



Effect of family style mealtimes on quality of life, physical performance, and body weight of nursing home residents: cluster randomised controlled trial

Kristel A N D Nijs, Cees de Graaf, Frans J Kok and Wija A van Staveren

BMJ 2006;332:1180-1184; originally published online 5 May 2006;
doi:10.1136/bmj.38825.401181.7C

Updated information and services can be found at:
<http://bmj.com/cgi/content/full/332/7551/1180>

These include:

References

This article cites 24 articles, 4 of which can be accessed free at:
<http://bmj.com/cgi/content/full/332/7551/1180#BIBL>

1 online articles that cite this article can be accessed at:
<http://bmj.com/cgi/content/full/332/7551/1180#otherarticles>

Rapid responses

6 rapid responses have been posted to this article, which you can access for free at:
<http://bmj.com/cgi/content/full/332/7551/1180#responses>

You can respond to this article at:
<http://bmj.com/cgi/eletter-submit/332/7551/1180>

Email alerting service

Receive free email alerts when new articles cite this article - sign up in the box at the top right corner of the article

Topic collections

Articles on similar topics can be found in the following collections

[Other nutrition and metabolism](#) (1230 articles)
[Long term care](#) (92 articles)
[Nursing](#) (259 articles)
[Patient - other](#) (526 articles)

Notes

To order reprints of this article go to:
<http://www.bmjournals.com/cgi/reprintform>

To subscribe to *BMJ* go to:
<http://bmj.bmjournals.com/subscriptions/subscribe.shtml>

Research

Effect of family style mealtimes on quality of life, physical performance, and body weight of nursing home residents: cluster randomised controlled trial

Kristel A N D Nijs, Cees de Graaf, Frans J Kok, Wija A van Staveren

Abstract

Objective To assess the effect of family style mealtimes on quality of life, physical performance, and body weight of nursing home residents without dementia.

Design Cluster randomised trial.

Setting Five Dutch nursing homes.

Participants 178 residents (mean age 77 years). Two wards in each home were randomised to intervention (95 participants) or control groups (83).

Intervention During six months the intervention group took their meals family style and the control group received the usual individual pre-plated service.

Main outcome measures Quality of life (perceived safety; autonomy; and sensory, physical, and psychosocial functioning), gross and fine motor function, and body weight.

Results The difference in change between the groups was significant for overall quality of life (6.1 units, 95% confidence interval 2.1 to 10.3), fine motor function (1.8 units, 0.6 to 3.0), and body weight (1.5 kg, 0.6 to 2.4).

Conclusion Family style mealtimes maintain quality of life, physical performance, and body weight of nursing home residents without dementia.

Trial registration Clinical trials NCT00114582.

Introduction

Residents of nursing homes face not only physical deterioration but also loss of independence, privacy, their spouse, and a familiar environment. These factors lead to a high prevalence of loneliness and depression and a low perceived quality of life.¹

Mealtimes in nursing homes provide an opportunity to integrate and implement physical care with measures to improve quality of life. Food and nutrition are essential components of "the good life."² Mealtimes also enable residents to socialise with staff and other residents, to make choices according to personal preferences, and to relax. A convivial and social environment at mealtimes might add a sense of security, meaning, order, and structure to the day and improve satisfaction with life.^{2,3}

In a pilot study we showed that improving the social and physical ambience during mealtimes in Dutch nursing homes counteracted a decline in reported quality of life of the residents.⁴ Residents with dementia were less irritated, anxious, agitated, and depressed and increased their participation and communication during mealtimes when food was served in family style or when music was played.⁵⁻⁷ Studies in this specialty are characterised by small sample sizes (six to 29 participants),⁴⁻⁷ so the results

need to be interpreted cautiously and should not be generalised on a larger scale.

In most nursing homes, meals are individually served on trays in a non-stimulating social environment. Such meals provide task oriented care rather than resident oriented care.⁸ In our study we offered residents family style mealtimes (see table 1[t1]). We hypothesised that, during a six month study period, quality of life, physical performance, and body weight would remain stable among residents offered family style mealtimes but would decline in those receiving the usual pre-plated service.

