

3D printing of foods which are suitable for those with dysphagia

Róisín Burke (Lecturer) and Students from the B.Sc. (Hons) in Culinary Science Year 2.

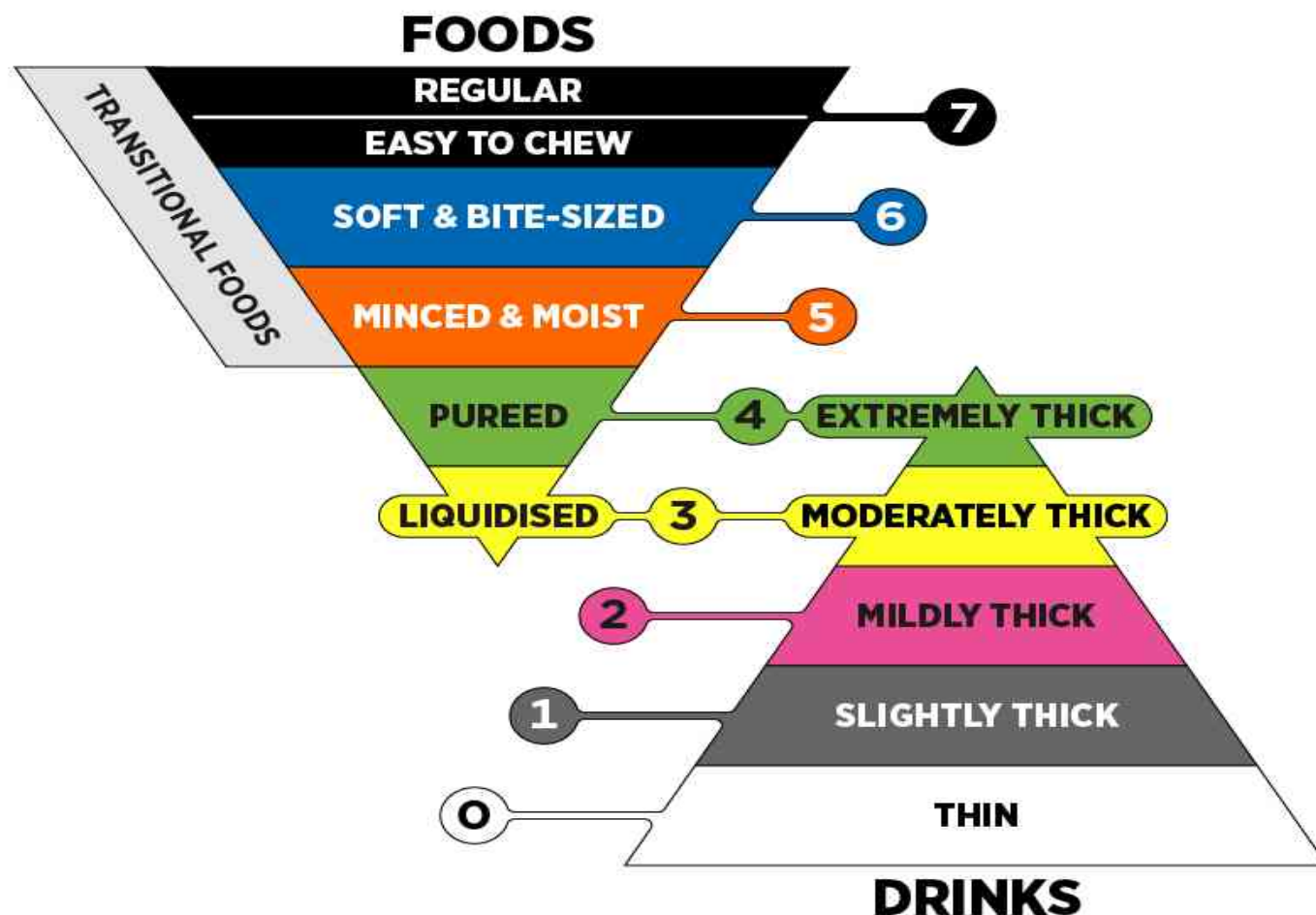
Meghanna Balasubramani, Livia Cretu, Róisín Dawson, Seán Dowd, Fionán Dwyer Hyland, Emma Gibbs, Tiffany Hui, Porsche Mc Court Flynn, Donagh McSweeney, Peter K. Mphahlele, Saoirse Owens.



