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Need-based nutritional intervention is effective in improving handgrip strength and Barthel Index scores of older people living in a nursing home: A randomized controlled trial

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ABSTRACT

Background: Nutritional status is associated with physical functioning in older people. Protein–energy malnutrition can limit functional performance.
Objectives: This study examined the effectiveness of a "need-based intervention" on improving the physical functioning of older adults living in nursing homes.
Design: A 24-week randomized, double-blind, controlled trial.
Settings: A privately managed geriatric nursing home in Taiwan.
Participants: Ninety-two persons who were ≥65 years old, ≤25 kg/m^2, >1 month residence, non-bed-ridden, without acute infection, and able to self-feed or receive oral feeding.
Methods: Qualified participants were stratified by gender and then randomly assigned to either the control group ($n = 45$) or the intervention group ($n = 47$). Each participant in the intervention group would receive a 50 g/day soy-protein-based nutritional supplement when he/she was rated as undernourished, defined as Mini Nutritional Assessment score ≤24 and body mass index ≤24 kg/m^2. The supplement contained 9.5 g protein, 250 kcal energy, and all essential micronutrients. The supplementation would be suspended if either one of the two "at risk" conditions was not met at the next measurement (every 4 weeks). Handgrip strength and Barthel Index were measured at baseline, mid-point (week 12), and end-point (week 24) of the trial. Results were analyzed with Student's *t*-test and by the Generalized Estimating Equations controlled for nutritional status.
Results: The intervention significantly improved (a) handgrip strength of the older adults at weeks 12 and 24, and (b) the overall Barthel Index at week 24 (all $p < 0.05$) according to the Generalized Estimating Equations.
Conclusions: "Need-based intervention" can be an effective and useful strategy for improving the physical functioning of older adults living in nursing homes, without adverse effects. The results probably are the indirect results of the improved nutritional status. The study highlights the importance of routine screening and timely intervention in geriatric care. The applicability of this need-based strategy to community-living older adults is an important issue and should be evaluated. We can probably reap a greater benefit by eliminating the risk of malnutrition at the emerging stage.

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What is already known about the topic?

- Elderly people are at increased risk of physical functional decline, inability to self-care and -feed, and malnutrition.
- Nutritional intervention has been shown to improve physical functioning of elderly people living in nursing homes.
- Most studies conducted to date involved fixed treatment regimens that meet research design principles but not the need of geriatric care practice.

What this paper adds

- Need-based intervention can improve physical functioning of nursing home elderly people in as short as 12 weeks.
- Need-based intervention is most effective in those who are at the emerging stage of malnutrition.
- Need-based intervention strategy appears suitable for community-living elderly people, but confirmation is needed.

1. Introduction

Protein–energy malnutrition is common in older adults, especially among those who are institutionalized. Studies have shown that 12–29% of nursing home residents are malnourished and 51–62% are at risk of malnutrition (Pauly et al., 2007; Suominen et al., 2005; Wojszel, 2006). Malnutrition can affect physical functioning (Ferdous et al., 2009; Kiesswetter et al., 2013; Lee and Tsai, 2012; Li et al., 2013). Individuals who have protein–energy malnutrition will have negative body energy and nitrogen balance. Over time, it will deplete total body energy and tissue protein reserve, and reduce body cell mass and muscle strength (Gaffney-Stomberg et al., 2009; Houston et al., 2008; Rolland et al., 2008). If accompanied by physical inactivity, protein–energy malnutrition will increasingly impair functional performance, handgrip strength, and the ability to perform the basic activities of daily living (Chevalier et al., 2008; Ferdous et al., 2009; Kiesswetter et al., 2013; Norman et al., 2007). Elderly people who have protein–energy malnutrition are also likely to have poor quality of life (Moreira et al., 2013; Rasheed and Woods, 2013) due to impaired physical functioning and mobility limitations (Kiesswetter et al., 2013; Lee and Tsai, 2012; Li et al., 2013), weakened immune functions (Cawood et al., 2012; Milne et al., 2009; Omidvari et al., 2013), and hospitalization and length of stay (Kruizenga et al., 2005; Saka et al., 2010; Stratton et al., 2013). Therefore, it is important to prevent protein–energy malnutrition in older adults.

