Nutritional status and duration of overnight fast among elderly residents in municipal nursing homes in Oslo

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ABSTRACT
Aim: To examine the duration of overnight fast and the significance of having an overnight fast below or above 11 hrs with respect to nutritional status among elderly nursing home residents.
Background: Elderly nursing home residents are in high risk of malnutrition. In Norway it is recommended that the overnight fast should not exceed 11 hrs for elderly nursing home residents.
Methods: Overnight fast and nutritional status was examined for 342 long-term nursing home residents. Nutritional status was evaluated by the Malnutrition Universal Screening Tool, body mass index (BMI), weight loss during the last 3-6 months, triceps skinfold thickness, upper arm muscle circumference, and hand-grip strength.
Findings: For 98.5% of the participants the overnight fast was > 11 hrs. Median overnight fast was 15 hrs. Among the participants for whom the overnight fast exceeded 11 hrs, 35.6% were in middle or high risk of malnutrition, and 20% were underweight with BMI < 20 kg/m². No differences in overnight fast were observed between the different categories of nutritional status in this group.
Conclusion: For many participants the overnight fast exceeded recommended length. Future studies should further examine the significance of having an overnight fast below or above 11 hrs with respect to nutritional status for elderly nursing home residents.

KEY WORDS: Overnight fast, malnutrition, elderly, nursing home, Norway

INTRODUCTION

A high level of illness and requirements for assistance characterize elderly people today (1). With the increasing share of elderly in developed countries, there is a growing need for municipal health care and welfare services (1). Elderly are at risk of malnutrition, and in particular institutionalized elderly are at a high risk (2). Malnutrition is associated with a wide range of unfortunate consequences for elderly, and it is therefore desirable to find ways to treat and prevent this condition effectively (2, 3). Since malnutrition is easier to prevent than treat (4, 5), research to find effective preventive strategies is highly relevant. In Norway it is recommended that the overnight fast should not exceed 11 hrs for elderly nursing home residents (6). Previous studies carried out in Norway indicate that the overnight fast is above the recommended level (7, 8). There are no larger studies which have examined the consequences of having an overnight fast below or above 11 hrs for the nutritional status of elderly nursing home residents. Skipping meals and to have long periods without food intake during the day are associated with lower body mass index (BMI) and lower energy- and protein intake in this group (9). We therefore examined the significance of having an overnight fast below or above 11 hrs with respect to nutritional status for elderly nursing home residents.

Background

Malnutrition is defined as a state where deficiency of energy, protein, and other nutrients cause measurable adverse effects on tissue, function and clinical outcome (2). The prevalence of malnutrition among nursing home residents is between 15% and 65%, and varies with types of methods used (2, 10-13). Malnutrition is associated with a higher risk of death, a variety of diseases (2, 3, 14), prolonged and more frequent hospitalization (2, 15), and reduced quality of life among elderly (16). There are many reasons why elderly nursing home residents are in particular risk of malnutrition (2, 3). The most important risk factor is illness (2). Other important risk factors are low appetite (3, 17), impaired taste and smell (3), dental problems (18), low physical activity and long periods without food intake (9).

The Norwegian recommendation for duration of the overnight fast for elderly nursing home residents is currently based on the Nordic Nutrition Recommendations from 2004 (NNR2004) (6). In NNR2004, the recommendation is based on the fact that absorption, digestion, storage and metabolism, are reduced in elderly and that many have an impaired ability to mobilize blood glucose during the overnight fast. The NNR2004 builds on the Swedish National Board of Health and Welfare (19), which refers to expert recommendations that conclude that it is important to serve frequent meals as well as to avoid too long overnight fasts to ensure recommended intakes of energy and nutrients among nursing home residents (20). An overnight fast is defined as the number of hours between the last eating episode in the evening/at night and the first eating episode on the following morning.

Long overnight fast is associated with a lower total daily energy intake among institutionalized elderly (10, 21). In a doctoral thesis from Sweden, Persson found that the elderly who had the shortest quartile of overnight fast (11.5-14.9 hrs) had approximately an average daily energy intake of 300 calories more than the elderly who had the longest quartile of overnight fast (15.7-16.9 hrs) (10). In contrast, Odlund et al. found no such association in their studies among elderly service flat residents (22, 23). To our knowledge only one small (n=31) study has compared the length of overnight fast between well-nourished nursing home residents and nursing home residents that are malnourished or in risk of malnutrition (24). The overnight fast was in this study approximately one hour shorter among the well-nourished residents (24).

Aim

The aim of this study was to examine the duration of overnight fast and the significance of having an overnight fast below or above 11 hrs with respect to nutritional status among elderly long-term residents in somatic wards of municipal nursing homes in Oslo.