Methods

In most Dutch nursing homes two types of care are available: psychogeriatric care for residents with dementia or chronic somatic care for patients with conditions such as stroke or Parkinson's disease. These two groups of residents live in separate wards, with an average of 30 residents per ward. A traditional ward has three or four single rooms, four to six double rooms, and four dormitories for four people each. Many Dutch nursing homes have planned major reorganisations to their infrastructure to offer residents their own room and better care services. These services may include family style mealtimes.

Participants and study design

We invited nursing homes to participate in our study through an advertisement in *Prismant*, a magazine distributed to Dutch nursing homes, and through a branch organisation for the care of elderly people, "Arcare." In total 53 nursing homes expressed an interest. Eligible nursing homes had to be medium sized (175-275 beds) with a general nursing home population; had to have two wards for residents with chronic somatic diseases (for example, stroke, general malaise, osteoporosis, neuropathy) and long term care or permanent stay; had to be located in different parts of the country; and had to be similar for staff numbers, disciplines, education levels of the carers, newness of infrastructure, location, and residents' activities.

Sixteen nursing homes met the eligibility criteria; six agreed to participate and five took part. Ten wards for residents with chronic somatic diseases were involved in the study, each with its own dining area. Each nursing home had a control ward and an intervention ward.

To blind the allocation of the wards, we did not visit the wards nor have any contact with the staff or residents before allocation. The wards' name with the initial letter occurring first in the alphabet became the intervention ward. Admission of participants to the wards was independent of the ward's name. Only after this procedure did researchers visit the wards and staff.

Research

Table 1 Description of interventions

Variable	Family style mealtimes	Pre-plated service
Table dressing	Tablecloth; drinking glasses (no plastic cups); normal plates; full cutlery; napkins; subtle flower arrangements	No tablecloth; plastic cups; pre-designed plate, divided into three sections; residents wear bibs
Food services	Cooked meal served in dishes on table; menu choice between two types of vegetables, meat, and staple foods; no ready to eat sandwiches during breakfast or supper	Cooked meal served on individually pre-plated tray; residents choose meals two weeks beforehand; ready to eat sandwiches during breakfast and supper
Staff protocol	Staff sit down at tables and chat with residents; minimum of one nurse or nutrition assistant or volunteer per table; drugs handed out before start of meal; no change of staff during mealtimes; dining room tidied up directly after meal, when everyone finished	Staff do not sit down; two staff members hand out trays, another staff member hands out drugs, and one staff member helps residents who prefer to stay in their room; family and volunteers sit down with residents they prefer; staff leave for lunch when they think nobody needs help; tray put away as soon as residents finish their meal; residents who finish early are helped to toilets or to leave the dining room
Residents' protocol	Balanced seating of residents (typically six per table); residents decide when food is served; most residents serve themselves, with some help from nurse or table companion; mealtimes begin when everybody is seated; before eating there is a moment for reflection or prayer	Seats assigned on basis of availability (typically six residents per table); residents cannot change meal if they dislike it; mealtime begins when trays arrive; residents hold their own moment of reflection
Mealtime protocol	No other activities (for example, cleaning, visits from doctor); dining room closed for visitors and healthcare providers (except where observation by healthcare giver is necessary or visitors help residents), in both cases they have to be in the room at start of mealtime and remain until end; meal, carriages for drugs and residents' files have to be out of sight	Diverse activities take place (cleaning, doctor visits, laundry arrives); family and friends walk in and out of dining room, disturbing other residents

The nursing home staff recruited the residents. A total of 282 residents were recruited from the five nursing homes. The residents received an information brochure detailing the purpose and protocol of the study. We excluded residents in the terminal phase of disease, those needing total parenteral feeding, and those unable to give informed consent owing to a physical or mental condition. New residents entered the wards when beds became vacant and not by choice.

Most of the study population needed help to bathe and dress; were functionally impaired for transferring from bed or chair; feeding, and toilet use; and had incontinence problems.

From the residents' files we collected information on sex, age, length of stay, number of drugs prescribed, diseases, and dietary supplements. Nutritional status was determined by using the mini nutritional assessment.⁹ This tool has been developed and validated to evaluate the risk of malnutrition.⁹ It classifies nutritional status into three categories: malnourished, risk of malnutrition, and well nourished. Residents' height was derived using the formula $\text{height (cm)} = 3.16 \times \text{knee to floor height (cm)}$.¹⁰

The intervention

The intervention lasted for six months and consisted of table dressing, food services, and protocols for the staff, residents, and mealtimes (table 1). Non-participating residents of the intervention group were given the same meal services as participants.

