Available online at www.sciencedirect.com

ScienceDirect

International Journal of Gastronomy and Food Science 3 (2016) 23–29

International Journal of Gastronomy and Food Science

www.elsevier.com/locate/ijgfs

Scientific Paper

Egg yolk fractions as basic ingredient in the development of new snack products

Damián Valverde[a], Amanda Laca[a], Lluis Nel Estrada[b], Benjamín Paredes[a], Manuel Rendueles[a,*], Mario Díaz[a]

[a]*Department of Chemical and Environmental Engineering, University of Oviedo, C/Julián Clavería s/n, 33071 Oviedo, Spain*
[b]*"40 Primaveres" (Comunicación y Sabores C.B.), C/Infante 13, 1° Izda, 33560 Ribadesella, Spain*

Received 28 November 2015; accepted 17 February 2016
Available online 23 February 2016

Abstract

In this work, a new type of snack has been developed. Egg yolk and its fractions (plasma and granules) have been employed as main ingredients for the development of three base formulations. These products were characterized by means of colour, microstructure, textural and sensorial analyses. In addition, the base recipes were interpreted by a trained chef in order to give a culinary point of view. Egg yolk derivatives proved to be a key ingredient for the development of these snacks. Additionally, yolk derivatives also enhanced the organoleptic characteristics of the snacks. Sensory evaluation results showed that, in general, products were favourably assessed. In addition to their low fat (and specifically cholesterol) content and, hence, their dietetic value, granule snacks obtained the highest score in the sensory evaluation.

Keywords: Egg yolk; Egg yolk fractions; Snacks; Texture; Sensory evaluation

Introduction

Egg industry has seen a considerable evolution in the last 50 years, indeed, in parallel with changes in egg-processing technology, there has been a continuing growth of further processed egg products. Specifically, nowadays, approximately 30% of the total consumption of eggs is in the form of further processed eggs (Froning, 2008).

As one of the most versatile product, and on account of its multifunctional properties, egg yolk is widely used, not only in the food industry, but also in the biotechnological field (Laca et al., 2015). Egg yolk is an oil-in-water emulsion containing 52% dry matter, about 65% of which is fat, 31% proteins and the remaining 4% carbohydrates, vitamins and minerals (Guilmineau et al., 2005). In natural conditions, yolk is constituted by a continuous aqueous phase referred to as plasma, and insoluble denser structures (0.3–2 μm) referred to as granules (Guilmineau and Kulozik, 2006). Thus, yolk can be easily separated at an industrial scale into this two fractions by centrifugation (the supernatant represents the plasma and the pellet is made up of granules) (Laca et al., 2014). Plasma contains LDL and livetins, while granules are mainly constituted by high-density lipoproteins (HDL), phosvitin, and low-density lipoproteins (Anton, 2013). Granules represent about 22% of yolk dry matter, accounting for about 50% of yolk proteins and 7% of yolk lipids; whereas plasma corresponds to about 78% of yolk dry matter and it accounts for about 90% of yolk lipids and 50% of yolk proteins (Anton, 2007), hence separate usage of each egg yolk fraction in food processing could possibly offer new approaches (Strixner and Kulozik, 2013).

According to Opazo (2012), in the last two decades, the knowledge and practices promoted by the avant-garde movement in the culinary industry have led to radical innovations in high-end cuisine, even beyond the gastronomic field. In this context, international gastronomy and food science are in search for appealing ingredients, new foodstuffs and new technology and methods for food preparation (Krigas et al.,

*Corresponding author.
E-mail address: mrenduel@uniovi.es (M. Rendueles).
Peer review under responsibility of AZTI-Tecnalia.

http://dx.doi.org/10.1016/j.ijgfs.2016.02.002

2015). Consequently, since nowadays industry is looking for new uses of egg components, it is important to explore innovative applications taking into account the benefits of the interaction of science and gastronomy.

Thus, two different products (plasma and granules) can be simply obtained from the egg yolk fractionation and, until now, these raw materials have scarcely been employed in the culinary field (García et al., 2015; Laca et al., 2010a, 2014, 2015). So, this paper addresses the exploitation of these new egg yolk products as food ingredients in the development of a new type of snacks. Additionally, these fractions can supply to the developed products interesting characteristics regarding nutrient profile and also physical properties. The final aim is to expand the uses of egg yolk, a product used as food ingredient since a long time ago, in the gastronomic field.

Egg yolk and egg yolk fractions (plasma and granules) have been employed in this work as key ingredient for the development of a new type of snacks with added value from a nutritional and sensorial point of view. These products have been characterized by means of colour, microstructure, textural and sensorial analyses. In addition, the base recipes were interpreted by a trained chef in order to give a culinary perspective.