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Vård i Norden 3/2012. Publ. No. 105 Vol. 32 No. 1 PP 20–24

METHODS

The Study

Design

The study has an observational design. Nutritional status and duration of the overnight fast were determined once for each participant during the study period.

Sample

Totally there were 29 municipal nursing homes in Oslo August 2010, and of these 24 had somatic wards. An invitation letter was sent out to the institution leaders of the 24 nursing homes, and 19 (79.2%) nursing homes wanted to participate in the study. Of these, 12 nursing homes included all their long-term wards, while the rest included between 1/3 and 3/4 of their long-term wards. Two nursing homes also included one or more of their short-term wards because they had residents who had lived there for > six months. All residents who were ≥ 65 years and who had lived in an open, somatic ward in a municipal nursing home in Oslo for > six months, could be included in the study. Residents with life expectancy < one month, who received parenteral/enteral nutritional support, or whom the nursing staff found unfit to participate, were excluded. The staff at the nursing homes decided who of the residents that fulfilled these inclusion criteria. At each nursing home 20 residents were randomized using randomization lists with random numbers. All residents that fulfilled the inclusion criteria were first numbered and the randomization lists were further used to decide which of the residents that should be asked for participation. Altogether 342 residents participated in the study, between 12 and 20 from each nursing home (Figure 1). Of these, 339 completed the study. Three participants were excluded, two of them due to death and one due to commencement of parenteral nutrition. Compared to descriptive data from all nursing homes in Oslo, the participants in this study are seen as representative for elderly nursing home residents in Oslo (25).

Data collection

Nutritional status was evaluated with the screening form Malnutrition Universal Screening Tool (MUST), BMI, percentage weight loss during the last 3-6 months, mid upper arm muscle circumference (MUAMC), triceps skinfold thickness (TSF) and hand-grip strength. MUST is a validated and recommended screening tool for detecting nutritional risk among adults in the primary health care services, and is shown to have both high reliability and practicability (26-29). Based on scorings of BMI (>20 kg/m² gives score 0, 18.5-20 kg/m² gives score 1, < 18.5 kg/m² gives score 2), percentage weight loss during the last 3-6 months (<5 % gives score 0, 5-10% gives score 1, > 10% gives score 2) and acute disease (no gives score 0, yes gives score 2), the individual is given an overall score which categorize them to be in either low risk (overall score 0), medium risk (overall score 1) or high risk (overall score 2 or more) of malnutrition (26, 30). Height was either measured standing to the nearest 0.1 cm (Seca 217 portable stadiometer), or the alternative measurements of knee height and ulna length were used (30). Weight was measured standing to the nearest 0.1 kg (Seca 877 class III digital floor scale). For participants who could not stand, the nursing home's latest recorded weight was used, which was usually up to one month old. The latest recorded weight used was 2.5 months old. Weight loss during the last 3-6 months was calculated from the nursing homes previously registered weight of the participants. To evaluate BMI and weight loss during the last 3-6 months alone the cut-off values in MUST were used. MUAMC was calculated from measurements of mid upper arm circumference (MUAC) and TSF with a standardized formula (31). MUAC and TSF were both measured according to standardized procedures described in NHANES III (32). Due to physical changes that occurs during aging, TSF has a somewhat limited validity for the use in elderly, which therefore also is the case with MUAMC (31). The values of TSF and MUAMC were compared with Symreng's reference values, and the participants were either categorized as well-nourished or moderate/severe-nourished (33). TSF and MUAC were measured by the same recorder throughout the whole data collection period. The hand-

Figure 1. Flow chart illustrating the recruitment of participants in the study.
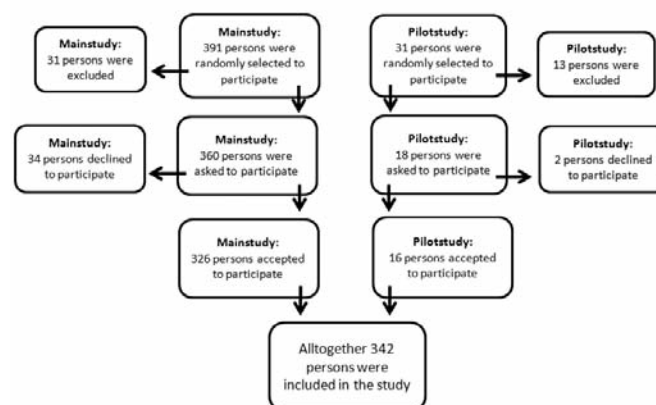
grip strength was measured as previously described by Ha et al. (34), and compared with Luna-Heredias reference values (35). The fifth percentile was used as the cut-off value for healthy elderly individuals (36). Two different recorders did the hand-grip strength measurements throughout the data collection period. The average value of three measurements of both TSF and hand-grip strength was used in analysis.