Dysphagia

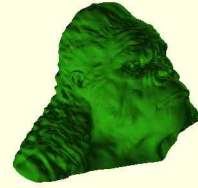
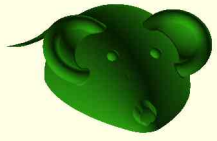
The IDDSI Framework

Providing a common terminology for describing food textures and drink thicknesses to improve safety for individuals with swallowing difficulties.

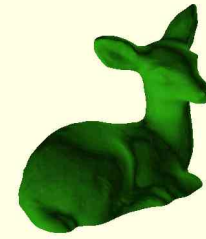
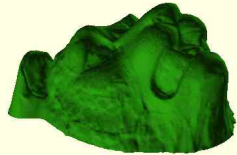
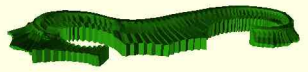




The Procusini 3D Food Printer



Examples of Shapes



*Minced & Moist food must
pass all three tests!*



IDDSI Fork Test

Paediatric, equal to or less than
2mm width and no more than
8mm in length

Adult, equal to or less than
4mm width and no more than
15mm in length



**Soft enough to
squash easily with
fork or spoon**

**Don't need thumb
nail to blanch
white**



IDDSI Spoon Tilt Test

Sample holds its shape on
the spoon and falls off
fairly easily if the spoon is
tilted or lightly flicked

Sample should **not** be firm
or sticky

MENU

Starter

Bruschetta-styled 3D printed bread base with tomato and chilli relish, basil and oregano foam, whipped goats' cheese and a balsamic glaze.

Main Course

3D printed chicken and gravy with a side of mashed potatoes, broccoli and carrots.

Dessert

3D printed Vanilla sponge cake and crème pâtissier (custard) with lemon mousse, lemon gel and Chantilly cream.

Starter

by

Róisín Dawson

Seán Dowd

Saoirse Owens



A bruschetta styled starter.

This contains five components including a 3D printed white bread base, a tomato and chilli relish, basil and oregano foam, whipped goats cheese and a balsamic glaze.



