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Original Study

Effectiveness of Mealtime Interventions on Behavior Symptoms of People With Dementia Living in Care Homes: A Systematic Review

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A B S T R A C T

Keywords:
Dementia
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Objective: Elderly residents with dementia commonly exhibit increased agitation at mealtimes. This interferes with eating and can be distressing for both the individual and fellow residents. This review examines the effectiveness of mealtime interventions aimed at improving behavioral symptoms in elderly people living with dementia in residential care.
Design: Systematic review.
Data sources: Medline, PsycINFO, Embase, HMIC, AMED (OvidSP); CDSR, CENTRAL, DARE (Cochrane Library, Wiley); CINAHL (EBSCOhost); British Nursing Index (NHS Evidence); ASSIA (ProQuest); Social Science Citation Index (Web of Knowledge); EThOS (British Library); Social Care Online and OpenGrey from inception to November 2012. Forward and backward citation chases, hand searches of other review articles identified in the search, and key journals.
Types of study: All comparative studies were included. Articles were screened for inclusion independently by 2 reviewers. Data extraction and quality appraisal were performed by one reviewer and checked by a second with discrepancies resolved by discussion with a third if necessary. Data were not suitable for meta-analysis so narrative synthesis was carried out.
Results: A total of 6118 articles were identified in the original search. Eleven articles were finally included. Mealtime interventions were categorized into 4 types: music, changes to food service, dining environment alteration, and group conversation. Study quality was poor, making it difficult to reach firm conclusions. Although all studies showed a trend in favor of the intervention, only 6 reported a statistically significant improvement in behavioral symptoms. Four studies suggest cumulative or lingering effects of music on agitated and aggressive behaviors.
Conclusion: There is some evidence to suggest that mealtime interventions improve behavioral symptoms in elderly people with dementia living in residential care, although weak study designs limit the generalizability of the findings. Well designed, controlled trials are needed to further understand the utility of mealtime interventions in this setting.

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Dementia is a global public health priority. The World Health Organization reports that 7.7 million new cases are identified each year, with an estimated 65.7 million people expected to have the condition by 2030, a near doubling from 2010.[1] In 2010, the worldwide cost of dementia was estimated to be US$604 billion, most of this paying for informal and social care.[1] In the United Kingdom, there are approximately 820,000 people with dementia, costing the economy more than £23 billion annually.[2]

Although cognitive decline is the key aspect of dementia, a number of behavioral and psychological symptoms of dementia (known as BPSD) often complicate the care needs of people with dementia. BPSD refers to a collection of noncognitive symptoms of disturbed perception, thought content, mood, or behavior (such as wandering, agitation, sexually inappropriate behaviors, depression,

anxiety, and delusions)[3] and are also known as neuropsychiatric symptoms.[4] As BPSD becomes more severe, people with dementia often require residential care.[5] Estimates suggest 37% of people with dementia in the United Kingdom are cared for within long term care or nursing homes at a cost of approximately £30,000 per person per year.[2] Long term care homes are increasingly expected to be able to provide appropriate care for people with a range of dementia symptoms, from wandering to fear and physical or verbal aggression,[4] all are aspects of BPSD. The UK government has reiterated this expectancy and, through the Dementia Challenge program, has committed £50 million for projects to design special environments in care homes and hospitals where people with dementia can feel safe and reduce their stress and anxiety (http://dementiachallenge.dh.gov.uk/). Stress and anxiety are also examples of the types of behaviors and cognitions that are part of BPSD.[6] Stress and anxiety occurs in up to 90% of residents in nursing homes, with prevalence increasing as dementia progresses and is often more common at mealtimes.[3] Increased stress and anxiety at mealtimes is a problem for a number of reasons: it reduces the sufferer's ability to meet their nutritional needs[7,8]; may disrupt other residents, potentially increasing other BPSD symptoms[3,8]; and causes strain and stress to care home staff.[9] Weight loss and malnutrition are recognized problems for people with dementia.[7,10] Reducing agitated behavior may result in more eating time, which in turn could lead to better nutrition. Therefore, interventions that aim to improve the mealtime environment within a care home may reduce the occurrence of these types of behaviors, which may in turn have beneficial effects for all residents and staff.