The duration of the overnight fast was measured by the nursing home staff using a specially developed form, within two weeks of the data collection visit. The overnight fast was mapped over three days (two weekdays and one weekend day), and the staff registered the time of the last eating episode at the evening, the first eating episode the following morning, and any eating episodes during the night for each participant. What the participant ate was also registered in the form. At the data collection visit the staff was informed about how to use the night fast form.

Each nursing home was visited two days in the period from August 1 to November 30, 2010. A pilot study was performed in advance of the main study at one nursing home to practice the methods, and to estimate how time consuming the data collection would be. The data collected in the pilot study are included in the total data material (Figure 1).

Data analysis

The data were analysed with the statistical software PASW version 18 for Windows. Descriptive statistics used are median, range and frequencies. The non-parametrical tests Mann-Whitney and Kruskal-Wallis were employed to examine differences in overnight fast between the different categories of nutritional status. A p-value < 0.05 indicated statistically significant results.

Ethical considerations

The study was approved by the Regional Committee for Medical and Health Research Ethics (registration number 2010/1303). Informed consent was given by the participants. For participants who could not give consent (e.g. those with dementia), consent was obtained from a next of kin or from a staff member who knew the participant well.

RESULTS

Characteristics of the participants are shown in table 1.

The duration of the overnight fast

The duration of the overnight fast was determined for 329 (97.1%) of the participants. For 307 (93.3%) the overnight fast was recorded for three days (two week days and one weekend day), and for the rest the overnight fast was recorded for two or one week day. Approximately 80% and 20% of the night fast forms were completed within five and ten weeks after the data collection visit, respectively. Figure 2 shows the distribution of the overnight fast among the participants. The median (interquartile range) duration of the overnight fast period was 15.0 (14.4-15.4) hrs, with a range of 10.5-19.5 hrs. A total of 80% of the participants endured an over-

Table 1. Subject characteristics		
Characteristic		
Gender	Women	254
	Men	85
Ethnicity	Caucasians	337
	Asians	2
Mean-age (years; range)	Women	88 (65-102)
	Men	84 (65-103)

Figure 2. Frequency distribution of the duration of the overnight fast periods among the study participants.
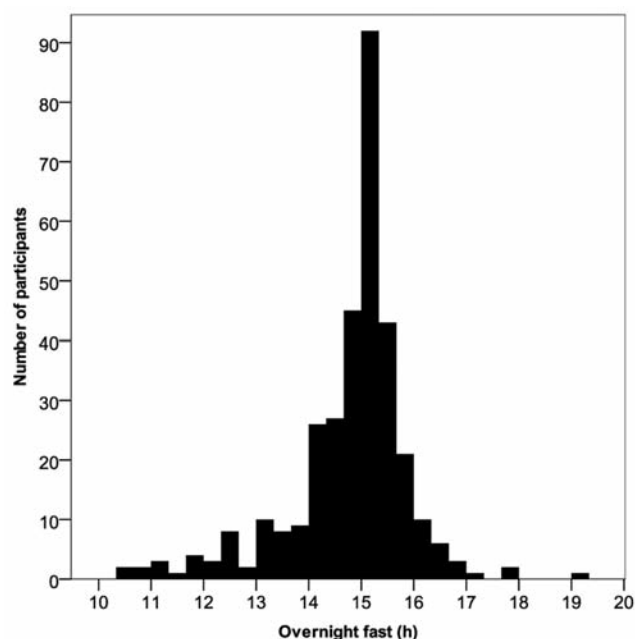
night fast lasting 14-16 hrs, and 324 (98.5%) of the participants endured an overnight fast longer than the recommended length ≤ 11 hours.

Nutritional status among participants who endured overnight fast ≤ 11 hours

Table 2 shows BMI, TSF, MUAMC and hand-grip strength among the participants who endured overnight fast < 11 hours. According to MUST, three of the participants were in low risk and one participant was in medium risk of malnutrition. All participants had a BMI > 25 kg/m² corresponding to overweight or obesity according to MUST. Three participants had lost < 5% of body weight during the preceding 3–6 months, which according to MUST is within 'normal' intra-individual variation. One participant had a weight loss between 5 and 10% during the past 3-6 months, which is an early indicator of increased risk of malnutrition according to MUST. Based on the values of TSF and MUAMC nobody in this group was malnourished or had hand-grip strength below the 5th percentile.