The control wards maintained the individual pre-plated service, whereby residents had to choose their meals two weeks

beforehand. Residents of both intervention and control groups ate their meals in the dining area of the particular ward.

In each nursing home a strictly standardised implementation procedure was followed. Staff served only the intervention ward or the control ward, not both.

Outcome measurements

Although the intervention was implemented at ward level, we measured outcomes at individual level.

Quality of life

Quality of life was assessed in a face to face interview using the validated Dutch quality of life of somatic nursing home residents questionnaire.¹¹ This questionnaire consists of five subscales, each representing a quality of life dimension: sensory functioning (focusing on pain)¹²; physical functioning (perceived performance of self care)¹³; psychosocial functioning (depression or loneliness)¹⁴; perceived autonomy (freedom of movement)¹¹; and perceived safety (feeling at home in the institution).¹¹ The number of statements in the five subscales is not equal. The questionnaire consists of 50 statements, scored on a dichotomous scale (yes or no). Each subscale and the total questionnaire could be computed to a range of 0 to 100—that is, multiplying by 100 and dividing by the number of statements. A high score represents a high quality of life. We measured the internal consistency by using the Kuder-Richardson formula 20, a Cronbach's α for dichotomous items. The coefficients obtained by this formula for each of the domains of the quality of life questionnaire in our study were: sensory functioning, 0.72; physical functioning, 0.80; psychosocial functioning, 0.75; perceived autonomy, 0.56; perceived safety, 0.62; and quality of life (total), 0.79. We consider this to be satisfactory within the context of our study.¹¹ A trained researcher read out the statements and marked the answers of the residents. The interview was carried out in a room separate from the wards.

Physical performance

We used the nursing home physical performance test to assess physical performance.¹⁵ This test was designed and validated among nursing home residents without end stage dementia. The residents had to carry out six tasks, which could be classified as gross and fine motor functions. The tasks related to gross motor function were change from a sitting to a standing position, putting on or taking off a sweater, and walking or using a wheelchair for six metres. The fine motor functions were spooning apple sauce from one vertically oriented bowl to another, washing the face, and dialling a telephone. The performance of each of the six tasks was assessed on speed (0-4) and assistance level (0-4). The score for each task could vary between 0 and 8, with a minimum score of 0 and a maximum score of 24 for both motor functions. The total score ranged from 0 to 48. A higher score means better physical performance.

Body weight

We measured body weight using mechanical sitting scales (Seca, Germany, to the nearest 0.2 kg), a digital sitting scale (Cormier, France, to the nearest 0.1 kg), and digital lifts with a weighing device (UWE, Taiwan; Arjo, Netherlands; TR-Care, Netherlands, to the nearest 0.1 kg).

Body weight was measured between 2.00 pm and 4.00 pm and after residents had used the toilet. The residents were wearing normal clothing without cardigans, sweaters, or shoes.

Energy intake

Dieticians specially trained for our study measured food intake with the observation and weighing back method during three days before and after the intervention. An observation day started at 6.00 am and ended at 10.00 pm. All food and drinks consumed by residents during the three days were recorded.

Statistical analyses

We calculated the sample size on the basis of a six point difference for quality of life score and taking into account the intraclass correlation coefficient and the associated design effects.^{16 17} We determined that we needed a sample size of 60 in each group to achieve a significant difference at the 5% level with 90% statistical power for a two tailed type 1 error for the primary outcome for quality of life. As we expected a mean dropout rate of 50%,^{11 18} we multiplied the sample size ($n = 60$) for each group by two. The total number of residents in each group at the start of the study had to be 120.

Because the allocation procedure was carried out at ward level (cluster) we took into account that the outcome measures within the same ward were not independent of each other.^{16 17} This was done by using a proc mixed model with a random intercept for wards.¹⁷ Based on the intraclass correlation coefficients of quality of life (0.0009), physical performance (0.006), and body weight (0.007), the main factor "ward" contributed to the variance in scores of quality of life (1%), physical performance (10%), and body weight (12%). Thus the effect of ward was limited.