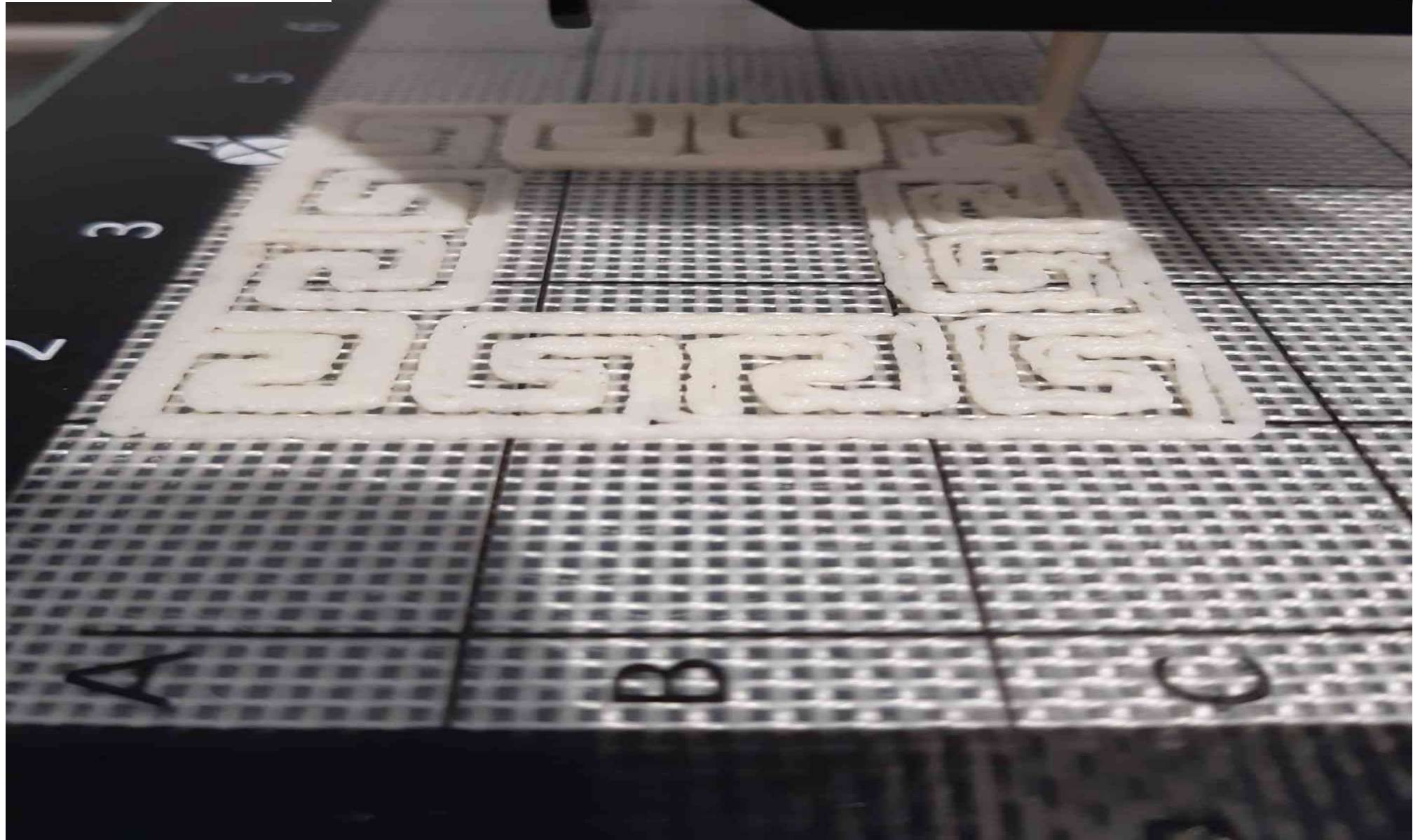
Recipe

For the Bread:

- 350ml milk
- 300g white sliced bread
(crusts removed)
- 20g vegetable gelling agent
- Two sprigs of fresh rosemary
- Salt & pepper

Recipe for 3D Printed Bread Base

- ▶ In a saucepan, heat the milk with the fresh rosemary to 90 °C.
- ▶ Strain the milk to remove the rosemary and add the white sliced bread.
- ▶ Blend the bread and milk with a hand blender to a smooth purée. Add the vegetable gel and blend further to fully incorporate it. Add seasoning.
- ▶ Transfer the mixture into a piping bag. Once the mixture has cooled, pipe into the required syringe that will be inserted into the 3D printer.
- ▶ Once the bread paste has been printed into the desired shape, complete checks using the ISDI Framework Testing Methods for Level 5.