The purpose of this review was to determine the effectiveness of mealtime interventions (not nutritional supplementation or food fortification) for improving behavioral symptoms (such as anxiety, agitation, aggression) of elderly people living with dementia in residential care.

Method

The systematic review was conducted following the general principles published by the NHS Centre for Reviews and Dissemination[11] and has been reported in accordance with the PRISMA statement.[12] The protocol for the review was developed in consultation with an expert in care of the elderly (AH). The protocol is registered with Prospero, registration number CRD42012002755.

Search Strategy

The search strategy was developed by an information specialist in consultation with topic and methods experts. The strategy used a combination of MeSH and free text terms; an illustration of the search strategy used on MEDLINE can be seen in Figure 1, but some examples of the search terms were mealtime, dining, eating, feeding, breakfast, lunch, dinner, elderly, geriatric, older, resident, nursing home, dementia, Alzheimer. Fifteen databases were searched from inception to November 2012: MEDLINE, PsycINFO, Embase, HMIC, AMED (OvidSP), CDSR, CENTRAL, DARE (Cochrane Library, Wiley), CINAHL (EBSCOhost); British Nursing Index (NHS Evidence), ASSIA (ProQuest), Social Science Citation Index (Web of Knowledge), EThOS (British Library), Social Care Online, and OpenGrey. No date or language restrictions were used. Forward (checking of where included studies have been cited) and backward (checking the bibliographies of included studies) citation chasing of each included article was conducted as well as hand searching of key journals (*Journal of Nutrition Health and Ageing* 2008–2012, *Journal of Clinical Nursing* 1992–2012, *Journal of the American Dietetic Association* 1993–2012, *Journal of Gerontological Nursing* 2006–2012, and *Journal of Gerontology* 1996–2012).

Types of Studies

Studies were included if they provided comparative data (studies in which data could be compared with a control or baseline measure, such as randomized controlled trials, before and after studies, or time series methods) on any mealtime intervention (described later in this article) conducted in the care home setting aimed at improving dementia-related behaviors, such as agitation, aggression, or hiding and hoarding behaviors. Case studies (and those without enough information for replication or quality appraisal) were excluded.

Types of Participants

The intervention had to take place in residential nursing homes or care homes with residents aged 65 years and older with dementia. Studies that included residents with specific eating difficulties, such as dysphagia, that were conducted in a hospital or palliative care setting or in an individual's home within the community were excluded.

Types of Interventions

For the purpose of this review, mealtime interventions were considered as those that aimed to improve the mealtime routine, experience, or environment. Interventions were included if they directly or indirectly provided assistance and encouragement with eating, a more stimulating environment to eat, increased access to food, more choice of food, or more appealing (visual, sensory) food. Nutrition education or training interventions that were specific to mealtime care for residential elderly were also included. Interventions that investigated the use of oral nutritional supplementation, such as commercial sip feeds, or vitamin and mineral supplements were excluded. Interventions that fortified food with protein or energy were also excluded.[13]

Types of Outcome Measures

Behavioral and psychological symptoms of dementia were primarily of interest for this review.

Data Collection

Two reviewers (RA and RW) independently screened titles and abstracts using the eligibility criteria. Where the eligibility of an article was unclear (and where the article appeared to fit the eligibility criteria) the full text was retrieved to compare it fully against the eligibility criteria to make an informed decision on inclusion to the review. Discrepancies were discussed and resolved with a third reviewer (JTC) where necessary. Data on study design, setting, population, intervention, outcomes and results, and risk of bias were collected using a standardized, piloted data extraction form. The data extraction form was piloted independently by 2 reviewers on 2 articles for inclusion, their forms were then compared, and any inconsistencies and queries about the form were agreed and modified in the final form. Data were extracted by 1 of 2 reviewers (RA or RW) and fully checked by 1 of 3 reviewers (RA, RW, or JTC).

Quality Appraisal

The quality of the studies was assessed using a checklist based on guidelines from the Centre for Reviews and Dissemination[11] by 1 of 2 reviewers (RA or RW) and checked by 1 of 3 reviewers (RA, RW, or JTC). Any discrepancies were discussed and resolved.

