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# Effects of food fortification on nutritional and functional status in frail elderly nursing home residents at risk of malnutrition

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**Abstract**

**Objective:** Malnutrition is a frequent problem in the elderly and is associated with an impaired functional status and higher morbidity and mortality. In this study we evaluated the effect of a 12-wk nutritional intervention with fortified food on nutritional and functional status in nursing home residents at risk of malnutrition.

**Methods:** Nutritional status was assessed with the Mini Nutritional Assessment. Body composition was measured with bioelectrical impedance analysis. Functional status was assessed with handgrip strength, peak flow, the Barthel Index, and the Physical Functioning component of the Short Form 36 questionnaire. The residents were assigned to a group receiving the standard food of the nursing home or a group with a protein- and energy-enriched diet and snacks.

**Results:** Sixty-five nursing home residents were included; 62 were at nutritional risk and 3 were severely malnourished according to the Mini Nutritional Assessment. Protein intake was significantly higher in the group on the enriched diet, whereas energy intake did not differ from the group on the standard diet. Both groups significantly improved most nutritional and body composition parameters during the intervention period. We did not observe convincing improvements in muscle function. Furthermore, the Barthel Index and the Physical Functioning component of the Short Form 36 questionnaire declined in all participants.

**Conclusion:** Standard food in this nursing home provided sufficient energy and macronutrients. Provision of snacks was not effective in increasing energy intake. Although nutritional status improved, functional status did not increase as a consequence. Functional frailty in this study population seems to be influenced more by age-related morbidity and immobilization than by nutritional intake. 

*Keywords:* Nursing home residents; Nutritional status; Malnutrition; Nutritional intervention; Food fortification; Functional status

## Introduction

Impaired nutritional status is a frequent problem in the elderly. Individuals in long-term care facilities in particular are prone to deficits in nutritional status. Prevalence rates of protein–energy malnutrition are high and range from 30% to 60% [1,2].

Causes of reduced food intake are various: disease, physical impairment, age-related physiologic changes, and psychological and psychosocial issues [3,4]. Alone or in combination they can result in a reduced nutritional status, which is associated with an impaired functional status [5,6] and higher morbidity and mortality [7,8]. The functional consequences of malnutrition very often lead to an increasing isolation and a greater dependency that ultimately impair quality of life [8,9]. A sufficient food supply according

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to the needs of this special population is therefore highly important.

Because it has been shown that elderly individuals often have problems in managing an intake of adequate amounts of food due to several reasons (e.g., loss of appetite, poor dentition, etc.), various studies have investigated the use of nutritional support. The meta-analysis by Milne et al. [10] is cautious with stating positive effects of nutritional intervention by an oral or enteral route. There is evidence of increased survival and fewer complications for undernourished hospitalized patients and possibly increased survival for those in long-term care, but the investigators found no benefit of nutritional support in well-nourished elderly patients [10]. Stratton et al. [11] reviewed nutritional support in the elderly and concluded there were positive effects on nutritional outcomes and mortality and in some cases clinical and functional benefits. However, when comparing studies in different settings, it has to be taken into account that interventions in the hospital setting are different from those in long-term care, because acute disease might have a greater influence on outcome than impaired nutritional status.

One useful strategy in ensuring and improving nutritional intake other than with enteral nutrition or oral nutritional supplements is increasing energy and nutrient density through dietary fortification [12–15]. Also, fortified standard food might be more appealing to elderly nursing home residents (NHRs) than conventional oral nutritional supplements.

The aim of this study was to evaluate the effect of a 12-wk nutritional intervention with protein- and energy-enriched food and snacks on nutritional and functional status in elderly NHRs at risk of malnutrition.

## Materials and methods

### *Subjects*

The NHRs who were assessed to be malnourished or at risk of malnutrition (Mini Nutritional Assessment [MNA] ≤23.5 points) were asked to participate in the study. Exclusion criteria were good nutritional status (MNA >23.5 points), severe cognitive impairment, enteral feeding, and a hospital stay ≥6 d during the study period. Cognitive status was determined by the nursing home staff based on their subjective perception of the cognitive ability of the NHR.

Of 295 screened residents from three nursing homes, 92 were eligible and 65 subjects could be included (Fig. 1, flow chart). Implanted defibrillators were considered exclusion criteria for the performance of bioelectrical impedance analysis and patients with hemiplegia or severe arthritis were excluded from muscle strength measurements due to potential confounding. All study participants gave written informed consent and the ethics committee of the Charité Universitätsmedizin Berlin approved the study.

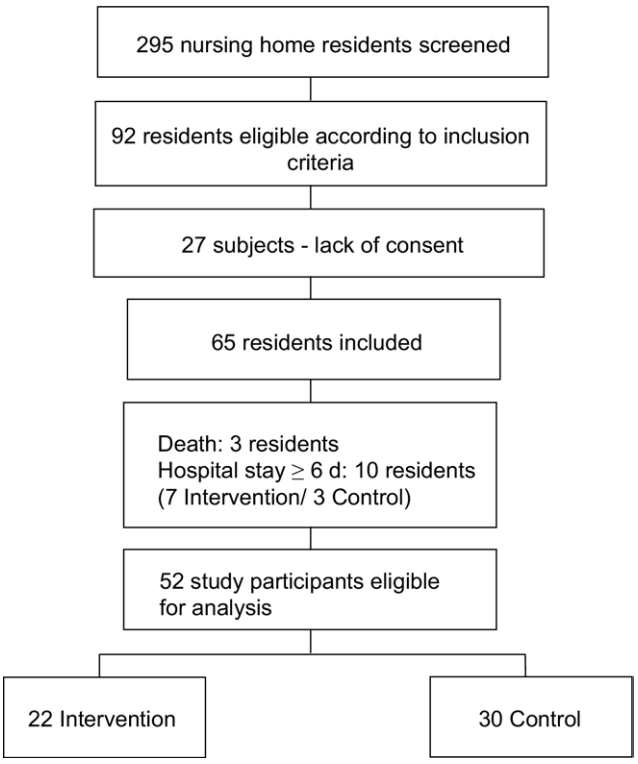


Fig. 1. Flow chart shows how many nursing home residents were screened for the study, how many could be included, and how many remained for analysis.

### *Methods*

#### *Intervention*

Residents with an MNA score ≤23.5 points were assigned to one of two diet groups for an intervention period of 12 wk. Randomization was done according to ward, because it was logistically not feasible to serve different diets and snacks within the same ward. Eighteen wards in three homes participated in the study, each with a variable number of participants and well mixed regarding disease severity. One group, hereafter referred to as the standard group, received a diet according to German reference values [16]. The other group received the same diet with protein- and energy-enriched soups and sauces and two additional snacks high in protein and energy that were served between meals. This group is referred to as the food-fortification (FF) group. The approximate nutrient content of the standard diet was 2000 kcal of energy, 80 g of protein, 60 g of fat, and 260 g of carbohydrates. Protein powder derived from hydrolyzed milk was used to enrich soups and sauces, adding 5 g of protein powder per 100 mL. Energy was added in the form of 5 g of rapeseed oil per 100 mL of sauce and 10 mL of heavy cream per 100 mL of soup. Snacks on a milk basis were served in 150-mL cups containing approximately 300 kcal, 20 g of protein (including 15 g from added protein powder), 20 g of fat, and 20 g of carbohydrates.