded. Thus, the findings cannot be extrapolated to community dwellers or people without dementia who may be impacted by facility-wide interventions introduced to an aged care facility. The review was limited to publications in English and therefore at high risk of language bias. The studies included in the review represented people with dementia from a diverse range of ethnicities, both within samples from studies set in US, UK and Canadian and in a number of studies set in Asia (Chang et al., 2005; Lin et al., 2010, 2011; Wu et al., 2014a, b) or Europe (Charras et al., 2010), suggesting that the review conclusions might be generalisable across cultures. However, further work in this area is considered important, because there is cultural diversity in the ways in which meals are enjoyed, and mealtime skills are also varied. The selection of outcome measures in the included studies, which has been discussed at length throughout this review, raises the issue of outcome reporting bias. Valid and reliable outcome measurement was lacking in many studies. Few studies reported that interrater reliability was established when using subjective assessment tools, and blinding of data collectors was addressed poorly in almost all the studies. However, it is a strength of this review that a wide range of outcome measures have been classified and reported, thereby providing clinicians with some guidance on the type of interventions that might best address a specific functional deficit.

The lack of any substantial review findings reflects both the limited outcome measures reported in the included studies, and other study limitations. Most of the studies used designs considered to be at high risk of bias and therefore provide only low quality evidence on interventions to promote mealtime function of people with dementia. For example, the small sample sizes for most studies suggested that there was insufficient power to detect significant change in outcome results. Selection of indirect outcome measures and the short duration of many of the studies hindered their ability to demonstrate a significant impact on body weight or BMI (Abbott et al., 2013). Further work is required to determine whether the small statistically significant results reported in some studies are clinically significant for people with dementia.

6. Conclusion

Selection of a mealtime intervention should be made with consideration to the rationale and goals of care for the individual and the functional deficits at which an intervention is aimed. Outcome measures that appropriately evaluate these goals should be selected. The small body of low quality literature failed to provide strong guidance on mealtime interventions that might achieve significant clinical effects for people with dementia. While this review did not find any high quality evidence to support interventions to promote mealtime function of people with dementia, it did find a small body of low quality evidence showing that low cost, easily implementable interventions such as music or animal-assisted therapy may achieve improvements in oral intake

for people with dementia. Oral intake might also be improved by implementing skills training courses or undertaking adaptations to a dining room. Further research is required to determine the effectiveness of interventions in improving mealtime function for people with dementia, with consideration to meaningful outcome measures and feasibility for implementing in the residential aged care setting.

Conflict of interests

The authors declare that there is no conflict of interest.

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