Searched 13/11/12

MEDLINE 18

EMBASE 42

PsycINFO 54

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)

<1946 to Present>

Search Strategy:

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1   meal*.ti,ab. (47590)

2   (undernutrition or under nutrition).ti,ab. (4822)

3   nutrition education.ti,ab. (2793)

4   malnutrition.ti,ab. (24839)

5   food.ti,ab. (223204)

6   eating.ti,ab. (39968)

7   dining.ti,ab. (596)

8   feeding.ti,ab. (124759)

9   breakfast*.ti,ab. (5959)

10   dinner*.ti,ab. (2189)

11   lunch*.ti,ab. (4046)

12   (tea or teatime).ti,ab. (17424)

13   snack*.ti,ab. (3664)

14   home environment.ti,ab. (2434)

15   (ambience or ambiance).ti,ab. (294)

16   (diet or dietary).ti,ab. (287004)

17   or/1-16 (634931)

18   Aged/ (2157454)

19   geriatric*.ti,ab. (29954)

20   elderly.ti,ab. (156735)

21   (old* adj (people or resident*)).ti,ab. (15915)

22   old* adults.ti,ab. (28969)

23   old* men.ti,ab. (7613)

24   old* male*.ti,ab. (47669)

Fig. 1. Example search strategy. (*continued on next page*)

Data Synthesis

Studies were split into groups by intervention type based on the literature that was included (music, group conversation, dining environment, and food service). The results of individual studies are tabulated using a visual graphics program (W. Stahl-Timmins, personal written communication, 2013) and described.

Results

The electronic searches found a total of 6118 results; of these, 97 full texts were retrieved for closer examination. A total of 11 studies were included in the final review, with 2 identified from forward and backward citation chasing (none were identified from hand searching key journals). Reasons for exclusion at the full text stage are shown in Figure 2.

Study Characteristics

Table 1 details the characteristics of the 11 included studies. Six were conducted in the United States,[14–19] 2 were in Taiwan,[20,21] and 1 each in Canada,[22] Sweden,[23] and Belgium.[24] All studies were conducted and reported within the past 20 years with the most recent published in 2011.[21] No randomized controlled trials were identified in this review. One controlled trial,[17] 3 before-and-after studies, and 7 repeated measure time series studies were included. Studies were small: sample sizes ranged from 5 to 41 participants. Three studies had fewer than 20 participants.[14,15,18] Residents' mean age ranged from 74.8 years to 87.0 years, with generally more women than men involved. However, ethnicity of the residents was rarely reported. Most (73%) studies were conducted in specialized dementia care units either within a nursing home (n = 4), connected to another facility (n = 2), or standing independently (n = 4). Two studies assessed

25   old* women.ti,ab. (11909)

26   old* female*.ti,ab. (37652)

27   later life.ti,ab. (5421)

28   (long stay adj2 patients).ti,ab. (593)

29   older patients.ti,ab. (21001)

30   old age patients.ti,ab. (54)

31   resident*.ti,ab. (101834)

32   or/18-31 (2364413)

33   care setting*.ti,ab. (19355)

34   care home*.ti,ab. (1601)

35   care residence.ti,ab. (15)

36   care unit*.ti,ab. (72546)

37   long term care.ti,ab. (12946)

38   elderly care.ti,ab. (639)

39   geriatric care.ti,ab. (1156)

40   communal care.ti,ab. (11)

41   institutional* care.ti,ab. (1450)

42   (residential adj (care or unit* or home*)).ti,ab. (2439)

43   nursing home*.ti,ab. (20437)

44   or/33-43 (125492)

45   17 and 32 and 44 (2590)

46   (dementia adj (home* or unit* or facilit*)).ti,ab. (83)

47   (alzheimer* adj (home* or unit* or facilit*)).ti,ab. (44)

48   46 or 47 (127)

49   (dementia or alzheimer*).ti,ab. (117514)

50   17 and 48 (11)

51   44 or 48 (125574)

52   17 and 49 and 51 (377)

53   50 not 45 (4)

54   52 not 45 (18)

55   53 or 54 (18)

Fig. 1. (*continued*).