Nutritional status among participants who endured overnight fast > 11 hours

Table 3 shows BMI, TSF, MUAMC and hand-grip strength among participants who endured overnight fast > 11 hours. According to MUST, 192 (64.4%) participants were in low risk of malnutrition, 55 (18.5%) participants were in medium risk of malnutrition, while 51 (17.1%) participants were in high risk of malnutrition. Based on the cut-off values of BMI in MUST, 67 (21.4%) were underweight with BMI < 20 kg/m², 133 (42.5%) were of normal weight with BMI 20-25 kg/m², while 113 (36.1%) were overweight/obese with BMI > 25 kg/m². In total 241

Table 2. Anthropometry among subjects with overnight fast ≤ 11 hrs				
Parameter	**Gender**	**N**	**Median**	**Range**
Body mass index (kg/m²)	Women	3	30.7	25.5-32.5
	Men	1	27.4	
Triceps skinfold thickness (mm)	Women	3	18.0	16.4-28.2
	Men	2	15.7	14.5-16.9
Mid upper arm muscle circumference (cm)	Women	3	21.6	21.4-23.8
	Men	2	28.4	25.9-30.9
Hand-grip strength (kg)	Women	3	17.0	16.0-19.0
	Men	2	19.0	16.0-22.0

Table 3. Anthropometry among subjects with overnight fast > 11 hrs				
Parameter	**Gender**	**N**	**Median**	**Range**
Body mass index (kg/m²)	Women	236	23.3	13.1-43.7
	Men	77	23.4	17.3-38.0
Triceps skinfold thickness (mm)	Women	240	14.2	2.8-31.4
	Men	80	11.2	3.4-20.5
Mid upper arm muscle circumference (cm)	Women	239	21.2	14.8-32.5
	Men	80	23.7	18.5-31.2
Hand-grip strength (kg)	Women	193	11.0	1.8-25.0
	Men	74	19.3	1.5-40.0

(81.4%) participants showed a weight loss of < 5% during the preceding 3-6 months, which according to MUST is within 'normal' intra- individual variation. Totally 36 (12.2%) participants showed a weight loss of between 5 and 10% during the last 3-6 months, which according to MUST is an early indicator of increased risk of malnutrition, while 19 (6.4%) participants showed a weight loss of > 10% during the preceding 3-6 months, which according to MUST is clinically significant.

Based on TSF and MUAMC, 33 (10%) and 47 (15%) of the participants in this group were moderately or seriously malnourished, respectively. A total of 81 (30%) participants had hand-grip strength below the 5th percentile. Table 4 shows the duration of the overnight fast within the different categories of nutritional status. No significant differences in overnight fast were observed.

DISCUSSION

The majority of participants experienced an overnight fast that exceeded the recommended length. Of those who fasted > 11 hrs a night, about 36% were in medium or high risk of becoming malnourished, and about 20% were underweight with BMI < 20 kg/m². No differences in overnight fast were observed between the different categories of nutritional status for the participants who endured an overnight fast > 11 hrs.

The results in this study are in line with two previous Norwegian studies in which the average overnight fast was 14–15 hrs (7, 8). However, the overnight fast in those two studies was either surveyed at ward level (7), or only for residents able to give consent (8). Our results therefore provide a better and updated picture of how long the overnight fast lasts in practice for individual nursing home residents.

It was found as early as ten years ago that overnight fasts at nursing homes in Oslo municipality were too long (7). It was recommended

Table 4. Duration of the overnight fast within the different categories of nutritional status

Parameter	Category	N	Overnight fast (hrs)		p-value
			Median	**Range**	
Nutritional risk evaluated with MUST	Low Medium High	192 55 51	15.0 15.0 15.1	10.6-19.2 11.0-16.4 11.1-17.7	0.75
Body mass index (kg/m²)	< 20 20-25 > 25	67 133 113	15.1 15.0 15.0	11.1-17.7 11.3-19.2 11.7-16.8	0.79
Weight loss in the last 3-6 months (%)	< 5 5-10 > 10	241 36 19	15.0 14.9 15.1	11.1-19.2 11.8-17.7 11.8-16.0	0.43
Triceps skinfold thickness (mm)	Well nourished Moderate/seriously malnourished	273 47	15.0 15.1	11.6-19.2 11.1-17.7	0.36
Mid upper arm muscle circumference (cm)	Well nourished Moderate/seriously malnourished	286 33	15.0 14.9	11.1-19.2 11.8-16.5	0.18
Hand-grip strength (kg)	> 5 percentile < 5 percentile	186 81	14.9 15.0	11.3-19.2 11.2-16.5	0.32

that late supper and/or early breakfast should be introduced as regular meals and that night meals should be offered to restless residents to reduce the overnight fast (7). The results of our study show that not much has changed. The overnight fast was also relatively similar in duration for many participants in our study, which suggests little individual variation. It is recommended that residents in nursing homes as far as possible get the opportunity to eat according to their own desires and needs, also outside the regular meal times (7, 37).