Protein–energy malnutrition has many causes including biological, physiological, pathological, and socio-economic factors (Ahmed and Haboubi, 2010; Odlund Olin et al., 2005; Salva et al., 2009; Söderhamn et al., 2012; Suominen et al., 2005). However, protein–energy malnutrition in older adults is preventable. Oral supplementation of meals rich in protein and energy has been shown to improve nutritional status of nursing home residents (Lauque et al., 2000; Lee et al., 2013; Manders et al., 2009; Wouters-Wesseling et al., 2002). Consuming adequate and high quality protein and energy ensures adequate substrate (amino acids) for body protein synthesis (Bos et al., 2000; Cheskin et al., 2010; Solerte et al., 2008) and thus, can prevent body protein loss (Gaffney-Stomberg et al., 2009) or even enhance muscle protein deposition and improve muscle strength, particularly if accompanied by resistance exercise (Beck et al., 2008; Cawood et al., 2012; Huynh et al., 2014; Malafarina et al., 2013; Neelemaat et al., 2012; Rosendahl et al., 2006; Zak et al., 2009).

An earlier review by Milne et al. (2009) showed that protein and energy supplementation generally produced a small but consistent weight gain in older people and it might reduce mortality in older people who were undernourished. However, the study found no evidence of improvement in functional benefit or reduction in hospital stay. Recent studies have shown that protein and energy supplementation can improve overall nutritional status (Baldwin and Weekes, 2012; Beck et al., 2011; Stange et al., 2013a), and physical functioning in frail elderly people (Tieland et al., 2012), handgrip strength (Cawood et al., 2012) and lean body mass in malnourished adults (Cheskin et al., 2010; Solerte et al., 2008), and promote muscle mass and strength in older adults with sarcopenia (Malafarina et al., 2013). An earlier study also demonstrated that the supplementation enhanced fat-free mass gain and protein synthesis in poor nourished elderly people (Bos et al., 2000), Hence, nutritional supplementation appears to be a viable strategy for maintaining and improving physical functioning of older adults. However, intervention trials conducted to date usually involved fixed regimens that met the study design principles, but might not be practical in clinical settings. Nursing home elderly people often have varying degree of nutritional conditions, ranging from severe deficiency to over-nutrition.

"Routine monitoring (of nutritional status) and timely (nutritional) intervention" has long been advocated as a goal in geriatric care practice (Babineau et al., 2008; Kruizenga et al., 2005; Stange et al., 2013b; Stechmiller, 2003). Routine monitoring enables early detection of those who are at risk of malnutrition and timely intervention prevents full-bloom malnutrition. The practice has been shown to be effective in improving the nutritional status of nursing-home elderly and malnourished patients (Babineau et al., 2008; Kruizenga et al., 2005; Lee et al., 2013). However, a recent review has concluded that evidence to support the effectiveness of nutritional screening is inconclusive due to lack of sufficient high quality study (Omidvari et al., 2013). Hence, it is sensible to combine routine monitoring and timely intervention to formulate a flexible and targeted approach to provide a need-based nutritional intervention for elderly people.

Physical functioning of elderly people, particularly those who are institutionalized is commonly rated with the Barthel Index (especially in Taiwan), a scale that evaluates the level of independency in performing the activities of daily living. However, studies have suggested that handgrip strength may be a simple, convenient, and effective alternative (Bohannon, 2008; Kilgour et al., 2013; Legrand et al., 2013). It can predict functional decline of higher-level competence in elderly people (Ling et al., 2010; Sugiura et al., 2013). Measuring handgrip strength