Fork and spoon tests



Main Course

By

Livia Cretu

Tiffany Hui

Fionn Dwyer Hyland

Porsche McCourt Flynn

Ingredients and Recipe for 3D Printed Chicken

Ingredients

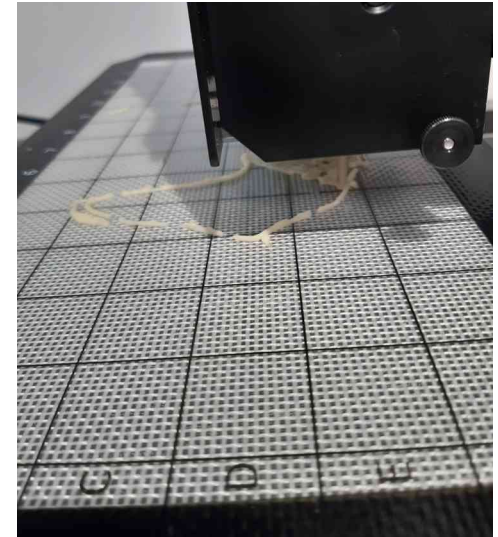
500g diced chicken
breast

500g cream

1 egg

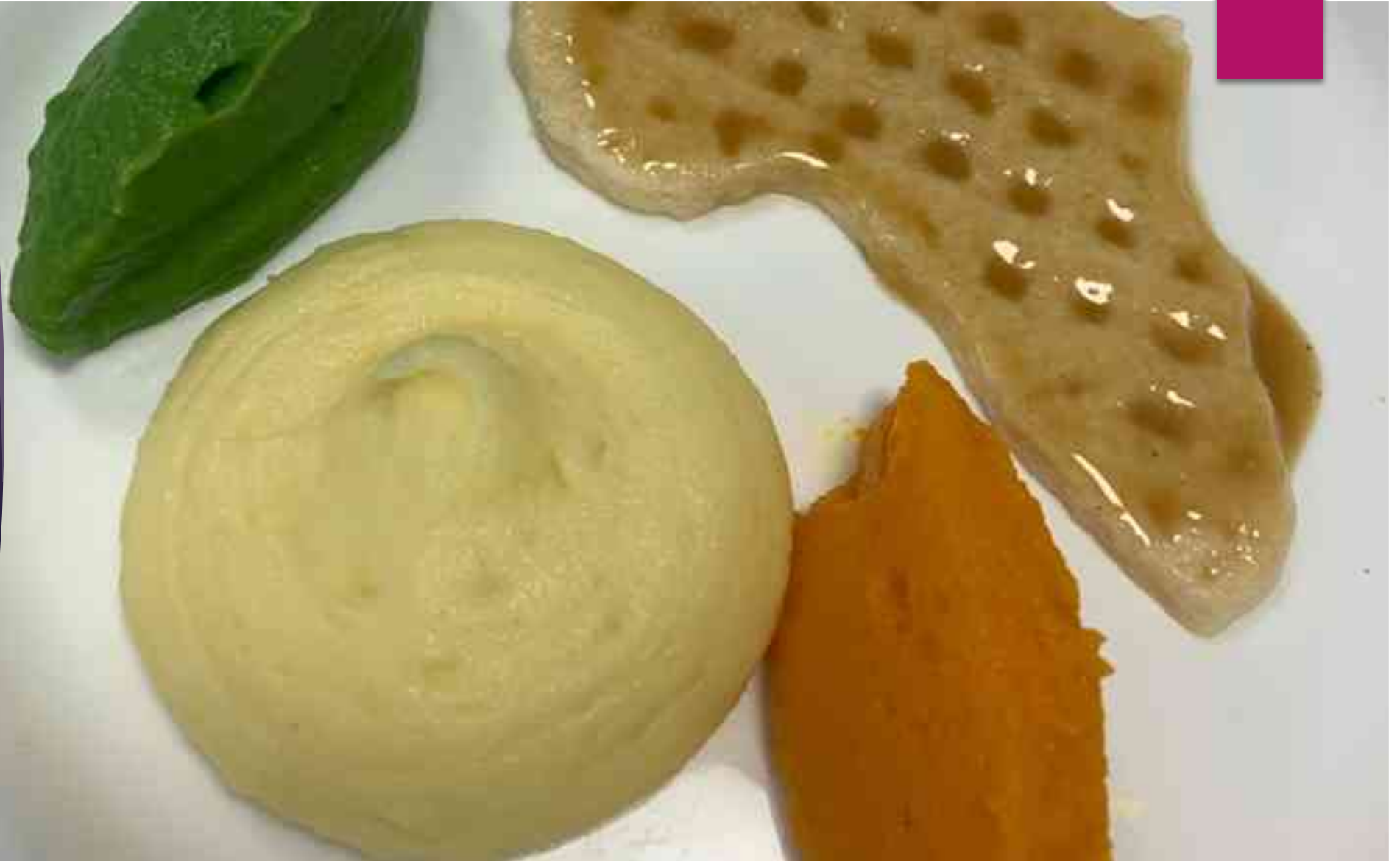
5g salt

Drawing the outline shape and filling it in by building up layers.





