

Development and validation of a range of food products (yoghurts with rheological adaptation and caloric and protein supplements for senior citizens with oropharyngeal dysphagia)

Summary

Dysphagia is the sensation of difficulty when transporting food from the mouth to the stomach. Swallowing consists of four stages: the oral preparatory phase, the oral transit phase, the pharyngeal phase and the oesophageal phase. Oropharyngeal dysphagia is the result of an alteration in the oral and/or pharyngeal phase.

Oropharyngeal dysphagia (OD) is a pathology of the digestive system according to the WHO International Classification of Diseases (787.2 (ICD-9) with code R13 (ICD-10)).

It is very common in various types of patients: between 38% and 78% of patients who have experienced a stroke, 18%–82% of patients with Parkinson's disease, 80% of patients with Alzheimer's disease, in addition to 55% of institutionalised elderly people, 47% of patients admitted to Acute Geriatric Units and 27% of seniors living in the community.

The risk of OD increases in old age, and it has a major impact on the functional capacity, health, and quality of life of the older people who suffer from it.

Demographic ageing is one of the main characteristics of the Spanish population. According to the 2015 census, more than 18% of Spaniards were over 65 years old, and this proportion may increase to more than 30% in less than 40 years.

The aim of the diagnosis of OD is to assess the two characteristics that define swallowing:

- Efficiency, or the patient's ability to ingest all the calories and fluids he or she needs to be well nourished and hydrated.
- Safety, or the ability to ingest fluids and nutrients without respiratory complications.

The dangers involved in OD can range from moderate difficulty to a complete inability to swallow, and lead to two groups of complications:

- Alterations in the effectiveness of swallowing can lead to malnutrition and/or dehydration.
- Alterations in the safety of swallowing (choking or tracheobronchial aspiration) can lead to respiratory infections or aspiration pneumonia (AP). Respiratory complications are the leading cause of death in patients with OD.

These two characteristics of swallowing can be assessed by highly accurate clinical examination methods and the volume-viscosity swallow test (V-VST). The test's diagnostic sensitivity can identify 90% of safety alterations when administered by trained personnel.

In addition to being able to identify patients with OD, the V-VST identifies patients who require thickening agents in their food, and provides data on the most suitable type of bolus (volume and viscosity) for each patient.

Viscosity is a physical property that is expressed in two groups of SI units known as the *Pascal seconds* (Pa·s) and the centipoise (cP) (1mPa·s = 1CP).

The prevalence of penetrations and aspirations is highest with liquids (~ 20mPa·s), and it declines with a bolus viscosity of nectar (~ 300 mPa·s) and pudding (~ 4000 mPa·s). At the same viscosity, the increase in the volume

of the bolus has also been reported as causing an increased risk of aspiration.

Furthermore, malnutrition is a consequence of OD, as mentioned above. In a study of elderly people with OD, their calorie and protein needs were calculated according to their MNA (*Mini Nutritional Assessment*), thereby adding a second level of nutritional adaptation for these patients (texture and nutritional value).

With elderly patients with OD, the traditional diet must be adapted to the patient's ingestion capacity (i.e. chewing and swallowing) depending on the level of severity of their OD.

The market currently includes several manufacturers of nutritional products (nutritional supplements) especially designed to remedy this problem which is common among elderly people with OD (malnutrition). The main problem with these products is that although their calorie-protein levels are sufficient to meet the needs of malnourished patients, they do not have the proper viscosity. The vast majority have liquid viscosity (<50 mPa·s), which poses a risk of aspiration and respiratory complications. In addition, nutritional supplements are only sold in pharmacies, and are expensive for most senior citizens.

Other food products, such as yoghurt, have ideal viscosity for elderly people with OD due to their intrinsic rheological properties, in addition to good organoleptic properties. These products are usually also more affordable and more widely available commercially (in supermarkets). The drawback is that they do not provide an extra intake of calories and protein to help patients who also suffer from malnutrition.

The primary objective of this project is to **develop a yoghurt-based product for elderly people with OD, which can be purchased in supermarkets at an affordable price and adapted in three aspects: rheological (optimal viscosity), nutritional (caloric-protein similar to nutritional supplements) and organoleptic (yoghurt-like taste, smell and texture).**

The working hypothesis is that these products could improve nutrition, and prevent aspirations and penetrations and therefore respiratory complications, thereby improving the health and quality of life of patients.

Objectives

The objective of this project is to develop fermented milk with specific nutritional requirements and a characteristic texture that is suitable for elderly people with oropharyngeal dysphagia. The raw materials used were: whole cow's milk, milk proteins, cream, dextrin, glucose, sucrose, dietary fibre and probiotic cultures: *Bifidobacterium* sp., *S. thermophilus*, *L. acidophilus* and *L. delbrueckii* subsp., *bulgaricus*. In order to characterise the formulations developed, it is necessary to monitor its acidity, the final texture in the mouth (*shear rate of 50^{s-1}*), the final texture in the mouth after developing the effect of salivary α -amylase (the enzyme present in the oral cavity) and its shear thinning effect, i.e. the viscosity value at 300^{s-1} (the shear rate in the mesopharynx).