people with dementia living alongside elderly people without dementia,[16,24] but where this happens only the data relating to residents with dementia are reported. Eight studies included participants with a formal diagnosis of dementia or Alzheimer disease; in 1 study a diagnosis of Alzheimer disease was assumed based on the setting (a "high-functioning dementia unit")[15] and 2 studies used scores on the Mini Mental State Examination to assess eligibility, using thresholds of less than 17[24] or 23.[21]

Despite looking for all BPSD-related symptoms, studies did not tend to report on the full range and often used only observation to record the outcomes. Six studies used the Cohen-Mansfield Agitation Inventory (CMAI),[25] or a version of it, to measure aggressive and agitated behaviors. The remaining studies assessed behavior, communication, functional independence, and psychological outcomes using validated measures, such as the Communication Outcome Measure of Functional Independence (COMFI scale),[17] the Arizona Battery of Communication Disorders in Dementia (ABCD),[26] the Gottfries-Brane-Steen Scale (GBS),[27] or observations of events or behaviors.[14,15,17,20]
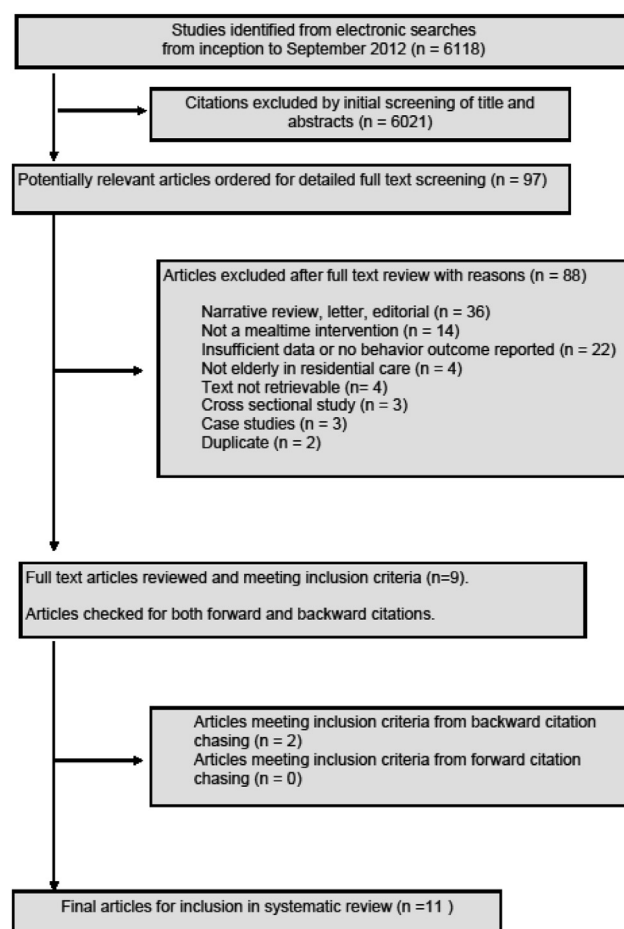

Fig. 2. Flow chart of selection process.

Study Quality

Most studies (n = 9) described outcome data and accounted for all participants (Table 2). However, power calculations were not reported for any of the studies and the blinding of participants or of the outcome assessment was not possible for these studies. Eligibility criteria were described in only half the studies, compliance with the intervention was rarely reported, and the validity and reliability of data collection tools was rarely discussed even though in most circumstances the tools had known validity and reliability. Reassuringly, few studies appeared to show any selectivity in reporting their outcomes. In general, the standard of reporting was too poor to make an informed judgment on the quality of the study; however, 2 studies[20,24] stand out as being better-quality studies according to their reporting, as they met more of the appropriate quality appraisal criteria.

Seven studies evaluated music interventions during the mealtime, 2 studies evaluated changes to the dining environment, such as lighting and table setting, 1 study evaluated a food service intervention, and 1 evaluated a group conversation intervention.