We carried out data analyses with and without adjustments. Because residents in the intervention group were older, had a shorter length of stay, and comprised more women than the control group, we adjusted for age, length of stay, and sex. In further analysis the variable nursing home turned out to be a confounder, therefore we also adjusted all outcome measures for the effect of nursing home. The reported adjusted estimates and confidence intervals were similar to the unadjusted estimates and confidence intervals. In the text we provide data for the adjusted estimates.

Statistical analyses were carried out using SAS version 8.

Table 2 Baseline characteristics of nursing home residents assigned to family style mealtimes (intervention) or to individually pre-plated service (controls). Values are numbers (percentages) unless stated otherwise

Characteristic	Intervention group (n=95)	Control group (n=83)
Mean (SD) age (years)	78 (11.1)	75 (9.9)
Median (interquartile range) length of stay (months)	23 (12-48)	32 (9-52)
Mean (SD) body mass index	28.7 (6.8)	28.4 (5.8)
Mean (SD) No of prescribed drugs	7 (3.3)	7 (3.2)
Mean (SD) No of diseases	3 (1.4)	3 (1.6)
Mean (SD) quality of life score* (range, 0-100)	60 (13.4)	59 (13.5)
Mean (SD) body weight (kg)	73 (16.5)	74 (16.1)
Women	67 (70)	46 (55)
Stroke	51 (54)	35 (42)
In wheelchair	74 (78)	71 (86)
Malnourished†	21 (22)	12 (15)
Taking dietary supplements	24 (25)	15 (18)

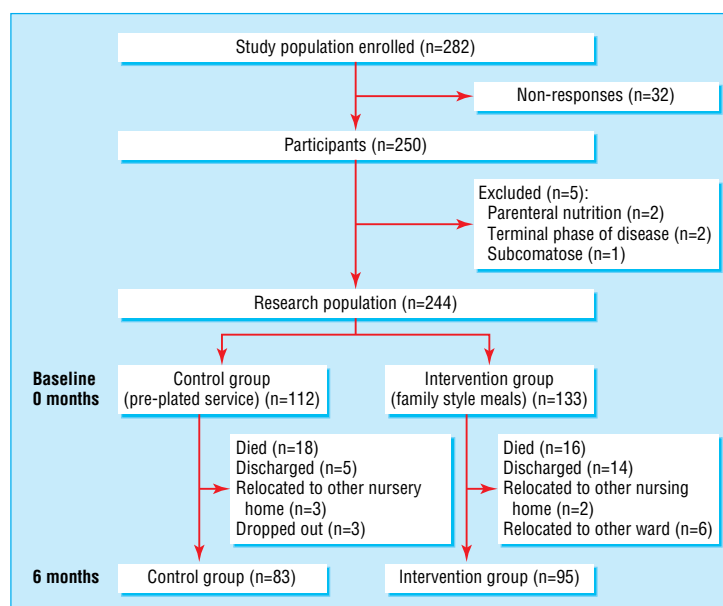
*Range 0-100, with higher scores denoting better quality of life.

†Mini nutritional assessment score ≤ 17 (range 0-30).

Results

Overall, 250 of 282 invited residents took part in the study. We excluded five residents: one was partially comatose, two were terminally ill, and two were switched to parenteral nutrition. During the study period 34 residents died, 11 moved to another institution or ward, 19 were discharged, and three withdrew consent. Overall, 178 residents completed the study. The intervention group consisted of 95 residents and the control group 83 residents (figure). The residents who did not complete the study had similar personal and baseline data to those who completed the study (table 2).

The difference in changes in quality of life between both groups was significant (6.1 units, 95% confidence interval 2.1 to 10.3 units; table 3). The intervention group remained stable (0.4, -1.8 to 2.5) whereas the control group declined (-5.0, -9.4 to -0.6). This difference in change was also seen in physical functioning (5.1, 0.8 to 9.4), psychosocial functioning (7.3, 1.6 to 13.1),



Flow of residents through trial

Research

Table 3 Quality of life, physical performance, and body weight at baseline and changes within and between groups of nursing home residents assigned to family style mealtimes (intervention) or to individually pre-plated service (controls)