The products to be developed must adapt in three ways:

- a) In rheological terms (viscosity, shear thinning and resistance to optimal salivary amylase) to prevent aspirations and residues.
- b) In nutritional terms (calorie-protein) to contribute to meeting the nutritional needs of patients, and especially those with malnutrition, while taking the specific needs of subgroups of patients with diabetes and hypercholesterolemia into account.
- c) In organoleptic terms (taste, smell) within the parameters of a traditional diet.

Description of the measures planned in the project

The activities to be carried out and the expected results are described below.

This project is divided into 4 main activities:

1. Literature review and rheological analysis of the existing products on the market.
2. Design and development of the new range of products
 - Formulation and search for raw materials
 - Laboratory level tests
 - Pilot plant level tests
 - Product industrialisation
3. Assessment of new products developed.
 - Clinical study carried out by the Digestive Physiology Unit of the Private Health Foundation of El Maresme Health Consortium.
4. Protection and dissemination of the results of the project.

The Digestive Physiology Unit of the Private Health Foundation of El Maresme Health Consortium (FPSCSM) will be responsible for the analytical, clinical and informative aspects of the project at Mataró Hospital, and the product development, production, correction and marketing will be carried out by the La Fageda Foundation. Finally, the project will be undertaken in partnership with the FUREGA Foundation, which will carry out an informative campaign emphasising the importance of OD in the elderly and the properties of the products developed.

Description of the measures planned in the project

The activities to be carried out and the expected results are described below.

This project is divided into 4 main activities:

5. Literature review and rheological analysis of the existing products on the market.
6. Design and development of the new range of products
 - Formulation and search for raw materials
 - Laboratory level tests
 - Pilot plant level tests
 - Product industrialisation
7. Assessment of new products developed.
 - Clinical study carried out by the Digestive Physiology Unit of the Private Health Foundation of El Maresme Health Consortium.
8. Protection and dissemination of the results of the project.

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Expected results and practical recommendations

A simple product (yoghurt) which is already a common part of the traditional diet for elderly people with a rheological adaptation (adjustment of its optimal viscosity) and nutritional adaptation (caloric and protein supplementation) like the one proposed in this project will be a safe and important nutritional supplement for these patients. **This will reduce nutritional and respiratory complications, and will have a positive impact on reducing the costs of purchasing nutritional health material (at a much more affordable price than traditional supplements) and on the costs associated with complications,** as they will probably be reduced due to **the high levels of acceptance anticipated with this type of product.**

Leader of the Operational Group

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Subject area(s) of application

- Agricultural production system
- Agricultural practice
- Agricultural equipment and machinery
- Livestock farming and animal welfare
- Vegetable production and horticulture
- Landscape / Territorial management
- Pest and disease control
- Fertilisation and nutrient management
- Soil management
- Genetic resources
- Forestry
- Water management
- Climate and Climate Change
- Energy management
- Waste and by-product management
- Biodiversity and environmental management
- Food quality/processing and nutrition
- Supply chain, marketing and consumption
- Competitiveness and agricultural and forestry diversification
- General

Geographical area(s) of application

PROVINCE(S)	REGION(S)
Girona	La Garrotxa

Dissemination of the project (publications, seminars, multimedia, etc.)**Dissemination campaign on the clinical importance of dysphagia in the elderly**

"Swallow Well". <http://furega.com/disfagia/>

The objectives of Furega's "Swallow well" campaign are to:

- Provide information for those suffering from the condition and their families.
- Train and inform professional and family caregivers. This will involve diagnostic training workshops at health centres and senior citizens' residential homes and social centres. Textured cooking workshops for patients with dysphagia will also be held in municipal markets and health centres.

Raise social awareness of the major impact of the disease. This will involve outreach articles in the printed press and social media. Promote research into dysphagia, dysphagia can be cured

- Ensure the rights of patients and that OD is included in medical protocols. Many diseases are associated with this disorder, which means it is difficult to consider it a disease in its own right as recognised by the WHO. This will be achieved by interaction with the Ministry of Health.

Promote a multidisciplinary team strategy for caring for patients and developing a new discipline - Deglutology. To date, dysphagia has been treated within various disciplines: otorhinolaryngology, speech therapy, gastroenterology, gerontology, paediatrics and neurology. This will be achieved with courses and training activities, and interaction with professional associations (doctors, nurses, speech therapists, etc).

More information on the project

PROJECT DATES	TOTAL BUDGET
Start date (month-year): July 2019	Total budget: €185,064.94
Completion date (month-year):	DARP funding: €73,840.91
Current status: Underway	EU funding: €55,704.55
	Own funding: €55,519.48

With funding from:

Project funded through Operation 16.01.01 (Cooperation for Innovation) through the Catalan Rural Development Programme 2014–2020.

Order ARP/133/2017 of 21 June, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ARP/1282/2018, of 8 June, announcing the call for the grant.



Generalitat de Catalunya
Departament d'Agricultura,
Ramaderia, Pesca i Alimentació



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