Music Interventions (7 Studies)

In all these studies, some form of music was played during the main meal of the day (lunch or evening meal). In 1 study, music was played during both lunch time and the evening meal.[21] The meals were delivered in a communal dining room. Most studies used relaxing music with the exception of 1 study that investigated the use

Table 1
Study Characteristics

Source	Design/Follow-up	No. Participants (Male/Female, Mean Age)	Setting	Intervention	Measure/Timing
Chang 2010	Time series repeated measures 8 wk, alternating between C&I (C,I,C,I,C,I,C,I)	41 (15/26, 81.68 y)	Dementia institution, Taiwan (diagnosis of Dem, MMSE 23 or lower)	Nature music played during lunch times	CMAI (Chinese version)/ daily
Denney 1997	Time series repeated measures ABAB, 4 wk	9 (3/6, 74.8 y)	Dementia dedicated facility, USA (diagnosis of Dem or Alz, 80% MMSE 5 or lower)	Relaxing music played over lunchtimes	CMAI (modified Goddaer 1994)/ mealtime
Goddaer 1994	Time series repeated measures 4 wk, C,I,C,I, 1 wk each	29 (6/23, 81.3 y)	Nursing home residents with dementia, Belgium (only MMSE 17 or lower)	Relaxing music played over lunchtime	CMAI (Dutch version modified Goddaer 1994)/ mealtime
Hicks-Moore 2005	Time series repeated measures, C,I,C,I, 1 wk each	30 (9/21, 82.4 y)	Nursing home (Special Care Unit) residents with dementia, Canada (only diagnosis of Dem or Alz or severe cognitive impairment)	Relaxing music played over evening meal	CMAI (modified Goddaer 1994)/ mealtime
Ho 2011	Pre-post 4 wk I, 2 wk C	22 (10/12, 77.27 y)	Nursing home (hospital based), residents with dementia, Taiwan (only MMSE 23 or lower)	Music played at mealtime 2 x day	CMAI (Chinese version)/ daily
Ragneskog 1996	Time series repeated measures, 7–10 day conditions: C,I,C,I,C,I,C	20 (10/10, 80 y)	Nursing home (psychogeriatric ward, all had dementia), Sweden (diagnosis of Dem using DSMIII-R and NINCDS-ARDRA and MMSE 25 or lower)	Music played over dinner: 3 types (soothing, 20s/30s, pop)	Gottfries-Brane-Steen (GBS) Scale (1982)/ daily (end of intervention period)
Richeson 2004	Time series repeated measures 2 wk, ABAB	27 (6/21, 87 y)	Nursing home dementia unit, USA (only diagnosis of Dem)	Relaxing music played over evening meal	CMAI (modified Goddaer 1994)/mealtime
Brush 2002	Pre-post 4 wk	25 (3/22)	1 x nursing home with residents with/without dementia and 1 x ALF for dementia only, USA (only diagnosis of Dem)	Improved lighting and table-setting contrast	Meal Assistance Screening Tool (MAST) and Communication Outcome Measure of Functional Independence (COMFI)/ mealtime
Koss 1998	Pre-post 21 d C 21 d I 21 d post I	13 (no info)	High-functioning Dementia Unit, USA (only assumed diagnosis of Alz)	Improved lighting and table-setting contrast	Observation only/daily
Altus 2002	Time series repeated measures ABAB, 25 d	5 (all female, 80 y)	Dementia Care Unit within an assisted-living facility, USA (Diagnosis of Dem or Alz, moderate-severe dementia MMSE 16 or lower)	Family-style meals versus pre-plated meals	Observation only/ mealtime
Santo Pietro 1998	Controlled trial	40 (no info)	Specialized Alzheimer's Unit, USA Dem diagnosis?	Breakfast club versus conversation group	Arizona Battery for Communication Disorders (ABCD, 1993) and COMFI (1997) and observations/ unclear

ALF, assisted living facility; Alz, Alzheimer disease; C, control; CMAI, Cohen-Mansfield Agitation Inventory; Dem, dementia; DSM-III-R, Diagnostic and Statistical Manual of Mental Disorders, third edition revised; I, intervention; MMSE, Mini-Mental State Examination; NINCDS-ARDRA, National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association criteria.

of different types of music (relaxing, 20s/30s, and pop).[23] Relaxing music ranged from nature sounds, such as bird and whale songs, which use a beat that mimics the human heart rate; music from a single piano; soft, melodious music with string instruments; and new world music to quiet and peaceful music without sudden changes in tempo or volume and quiet classical music pieces. Music was played through a CD or tape player at a volume that could be heard over the background noise. Four studies used a time-series repeated measures design involving a period (eg, a week) of no music at mealtimes followed by a week of music during mealtimes followed by a week of no music and then a week of music.[14,18,22,24] Two studies used an extended version of this design[23,20] and one used a pre-post design.[21]