Variable	Intervention group (n=95)		Control group (n=83)		Difference in change (intervention group-control group)*	
	Mean (SD) at baseline	β coefficient (95% CI)	Mean (SD) at baseline	β coefficient (95% CI)	Unadjusted	Adjusted* (95% CI)
Quality of life (0-100):	60 (13.4)	0.4 (-1.8 to 2.5)	59 (13.6)	-5.0 (-9.4 to -0.6)	5.4	6.1 (2.1 to 10.3)
Sensory functioning	85 (20.5)	-2 (-5.4 to 1.59)	84 (21.2)	-4.7 (-10.7 to 1.4)	2.7	3.6 (-1.7 to 8.9)
Physical functioning	40 (24.5)	-0.4 (-2.6 to 1.8)	38 (18.1)	-3.4 (-8.9 to 2.1)	3.0	5.1 (0.8 to 9.4)
Psychosocial functioning	57 (22.1)	2.9 (-1.2 to 7.2)	55 (21.9)	-6.2 (-10.7 to -1.8)	8.8	7.3 (1.6 to 13.1)
Perceived safety	70 (30.2)	5.8 (-10.2 to 7.1)	78 (26.5)	-8.7 (-17.2 to -0.2)	14.4	16.6 (4.3 to 28.9)
Perceived autonomy	90 (19.7)	-1.6 (-10.2 to 7.1)	92 (19.1)	-3.9 (-10.9 to 3.1)	2.3	2.1 (-1.4 to 5.7)
Physical performance (0-48):	25 (12.3)	0.2 (-2.3 to 2.7)	24 (12.3)	-2.2 (-4.1 to -0.4)	2.4	3.2 (0.9 to 5.5)
Gross motor function (0-24)	7.8 (7.8)	0.7 (-1.1 to 2.5)	7.7 (7.1)	-0.1 (-1.7 to 1.5)	0.8	1.3 (-0.6 to 3.3)
Fine motor function (0-24)	17.7 (6.4)	-0.5 (-1.6 to 0.7)	16.4 (6.9)	-2.1 (-2.6 to -1.5)	1.6	1.8 (0.6 to 3.0)
Body weight (kg)	73.8 (16.5)	0.5 (-0.3 to 1.2)	74.6 (16)	-1.1 (-1.9 to -0.2)	1.5	1.5 (0.6 to 2.4)
Energy (kJ)	5979 (139)	481 (84 to 878)	6285 (167)	-420 (-713 to -127)	959	991 (504 to 1479)

*Adjusted for age, length of stay, sex, nursing home, and cluster effect of wards.

and perceived safety (16.6, 4.3 to 28.9). The changes within the groups were not different from each other for sensory functioning (3.6, -1.7 to 8.9) and perceived autonomy (2.1, -1.4 to 5.7).

Scores for physical performance were stable in the intervention group (0.2 units, -2.3 to 2.7 units) but declined significantly in the control group (-2.2, -4.1 to -0.4). The difference in change was mainly in the subscale fine motor function (1.8, 0.6 to 3.0), where the scores for controls declined significantly (-2.1, -2.6 to -1.5). No statistically significant changes were found in scores for gross motor function.

Mean body weight remained relatively stable in the intervention group (0.5 kg, -0.3 to 1.2 kg) but decreased significantly in the control group (-1.1, -1.9 to -0.2). Changes in body weight between control and intervention groups were significantly different (1.5, 0.6 to 2.4).

Mean energy intake increased significantly in the intervention group (481 kJ, 84 to 878 kJ) but decreased significantly in the control group (-420, -713 to -127). Changes in energy intake between control and intervention group were significantly different (991, 504 to 1479).

Discussion

Family style mealtimes prevent a decline in the quality of life, physical performance, and body weight of nursing home residents without dementia.

In our study, 89% of the invited residents agreed to participate. A total of 28% of the residents did not complete the study for various reasons (see figure). The personal characteristics of these residents were similar to those who completed the study. Moreover, considering the low non-response (11%) and our inclusion criteria we conclude that the study population was representative of residents in Dutch nursing homes with a chronic somatic disorder.

Earlier research showed that residents with dementia benefit from these kinds of interventions.⁵⁻⁷ Although we excluded this important group, we think that our principal conclusion may be extended to all nursing home residents.