Fork and spoon tests



Dessert

by

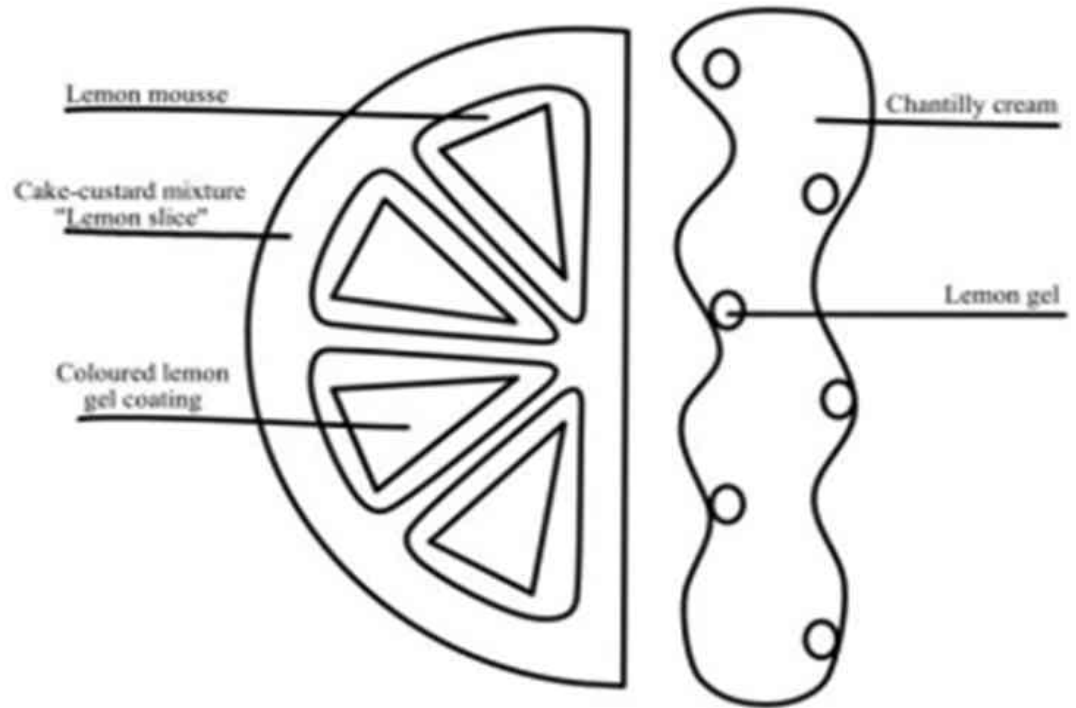
Emma Gibbs

Donagh McSweeney

Meghanaa Balasubramani

Peter Mphahlele

3D printed Vanilla sponge cake and crème pâtissier (custard) with lemon mousse, lemon gel and Chantilly cream



printer and structure of printed lemon slice

- ▶ **The desired 3D printed “lemon slice” shape was formed on the software Affinity Designer and converted into an ‘. STL’ format, which is suitable for 3D printing on Blender 3.0. The file was uploaded onto the Procusini Club interface and adjusted to the required dimensions of 4cm(L) x 2cm(W) x 1cm(H). The final structure was printed, under the marzipan setting, with a fine nozzle and without preheating. The printing process took approximately 45 minutes to complete the structure**

Printed component: Vanilla sponge

► Ingredients

The vanilla sponge was prepared from 110g Self-rising flour, 5g Baking Powder, 110g Unsalted butter, 110g Caster sugar, 130g whole eggs, 2g Vanilla extract.

► Recipe

Flour and baking powder was combined and sieved into a bowl. The remaining ingredients were incorporated into the flour with a stand mixer (Maxima Stand mixer 7L with paddle attachment). The cake batter was transferred into a parchment lined 18cm baking tin and baked for 30 minutes at 170 °C in a preheated fan oven. Once the cake was completely cooled, it was removed from the tin and crumbled by hand to form a fine crumb.

Printed component: Crème pâtissier (custard)

Ingredients

The was composed of 600ml Whole milk, 2g Vanilla extract, 68g Egg Yolk, 24g Powdered Xylitol, 9g cornflour.

Recipe

The milk was heated to a simmer, approximately 90 °C on medium-high heat and then removed from the stovetop. Egg yolks were whisked with xylitol, vanilla extract, and cornflour for 3-5 minutes or until pale in colour. The warm milk was gradually incorporated into the egg yolk mixture while whisking. The mixture was transferred into a saucepan and whisked over low heat until it reached 80 °C or thickened.