Materials and methods

Extraction of egg yolk and egg yolk fractions

Egg yolks were prepared from fresh eggs. The shelling of the eggs and the separation of the yolk from the albumen were performed manually. The albumen residuals were eliminated from the yolk using a blotting paper, and the removal of the vitelline membrane was achieved using tweezers. The fractionation method was conducted according to Laca et al. (2010b). The egg yolk material is mixed with distilled water (1:1.5 v/v) and pH is adjusted to 7 by the addition of NaOH (1 N) (PanReac AppliChem, Barcelona, Spain). Then, diluted yolk is kept overnight at 4 °C before centrifuging at 4 °C and 10,000*g* for 45 min to separate into plasma (supernatant) and granule (precipitate) fractions (KUBOTA 6500, Kubota Corporation, Tokyo, Japan). Egg yolk and egg yolk fractions (plasma and granules) were freeze-dried at −70 °C and 0.1 mBa in a Telstar Cryodos Lyophilizator (Telstar Group, Terrassa, Spain). Samples were frozen at −80 °C prior to lyophilization.

Formulations and development of snacks

After preliminary assays, the final formulation of snacks was as follows. The snacks contained 4.5% (w/v) of egg yolk, plasma or granules, 2.5% (w/v) of carrageenan GPI 200 (Gum Products International, Ontario, Canada) and 1.5% (w/v) of locust beam gum E-415 (Innovative Cooking S.L., Madrid, Spain) in distilled water. Snacks of 20 g were prepared by mixing the corresponding quantity of ingredients, and then the mixture was blended with a Heidolph SilentCrusher Homogenizer (Heidolph Instruments, Schwabach, Germany) during 15 s at 17,500 rpm. The homogenize dough was cooked at 105 °C during 20 min in a UNB 400 heater (Memmert GmbH+Co. KG, Schwabach, Germany), with hand mixing during 3 s at 10 min of cooking. Afterwards, the mixture was gelled by cooling at room temperature. Once the product was gelled, it was taken out from the mould and it was cut into slices of 2 mm of thickness. Then, these slices were dried in a heater at 105 °C during 7 h. In addition, a sample without egg derivatives was prepared following the same steps with the same conditions in order to be employed as control product.

This elaboration procedure was slightly modified as follows by a trained chef with the aim to obtain different culinary products. The initial mixture of ingredients was seasoned with salt and garlic, and, once the products were gelled, they were dried in a food dehydrator 245 W (Lacor, Álava, Spain); finally, they were deep fried in hot olive oil. In addition, the initial mixture of ingredients was gelled in a mould in order to get edible recipients. These edible recipients were filled with a blend of beaten egg, cream, bacon and mushroom flavoured with salt, black pepper and basil, and cooked in a kitchen oven.

Microstructure analysis

Snacks were analyzed employing scanning electron microscopy (SEM). Samples were fractured and torn with a blade; fragments were mounted on aluminium SEM stubs and coated with gold in a Sputtering Balzers SCD 004 (Optics Balzers AG, Balzers, Liechtenstein). The microscope used was a JEOL-6610LV SEM (Jeol Ltd., Tokyo, Japan).

Colour measurement

The colour measurements were carried out using an UltraScan VIS spectrophotometer (Hunter Associates Laboratory Inc., Reston, Virginia, USA). It was standardized with a light trap and white title, and a green title was used to verify the instrument long-term performance. Analyses were carried out at least in duplicate and were conducted in specular exclusion mode; this mode includes the effects of gloss and texture, so the evaluation of colour is similar to human-eye perception. The colour was measured in terms of CIE-Lab parameters: L^* (whiteness or brightness), a^* (redness or greenness) and b^* (yellowness or blueness) (Wei et al., 2012).

Moisture content

Moisture content was determined by gravimetry, in triplicate. Twenty grams of thick grain sea sand (PanReac AppliChem, Barcelona, Spain) were weighted in a stainless steel mortar with its pestle and it was dried in a UNB 400 heater (Memmert GmbH+Co. KG Schwabach, Germany) at 165 ± 1 °C during 1 h. The mortar was then kept in a vacuum desiccator for 30 min until its weight value was constant. Subsequently, approximately 3 g of sample were weighed into the mortar and the sea sand and snack sample were mixed with the pestle. The mortar was placed in a UNB 400 heater (Memmert GmbH+Co. KG, Schwabach, Germany) at 105 ± 1 °C for 5 h. The mortars were then allowed to cool