About 36% of the participants enduring an overnight fast > 11 hrs were in medium or high risk of becoming malnourished, and about 20% were underweight with BMI < 20 kg/m². A study from Sweden found that 48% of residents who endured an overnight fast > 11 hours, were malnourished or at risk of becoming so (24). Therefore it can be disadvantageous for the residents to endure overnight fast periods longer than 11 hrs with regard to their nutritional status. Hence we wanted to compare nutritional status among nursing home residents who endured overnight fasting periods of shorter and longer duration than 11 hrs, but because only five of the participants fasted ≤ 11 hrs, we were unable to make such a comparison. Among participants who endured overnight fast > 11 hrs we did not find a significant difference in nutritional status between the groups. This suggests that nutritional status is rather independent of whether the overnight fast is e.g. 13 or 16 hrs. However, the weight of the food intake was not recorded in this study, which could have influenced the results. Whether the overnight fast lasts e.g. 13 or 16 hrs probably does not influence the nutritional status if the food eaten has a low energy and nutrient content. Only eating episodes were recorded in the night fast forms. Drinking episodes high in energy and nutrient would have had an influence on the nutrition status, and can also have influenced the results. Future studies should include a weighted food intake recording and should also include drinking episodes when they record overnight fast among elderly nursing home residents. The fact that approximately 80% of the participants in the study had a relatively similar overnight fast duration may also have influenced the results, because it is possible that greater differences in overnight fast are required to observe significant differences.

An appropriate distribution of meals involving frequent meals throughout the day is an acknowledged measure to increase energy intake and prevent malnutrition among elderly people with low food intake (38, 39). The recommendations regarding overnight fast in NNR2004 are based on this notion (6). An appropriate distribution of meals, with regularly spaced meals requires a short overnight fast, but the opposite is not necessarily true. A short overnight fast period will likely not have any impact on nutritional status if there are many hours between the meals during the day and only a few meals are eaten. A better specification regarding this should probably be included in the recommendation.

Our study was restricted to long-term residents at municipally run nursing homes in Oslo. We have no information about the corresponding conditions in private nursing homes. There is currently no consensus regarding a standard metric for measuring the eating frequency of individuals (40), and the overnight fast is monitored differently in different studies (10, 21, 24). Neither the reproducibility nor the validity of our night fast form has been formally tested. Furthermore, the recording of the overnight fast was performed after the data collection visit, which can have influenced the results of the study.

In this study, the screening form MUST was employed to detect malnutrition. To date no standardised method for identifying malnutrition has been developed (28). The Norwegian Directorate for Health recommends the screening forms Mini Nutritional Assessment (MNA) and MUST for the assessment of nutritional risk in the primary health care services (29). MNA is frequently used to uncover risk and prevalence of malnutrition among elderly (31). A comparison of MNA and MUST showed a systematically lower prevalence of malnutrition if the individuals were assessed using MUST compared to MNA (28). The prevalence of malnutrition may therefore be underestimated in this study compared to similar studies that have used MNA.

The optimal BMI for elderly individuals is debated (41). The cut-off values for BMI that we used are in line with the criteria for malnutrition suggested by the Norwegian Directorate for Health (29). Measurement of weight and height can be difficult in elderly as many are not able to stand. For 46% of the participants the most recent weight recorded by the nursing home was therefore used. MUAC and TSF were measured in either a sitting or a standing position in this study. The standardized measurement procedures of NHANES III recommend a standing position (32). Studies have however shown that this makes little difference (42, 43). Few of the participants in this study were able to perform the test of hand-grip strength according to the standardized procedure, which may have influenced the results (44). A more recent review claims that e.g. posture, the arm used and the placement of the hand, can alter the maximum hand-grip strength (45). It

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is also crucial that the individual is cooperative, which can be difficult due to illness or cognitive impairment (35, 46). This was the case for some of the participants in this study.

Conclusion

We found that the overnight fast was considerably longer than the recommended duration of ≤ 11 hrs for long-term residents > 65 years at somatic wards at municipally run nursing homes in Oslo. Of the participants who fasted > 11 hrs, over 35% were in medium or high risk of malnutrition, and about 20% were underweight with BMI < 20 kg/m². Future studies should investigate further the impact on nutritional status among elderly nursing home residents of enduring an overnight fast below or above 11 hrs.

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