Although many people support the idea that a warm and social ambience during mealtimes can contribute to the wellbeing of nursing home residents, only a small number of studies have measured its effects in a systematic way.^{4-7 19 20} Our pilot study produced similar results to the present study, but the statistical power was too low to make strong inferences.⁴ Most of the studies concerned residents with cognitive impairment and with

outcome variables that reflected changes in behaviour instead of changes in quality of life. The sample sizes in these studies were small (<30 participants).⁴⁻⁷ Two other studies optimised ambience during mealtimes by changing the food delivery system and by focusing on outcome measures such as food intake and body weight.^{19 20} In both studies there were no statistically significant changes in body weight, which was probably due to the short intervention periods (three months and 10 weeks).

Considering our simple method for optimising the ambience during mealtimes, the already low quality of life of the residents, and the limited prospect of revalidation or discharge, the observed difference of 6 points (relative change = 10%) for quality of life is important. Earlier research with the same questionnaire showed differences of 15 units (26%) of quality of life in nursing home residents between admission to a stroke rehabilitation programme and discharge.¹⁸ If we recalculated our estimates as proportions, then studies with the more drastic intervention of coronary artery bypass graft surgery had higher differences in physical functioning (25% v 13%) and social functioning (16% v 13%).²¹ However, in an activity stimulating programme for older community dwelling people and lay health mentoring in older people with ischaemic heart diseases the differences for physical functioning were similar (6.1 and 5.4) and were substantially lower for psychosocial functioning related aspects (0.4 and 4.4 v 7.4) than in our study.^{22 23}

The meals that were offered to the residents in the control and intervention groups were of similar weight and nutrient content. In the intervention group, nursing staff who helped residents with feeding were trained to order the same amounts of food as before the intervention, and the kitchen staff ensured that both wards got identical food. The only difference was the timing of choice. This implies that the effects of the current intervention cannot be attributed to differences in availability of food.

The protocol we used has to be considered as one package as we cannot say which part of the intervention protocol had most effect on the residents. This protocol was chosen on the basis of the Dutch situation, but there are other models to improve ambience during mealtimes, such as a restaurant, meals prepared by the residents themselves and waiter service.^{19 20 24}

As with most countries, Dutch nursing homes are limited by staff and budgets. Therefore we had to design an intervention protocol that did not necessitate extra staff and that would not increase the workload of the staff or the costs of the meal. The costs were limited to buying the required materials, such as table-

cloths and crockery. With motivated staff this programme is easy to achieve on a low budget. The enthusiasm of the residents and nursing staff convinced the management teams and nursing home boards to proceed with the protocols and to implement the programme in other wards.

We thank the staff and residents of the nursing homes, the research assistants, and Vincent Vanneste for help in locating the nursing homes.

Contributors: KANDN carried out the fieldwork, data analyses, interpretation, and drafting of the manuscript. WAvS, FJK, and CdG supervised the study, revised the study design, and obtained funding. All authors contributed to writing the paper. KANDN and CdG are guarantors.

Funding: Netherlands Organisation for Health Research and Development (project No 2420.0021).

Competing interests: None declared.

Ethical approval: This study was approved by the ethical committee of the nursing homes and the medical ethical committee of Wageningen university.

- 1 Patrick DL, Kinne S, Engelberg RA, Pearlman RA. Functional status and perceived quality of life in adults with and without chronic conditions. *J Clin Epidemiol* 2000;53:779-85.
- 2 Amarantos E, Martínez A, Dwyer J. Nutrition and quality of life in older adults. *J Gerontol A Biol Sci Med Sci* 2001;56(suppl 2):54-64.
- 3 Keller HH, Ostbye T, Goy R. Nutritional risk predicts quality of life in elderly community-living Canadians. *J Gerontol A Biol Sci Med Sci* 2004;59:68-74.
- 4 Mathey MF, Vanneste VG, de Graaf C, de Groot LC, van Staveren WA. Health effect of improved meal ambience in a Dutch nursing home: a 1-year intervention study. *Prev Med* 2001;32:416-23.
- 5 Altus DE, Engelman KK, Mathews RM. Using family-style meals to increase participation and communication in persons with dementia. *J Gerontol Nurs* 2002;28:47-53.
- 6 Goddaer J, Abraham IL. Effects of relaxing music on agitation during meals among nursing home residents with severe cognitive impairment. *Arch Psychiatr Nurs* 1994;8:150-8.