All of the studies reported positive effects from mealtime music on behavioral symptoms, including physical aggressive and nonaggressive behaviors, verbal agitated behaviors, hiding/hoarding behaviors, and total CMAI scores (Table 3). Goddaer and Abraham[24] (n = 29), report statistically significant effects of music on physical nonaggressive behavior ($P < .003$), verbal agitated behavior ($P < .01$), and total agitated behaviors ($P < .0001$). Significance was not reported in the remaining studies (n = 9,[18] n = 30,[22] n = 27[19]). The impact of music on hiding/hoarding behavior (which is less socially disruptive) was not clear, with 2 studies[24,22] reporting weak evidence of positive changes and 2 studies[18,19] reporting no changes in this behavior.

Chang and colleagues[20] report a slight increase in physical nonaggressive behavior, although these results are not significant

Table 2
Study Quality

Intervention	Random Sequence Generation	Allocation Concealment	Blinding of Participants	Blinding of Outcome Assessment	Outcome Data Reported	Nonselective Reporting	Eligibility Criteria Specified	Power Calculations Made	Baseline Details Similar/Imbalances Adjusted for	Compliance With Intervention	Data Collection Tools Valid and Reliable	All Participants Accounted for	Appropriate Analyses
Chang, 2010	Music	NA	NA	-	-	+	+	+	?	NA	+	+	+	+
Denny, 1997	Music	NA	NA	-	-	+	+	-	-	NA	?	+	+	?
Goddaer, 1994	Music	NA	NA	+	+	+	+	+	-	NA	+	+	+	?
Hicks-Moore, 2005	Music	NA	NA	+	-	+	+	-	-	NA	+	?	+	-
Ho, 2011	Music	NA	NA	-	-	+	+	+	-	NA	?	+	+	?
Ragneskog, 1996	Music	NA	NA	-	?	+	?	?	-	NA	?	?	+	?
Richeson, 2004	Music	NA	NA	-	-	?	-	+	-	NA	+	?	?	?
Brush, 2002	Dining environment	NA	NA	?	?	+	+	+	-	NA	?	?	+	?
Koss, 1998	Dining environment	NA	NA	?	?	+	+	-	-	NA	?	-	+	?
Altus, 2002	Food service	NA	NA	-	-	?	?	-	-	NA	?	?	?	?
Santo Pietro, 1998	Group conversation	NA	NA	?	-	+	?	+	-	+	?	?	+	?

+, described in article; −, not described in article; NA, not applicable; ?, unclear.

(n = 41). However, the effects on physically aggressive and verbally agitated behavior and total CMAI score show improvements in the weeks when music was playing.

Ragneskog and colleagues[23] reported significant improvements on the GBS scale in irritability, depressed mood, and fear-panic associated with a music intervention. Results appeared valid across 3 music types (relaxing, 20s/30s, pop), but were most pronounced during the relaxing music.

Finally, the before-and-after study conducted by Ho and colleagues[21] (n = 22) reported statistically significant effects of their music intervention on physical nonaggressive behavior, physical aggressive behavior, verbal nonaggressive behavior, verbal agitated behavior, and total agitated behaviors (all P < .001). This study also suggested the effects of the intervention continue to linger over the 2 weeks following the intervention period when no music was played during mealtimes. A possible lingering effect was also noted in the studies by Denney,[18] Goddaer and Abraham,[24] and Hicks-Moore.[22]

Other Interventions

The remaining 4 studies investigated 3 different types of mealtime interventions: a food service intervention where preplated meals were replaced with family-style meals with food placed on the table in bulk and served out individually[14]; a group conversation intervention where a Breakfast Club met with a facilitator to engage in conversation with others over the breakfast period[17]; and 2 dining room environment interventions where changes were made to increase the lighting in the room and maximize the visual contrast of the place settings during meals[15,16] (Table 3). No further details on these interventions were provided.