Final mixture for 3D printing

- ▶ The crème pâtissier and cake crumble were combined at a percentage of 65% custard to the quantity of cake. In this case, 200g cake was well combined with 130g custard until a semismooth paste was formed. The 3D printer cartridge was filled to 60mL with the cake mixture, ensuring no air bubbles were present. The “lemon slice” was printed on a silicone mat and then frozen in the blast chiller to enable it to be removed from the mat. It was then thawed in the refrigerator.

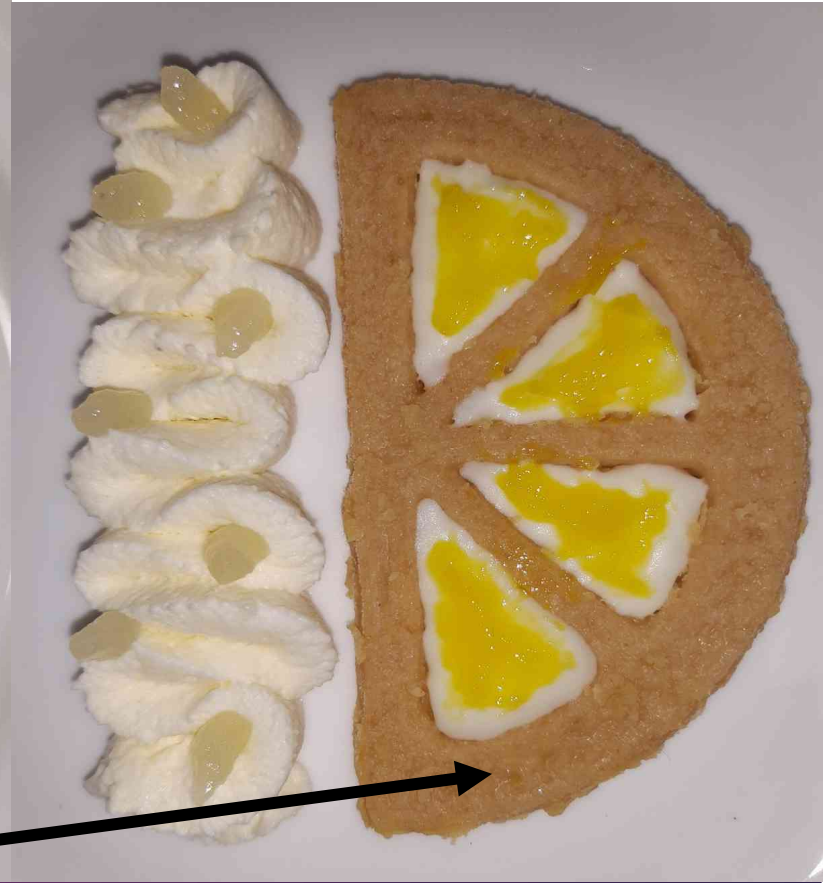
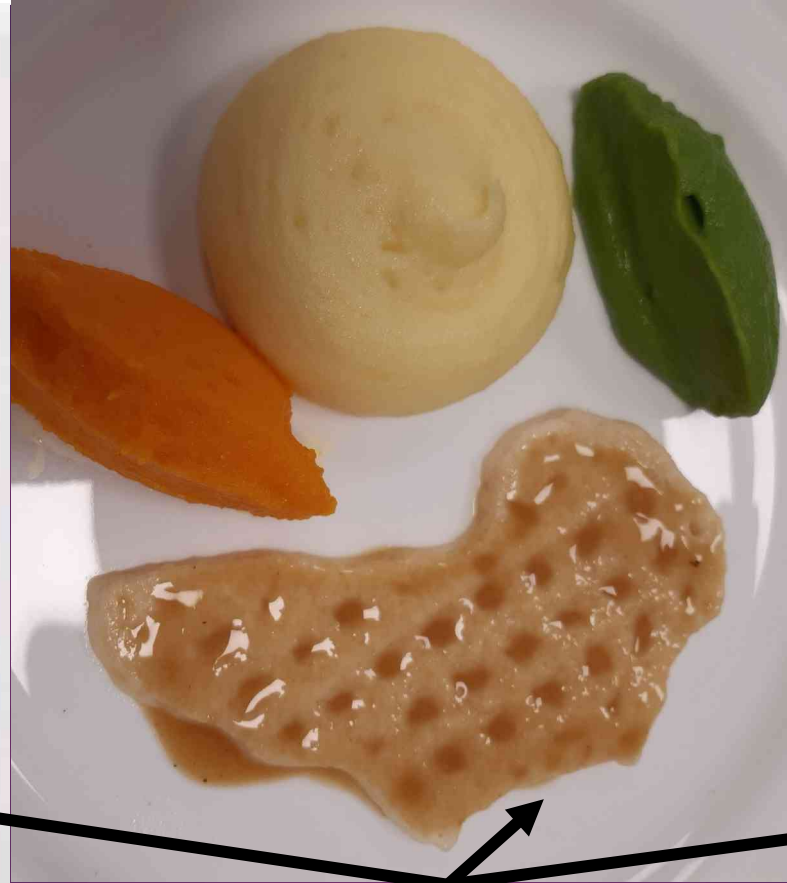