What is already known on this topic

Eating in the company of others significantly increases food intake

Family style mealtimes improve the mood of nursing home residents with dementia

What this study adds

Family style mealtimes improve the quality of life of nursing home residents without dementia

Improving the ambience at mealtimes prevents decline in physical performance and body weight

- 7 Ragneskog H, Brane G, Karlsson I, Kihlgren M. Influence of dinner music on food intake and symptoms common in dementia. *Scand J Caring Sci* 1996;10:11-7.
- 8 Sidenvall B. Meal procedures in institutions for elderly people: a theoretical interpretation. *J Adv Nurs* 1999;30:319-28.
- 9 Vellas B, Guigoz Y, Garry PJ, Nourhashemi F, Bannahum D, Lauque S, et al. The mini nutritional assessment (MNA) and its use in grading the nutritional state of elderly patients. *Nutrition* 1999;15:116-22.
- 10 Berkhout AM, Cools HJ, Mulder JD. [Measurement or estimation of body length in older nursing home patients]. *Tijdschr Gerontol Geriatr* 1989;20:211-4.
- 11 Van Campen C, Kerkstra A. [Perceived quality of life of elderly somatic nursing-home patients. Construction of a measuring instrument]. *Tijdschr Gerontol Geriatr* 1998;29:11-8.
- 12 Erdman RA, Passchier J, Kooijman M, Stronks DL. The Dutch version of the Nottingham health profile: investigations of psychometric aspects. *Psychol Rep* 1993;72:1027-35.
- 13 De Bruin AF, Buys M, de Witte LP, Diederiks JP. The sickness impact profile: SIP68, a short generic version. First evaluation of the reliability and reproducibility. *J Clin Epidemiol* 1994;47:863-71.
- 14 Lawton MP. The Philadelphia geriatric center morale scale: a revision. *J Gerontol* 1975;30:85-9.
- 15 Binder EF, Miller JP, Ball LJ. Development of a test of physical performance for the nursing home setting. *Gerontologist* 2001;41:671-9.
- 16 Campbell MK, Elbourne DR, Altman DG. CONSORT statement: extension to cluster randomised trials. *BMJ* 2004;328:702-8.
- 17 Wears RL. Advanced statistics: statistical methods for analyzing cluster and dier-randomized data. *Acad Emerg Med* 2002;9:330-41.
- 18 Dierckx RI, Froeling PG, Bor H. [Nursing home rehabilitation, functional independence and quality of life: a pilot study of somatic nursing home rehabilitation patients]. *Tijdschr Gerontol Geriatr* 2000;31:52-4.
- 19 Remsburg RE, Luking A, Bara P, Radu C, Pineda D, Bennett RG, et al. Impact of a buffet-style dining program on weight and biochemical indicators of nutritional status in nursing home residents: a pilot study. *J Am Diet Assoc* 2001;101:1460-3.
- 20 Shatenstein B, Ferland G. Absence of nutritional or clinical consequences of decentralized bulk food portioning in elderly nursing home residents with dementia in Montreal. *J Am Diet Assoc* 2000;100:1354-60.
- 21 Kiebzak GM, Pierson LM, Campbell M, Cook JW. Use of the SF36 general health status survey to document health-related quality of life in patients with coronary artery disease: effect of disease and response to coronary artery bypass graft surgery. *Heart Lung* 2002;31:207-13.
- 22 Coull AJ, Taylor VH, Elton R, Murdoch PS, Hargreaves AD. A randomised controlled trial of senior lay health mentoring in older people with ischaemic heart disease: the braveheart project. *Age Ageing* 2004;33:348-54.
- 23 Kerse N, Elley CR, Robinson E, Arroll B. Is physical activity counseling effective for older people? A cluster randomized, controlled trial in primary care. *J Am Geriatr Soc* 2005;53:1951-6.
- 24 Nijs K, Vanneste V, de Graaf K, van Staveren W. [Project models to improve the ambience during meal times in Dutch nursing homes: incentives and barriers for implementation]. *Tijdschr Gerontol Geriatr* 2003;34:246-53.

(Accepted 9 March 2006)

doi 10.1136/bmj.38825.401181.7C

Wageningen University, Division of Human Nutrition, PO Box 8129, 6700 EV Wageningen, Netherlands
 Kristel A N D Nijs *PhD fellow*
 Cees de Graaf *professor*
 Frans J Kok *professor*
 Wija A van Staveren *professor emeritus*
 Correspondence to: K A N D Nijs Kristel.Nijs@wur.nl