



## Original article

# An innovative brioche enriched in protein and energy improves the nutritional status of malnourished nursing home residents compared to oral nutritional supplement and usual breakfast: FARINE+ project



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## SUMMARY

**Background & aims:** To compare the effects of a 12-week nutritional intervention, in which an innovative protein-and-energy-enriched brioche, an oral nutritional supplement or a usual breakfast were eaten, on food intake and nutritional status in nursing home residents.

**Design:** Three-armed, multicentre, controlled trial.

**Setting:** Eight nursing homes in Burgundy, France.

**Participants:** Sixty-eight malnourished participants aged between 70 and 99 years old.

**Intervention:** Participants were randomly assigned to one of three groups according to the breakfast provided: brioche group, one portion of 65 g brioche enriched in protein and energy (12.8 g and 180 kcal) added to usual breakfast; supplement group, 200-ml of a ready-to-use, energy-dense liquid (14 g protein and 200 kcal) added to usual breakfast or control group, a usual breakfast only.

**Measurements:** Total energy intakes were assessed for three days at different periods of the study (day 0, day 30 and day 90); blood parameters, nutritional status (mini nutritional assessment, weight) and functional capacities (grip strength and activity level) were measured at the beginning and at the end of the nutritional intervention study (day 0 and day 90).

**Results:** The participants of the brioche group had higher total energy intakes at day 30 ( $p$  value 0.004) and at day 90 ( $p$  value 0.018) compared with the supplement group and the control group. At the end of the interventional study, 72% of the participants in the brioche group had reached the recommended minimum level of protein of 0.8 g/kg/day, compared with 53% in the supplement group and 36% in the control group ( $p$  value 0.036). In addition, between day 0 and day 90 in the brioche group, blood levels of vitamins B<sub>9</sub>, B<sub>2</sub>, D (all  $p$  value <0.001), B<sub>6</sub> ( $p$  value 0.026) and B<sub>12</sub> ( $p$  value 0.036) had increased and plasma homocysteine had decreased ( $p$  value 0.024).

**Conclusion:** The protein-and-energy-enriched brioche effectively increased energy and protein intakes and improved the nutritional status of elderly people living in nursing homes. It could be a good alternative to oral liquid nutritional supplements to counteract protein-energy-malnutrition.

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## 1. Introduction

An adequate food intake is necessary to maintain good health in ageing, but this objective is sometimes difficult to achieve because of physiological alterations, functional disabilities and diseases [1].

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As they get older, people eat less, even though nutritional needs do not decrease. This imbalance predisposes elderly people to weight loss and increases their nutritional risk. These problems are particularly present in dependent older people living in nursing homes, in which the incidence of malnutrition is high, ranging from 17% to 65% [2].

Malnutrition can be defined as: 'A state of nutrition in which a deficiency or excess (or imbalance) of energy, protein and other

nutrients causes measurable adverse effects on tissue/body form, function and clinical outcome' [3]. In this article, we used the term malnutrition synonymously with undernutrition.

Malnutrition is associated with a decline in functional status, impaired muscle function, delayed recovery from surgery, an increased incidence and severity of various diseases and complications, longer hospital stays, increased readmission rates, increased social isolation, reduced quality of life and increased mortality [4]. It places a considerable burden on community and health services and resources [4].

One of the most important causes of malnutrition is insufficient intake of nutrients because physiological, psychological and social changes associated with ageing [1]. Schroll et al. [5] estimated that 10% of elderly persons consume less than 1300 kcal/day (*i.e.* about 35% less than a normal adult). More recently, Bon et al. [6] noted that food intake only just reached 1500 kcal in hospitals and nursing homes, the threshold below which it is difficult to cover the majority of nutritional requirements [7] and one of the indicators of risk for inadequate micronutrient intake [8]. The recommended daily intake should be 1800 kcal for women and 2200 kcal for men aged more than 60 years old [9]. Current recommendations for protein intake are 0.8–1.0 g per kilogram of body weight a day (g/kg/day) for healthy older adults [9] and as high as 1.2–1.5 g/kg/day for older adults with an acute or chronic disease [10]. When elderly people do not meet their protein requirements, enriched nutritional supplements can be provided to make up the difference. The meta-analysis by Milne et al. [11] showed the positive clinical outcomes of nutritional interventions. There is evidence that supplements can increase survival, reduce complications and increase energy and protein intake in older people. Compliance in elderly people taking supplements is low, because of taste, satiety effects and the extra volume that needs to be consumed [12]. In addition, these products are often regarded as medications and not food.