One controlled trial (with a sample n = 40) looked at the influence of a Breakfast Club (Breakfast Club involved a small group of residents with Alzheimer disease preparing and eating breakfast together and then clearing up afterwards; the group is facilitated by a trained speech-language pathologist and is encouraged to practice their cognitive and physical capabilities, such as memory, reading, listening, decision-making, and communication over a 45-minute breakfast situation) intervention on the mealtime independence, conversation, cognition, interaction (measured by COMFI), memory, and communication (measured by ABCD).[17] Residents who were in the Breakfast Club scored significantly better than the control group at postintervention analysis on the ABCD scale (P < .025); similar results were reported for the COMFI scale (P < .0005). Interestingly, most of the improvements in the COMFI scale were found in psychosocial interaction and communication conversation, rather than mealtime independence. The study also found a significant increase in interest and memory within subjects in the intervention group from baseline to postintervention (P < .0005) (see the Appendix for details).[17] Altus and colleagues[14] designed a time-series repeated measures trial to investigate the effects of the way the food was delivered to residents on participation in mealtimes and the level of communication (n = 5). Communication in this study was observed and recorded as "appropriate" or "inappropriate." The intervention consisted of lunchtime food being served into communal serving dishes with serving spoons so that meals could be served up on the ward to the residents' preference rather than plates prepared in the kitchen. In the second round of repeated measures, the intervention also included a certified nursing assistant (CNA) who was trained to encourage participation and communication through prompting and praising the residents. Positive effects were seen in both interventions, although these were intensified in the intervention with the CNA. The statistical significance of these findings was not reported, and due to the sample size, should be interpreted with caution.

Table 3
Summary Results of Interventions

Title	Date	Intervention	Setting (Country)	Design	Size	Size and Duration	Outcomes (CMAI)	Outcomes (GBS)	Outcomes (other)
Chang	2010	Music	Dem Institution (Taiwan)	time series	N=41	no music / music	▽ ▲ △ ▲ ▲		
Denney	1997	Music	Dem Institution (USA)	time series	N=9	no music / music	△ △ △ — △		
Goddaer	1994	Music	Nursing home (Belgium)	time series	N=29	no music / music	▲ △ ▲ △ ▲		
Hicks-Moore	2005	Music	Dementia Unit (Canada)	time series	N=30	no music / music	△ △ △ △ △		
Ho	2011	Music	Nursing home (Taiwan)	pre-post	N=22	no music / music	▲ ▲ ▲ ▲ ▲		
Ragneskog	1996	Music	Dementia Unit (Sweden)	time series	N=24	no music / music		△ ▲ △ ▲ ▲ △ ▽ ▽ ▽	
Richeson	2004	Music	Dementia Unit (USA)	time series	N=27	no music / music	△ △ △ — △		
Brush	2002	Dining environment	Nursing home (USA)	pre-post	N=25	no intervention / intervention			△ △
Koss	1998	Dining environment	Dementia Unit (USA)	pre-post	N=13	no intervention / intervention			▲
Altus	2002	Food service	Dementia Unit (USA)	time series	N=5	no intervention / intervention			△ △
Santo Pietro	1998	Group conversation	Dementia Unit (USA)	controlled trial	N=40	intervention / control			▲ ▲

Key

- ▲ positive outcome (p < 0.05)
- △ positive outcome (p > 0.05) or no significance reported
- — no difference
- ▽ negative outcome (p > 0.05) or no significance reported
- ▼ negative outcome (p < 0.05)

Two before-and-after studies in which improvements were made to the dining room environment[15,16] were relatively small (n = 25 and 13, respectively) but found positive effects of the intervention on mealtime independence, conversation, cognition, and interaction (COMFI) and other factors associated with the mealtime event, such as seating problems, oral hygiene, diet, assistance, challenging behaviors, and eating problems (measured by Meal Assistance Screening Tool [MAST]). In particular, Koss and Gilmore[15] found a significant reduction in daily agitation in the 13 participants in their study ($P < .05$), through increasing light intensity and visual stimulation. In this case, visual stimulation refers to providing place settings with maximal visual contrast, such as colored glass and black placemats on a white table cloth. They also reported a continued significant effect of the intervention ($P < .05$) 7 days postintervention.