**3D printed Vanilla sponge cake and crème
pâtissier (custard) with lemon mousse,
lemon gel and Chantilly cream**



Fork and spoon tests





3D Printed food elements of the dishes

**3 course meal with 3D printed elements
at IDDSI level 5 texture and consistency**

Recent publications on 3D Food printing

- Burke R, Danaher P. 2022. **Developing a Customised Note by Note Prototype Recipe Which Can be 3D Printed**, International Journal of Molecular and Physical Gastronomy, 2022, 1, 1-9.
- Burke, R., Danaher, P. and Grazzia Peña Niebuhr, M. (2022) **Developing Tasty and Nutritious Sustainable Foods Using Note by Note Cooking and 3D Food Printing**. 36th EFFoST International Conference held in Dublin, 7 - 9 November.

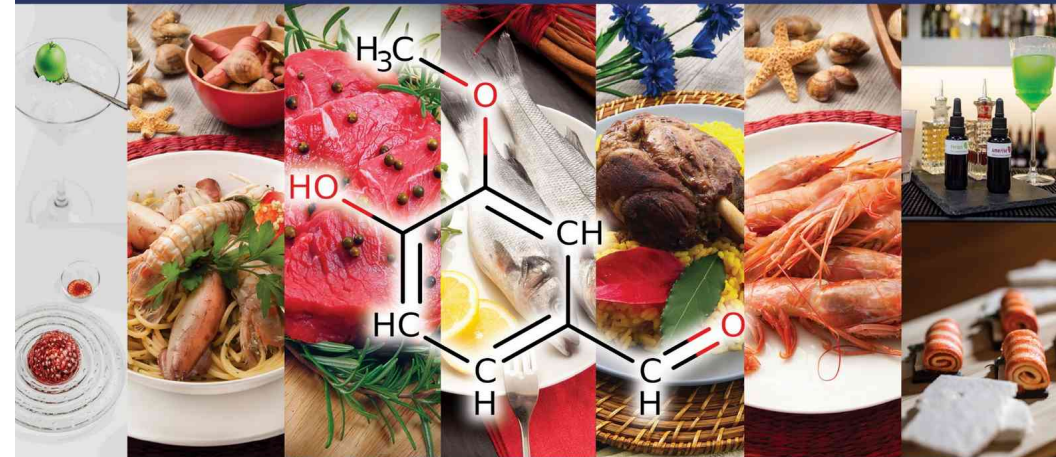
URL

https://www.researchgate.net/publication/366249705_Developing_Tasty_and_Nutritious_Sustainable_Foods_Using_Note_by_Note_Cooking_and_3D_Food_Printing

- Burke, R., Kelly, A., Lavelle, C. & This Vo. Kientza, H. (Eds) (2021). **Handbook of Molecular Gastronomy: Scientific, Educational Practices, and Culinary**

HANDBOOK OF MOLECULAR GASTRONOMY

Scientific Foundations, Educational Practices,
and Culinary Applications



edited by

**Róisín Burke • Alan Kelly • Christophe Lavelle
Hervé This vo Kientza**

Thank You

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