The aims of the current study were to evaluate the effects of providing elderly nursing home residents (NHR) with enriched brioche as compared with an oral nutritional supplement (ONS) or the usual breakfast over a 12-week nutritional intervention, during breakfast, 1) on the nutritional intake and nutritional status, plasma albumin, and plasma prealbumin, in NHR at risk of malnutrition or undernourished, as the primary outcomes, and then on different secondary outcomes, such as 2) the evolution of other blood criteria, *i.e.* an increase in vitamins B1, B2, B6, B9, B12 and D and selenium on the one hand, and a decrease in homocysteine and C-reactive protein (CRP) on the other, 3) the functional status, and finally 4) BMI. These results of two 12-week nutritional interventions, enriched brioche and an oral nutritional supplement (ONS), were compared with a control group. Brioche was chosen because it is a staple food and is commonly consumed in France.

## 2. Materials and methods

The nutritional intervention was a randomized controlled trial. Each participant was enrolled in the study for 12 weeks, which is sufficiently long to report clinical and nutritional outcomes. Each participant consumed one of the three breakfasts every day: enriched-brioche (brioche group), ONS (supplement group), or the usual breakfast (control group).

### 2.1. Participants

The study was conducted in eight nursing homes in the Dijon area. In accordance with the inclusion criteria, residents were first screened by the medical teams of each nursing home in order to select those who were eligible for this study. Then, physicians involved in the nutritional intervention interviewed each person

directly to verify the inclusion and non-inclusion criteria. Participants were included if they had the following criteria: a Mini Nutritional Assessment (MNA) score  $\leq 23.5$  [13] or plasma prealbumin  $\leq 0.2$  g/L, and aged 70 and older. Participants were excluded if they were allergic or intolerant to any of the foods offered in the study, suffering from an acute episode of disease at the time of the study or were incapable of feeding themselves. The study was approved by the Burgundy Ethics Committee (2010-A01337-32). After receiving information about the study, the participants signed a consent form. For elderly people with a low cognitive status, the study was explained in simple terms, corresponding to their level of understanding. If an elderly person did not manifest refusal to participate in the study, the study was explained to his/her legal guardian or representative, who countersigned the consent form.

### 2.2. Nutritional intervention

All participants consumed their breakfast sitting in their usual place in their nursing home and received the usual food regimen except for the breakfast in the two experimental groups (brioche and supplement groups) in which usual bread at breakfast was replaced by the enriched brioche or an oral nutritional supplement, respectively. The participants in the brioche group were given one brioche roll per day for 12 weeks. The brioche roll weighed 65 g and had one of three randomised flavours, orange, vanilla or honey and contained 12.8 g of protein and 180 kcal. The brioche was supplied by Cerelab<sup>®</sup> (Dijon, France) and was specially designed to suit the preferences, chewing and sensory abilities of the elderly [14]. It was designed to bring similar levels of energy and macro and micro-nutrients to those in the ONS, and focused on elements such as group B vitamins, vitamin D and selenium (for the composition of the brioche see Table 1). The participants in the supplement group received one 200-ml carton of a ready-to-use, energy-dense liquid with three randomised flavours, strawberry, coffee or vanilla (Fresenius Kabi, Nestlé S.A., Labège, France). The supplement contained 14 g of protein and 200 kcal (for the composition of the supplement see Table 1). In the brioche and the supplement groups, participants completed their breakfast with a hot drink, juice, butter, jam and ordinary bread or toast if they wanted to. Consumption of the brioche and the supplement was recorded every day by trained nursing-home staff who evaluated the quantity of brioche not consumed as 0, 25, 50, 75 and 100% of the portion served. Participants in the control group received their usual breakfast provided by the nursing homes.

### 2.3. Study parameters

On the day of inclusion, the variables studied included gender, age, cognitive status (Mini Mental State Estimation (MMSE) score) [15], nutritional status (MNA score), Body Mass Index (BMI), functional status (Activities of Daily Living (ADL) score) [16] and level of efficiency in basic and instrumental activities (Instrumental Activity Daily Level (IADL) score) [17], grip strength using a hydraulic dynamometer (JAMAR<sup>®</sup> plus+) as a measurement of muscle function, plasma albumin and plasma prealbumin values, medication use, prescription of ONS and dental status. Body-weight was measured with participants in light clothing after overnight fasting on a calibrated scale (to the nearest 0.1 kg, SECA, FRANCE). The BMI was calculated by dividing body weight by the square of the height, the latter using the Chumlea equation [18]. The BMI, MNA score, grip strength and ADL and IADL scores were also assessed at the end of the study (day 90).

Food intake was assessed at three time points, before the beginning of the nutritional intervention (day 0), then at one

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