Discussion

This is the first systematic review to examine the effects of mealtime interventions on behavior in care residents with dementia. We identified only 11 studies involving 265 individuals that met the inclusion criteria for this review. The interventions identified include playing music during mealtimes, changing the lighting and increasing visual stimulation, providing more choice, and promoting conversation. Most of the studies were small and the reporting was of poor quality. However, all studies demonstrate some positive influence of the mealtime intervention on dementia-related behaviors. The greatest amount of evidence exists for music interventions. The studies in this area demonstrated consistently positive effects of the intervention on physically aggressive behaviors, verbally aggressive behaviors, verbally agitated behaviors, and total CMAI score, as well as confusion, irritability, anxiety, fear/panic, depressed mood, and restlessness. However, some negative outcomes were reported in motor, intellectual, and emotional performance/impairment. The positive effect of the music interventions in our review should be taken into account alongside the wider Cochrane review of music therapy for people with dementia[28] and another recent review,[29] both of which also report positive effects. These reviews highlight the existing evidence for music as a form of therapy to help people with dementia; this reflects something different to music at mealtimes but may work on a similar basis. Several studies in our review (mainly regarding the music intervention) reported an ongoing effect of the intervention even in periods when the intervention had been discontinued. This may suggest that some effects may be cumulative and therefore linger with decreasing benefits after the intervention has finished; however, insufficient data were available to fully establish this.

We used a highly inclusive search strategy designed to identify both published and nonpublished evidence, and no study design, date, or language filters were applied. We are therefore confident that we have identified all relevant evidence. However, a limitation is that it is surprising that we identified no UK-based research and very little research suggesting negative influences of these interventions, raising a possibility of publication bias.

The lack of a formal dementia/Alzheimer diagnosis in some studies[15,21,24] should be noted, as these studies reported a large proportion of the statistically significant results. It is unclear what this may mean for the effectiveness of those interventions, as a wide spectrum of residents with dementia, ranging from those who are relatively high functioning to those who are very severely impaired may have been included. The lack of information regarding dementia status also brings a more general concern in understanding the literature, as it makes it difficult to ascertain whether there are interventions that work better with certain subgroups of dementia progression. On a practical level, this information would be helpful for those working in residential care homes who are considering implementing such interventions and who need to know what might work best for the specific residents they care for. Future studies in this area should use clear eligibility criteria (including details regarding dementia diagnosis), use power calculations to estimate the necessary sample size, monitor and report compliance with the intervention, register any harms, and ensure the reliability and validity of the measures used are clearly reported. Future research would also benefit from monitoring more positive behaviors, such as social engagement, mealtime independence, and conversation, to mention only a few. Suggested study designs would include larger controlled trials and cluster-randomized controlled trials to add weight and clarity to existing evidence.

There is evidence to suggest that people with dementia display more agitated behaviors when they feel anxious and that mealtimes can be particularly distressing.[24] The evidence in our review suggests that simple and inexpensive interventions can help to alleviate agitated behaviors. Similar mealtime interventions have been shown to improve weight gain and nutritional status in general populations of elderly people in residential care.[8,13] This emphasizes the important role mealtime interventions could play in improving overall well-being and the experience of residents with dementia in nursing and residential care, as suggested by Bostrom and colleagues.[10] As residential care services are increasingly expected to be able to provide appropriate care for people with a range of dementia symptoms, small and unobtrusive interventions, such as music or simple enhancement to the dining environment, as described in this review, could help to improve the dementia-related behavioral problems. Exploring whether the positive effects of interventions identified in this review are replicable in different contexts, and whether effects on behavior are more long lasting than at meal times, are important research questions. Overall, our review helps to inform debate about the use of nonpharmacological interventions to improve behavioral symptoms in elderly people with dementia.[30,31] Mealtime interventions may improve the general residential care environment and benefit both residents and carers alike, a key aim highlighted by the UK government's Dementia Challenge program (http://dementiachallenge.dh.gov.uk/).

Conclusions

There is some evidence that mealtime interventions improve behavioral symptoms in elderly people with dementia living in residential care, although the quality and therefore reliability of the research is open to some question. Well-designed (perhaps cluster-randomized) controlled trials are needed to test the generalizability of these results and to build evidence for best practice in this area. Effective, simple, nonpharmacological interventions have the potential to improve the residential care environment at little cost, while reducing negative dementia-related behaviors and improving the mealtime environment.

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