

Design and development of functional strained yoghurt with probiotic cultures encapsulated in prebiotic matrices



Christiana Tsirimiagkou^{1,2}, Vasiliki Giatrakou¹, Athina Geronikou^{1,2}, Katerina Velivasaki², Evangelia Krystalli¹, Evita Katsorida², Katerina Pissaridi^{1,2}

¹Hellenic Research & Innovation Center, 12131, Athens, Greece
²YIOTIS S.A., Nourishing Products Industry, 12131, Athens, Greece

INTRODUCTION

Probiotics have repeatedly been linked to gut health, but rising evidence highlights more biological actions especially for the immune system. The incorporation of probiotics in food products remains a challenge for the food industry, taking into consideration their short viability and their vulnerability to food processing. Encapsulation of probiotic cultures in prebiotic matrices tends to increase probiotics' stability, not only in the view of their durability through processing, but also regarding their viability through the intestinal tract. Thus, food products enriched with probiotic cultures encapsulated in appropriate matrices could be an innovative solution for functional food products development.

AIM

Design and development of functional dairy product with health-promoting probiotics in laboratory and pilot scale. Probiotics that will be used will be encapsulated in prebiotic matrices that maximize their stability and viability through processing and the intestinal tract transition.

METHODS

- ❑ Laboratory and semi-pilot trials were conducted to develop Greek strained yoghurt with probiotic cultures:
 - ❑ isolated from **Greek dairy products** or **infants' intestine** or **selected commercial strains**
 - ❑ in micro-encapsulated form or not
 - ❑ in different concentrations, each probiotic strain separately or in mixtures for the probiotic strains presenting the best biological action in breast or colon cancer cell lines.

Figure 1: Encapsulated probiotic strains of *Lactobacillus plantarum* ATHUBA 3001 isolated from Greek dairy products, in whey protein:inulin matrix, via freeze-drying method



- ❑ **Stability study of the developed yoghurts** for 15 days (4 °C) using the following criteria:
 - ❑ Maintenance of probiotic cells viability:
 - Total *Lactobacillus* Counts (including *L. bulgaricus*): target value = 7 log CFU/g. Method: MRS/ anaerobic/ incubation for 72h (37 °C)
 - *Lactobacillus plantarum* (Athuba 3001): target value = 7 log CFU/g. Method: MRS+ vancomycin/ anaerobic/ incubation for 72h (37 °C)
 - *Bifidobacterium lactis* (BLa80): Method: TOS-MUP agar /anaerobic / incubation for 72h (37 °C)
 - ❑ Accepted acidity (pH<4.5)
 - ❑ Accepted texture, odor, taste, appearance
 - ❑ Microbiological contamination flora <3 log CFU/g
- ❑ **Sensory evaluation:** taste, aftertaste, odor, appearance, taste intensity, aftertaste intensity, odor intensity, total.
- ❑ The sample that performed best regarding:
 - ❑ the stability test
 - ❑ the probiotic cultures' viability
 - ❑ the sensory evaluation
 was developed in pilot scale.

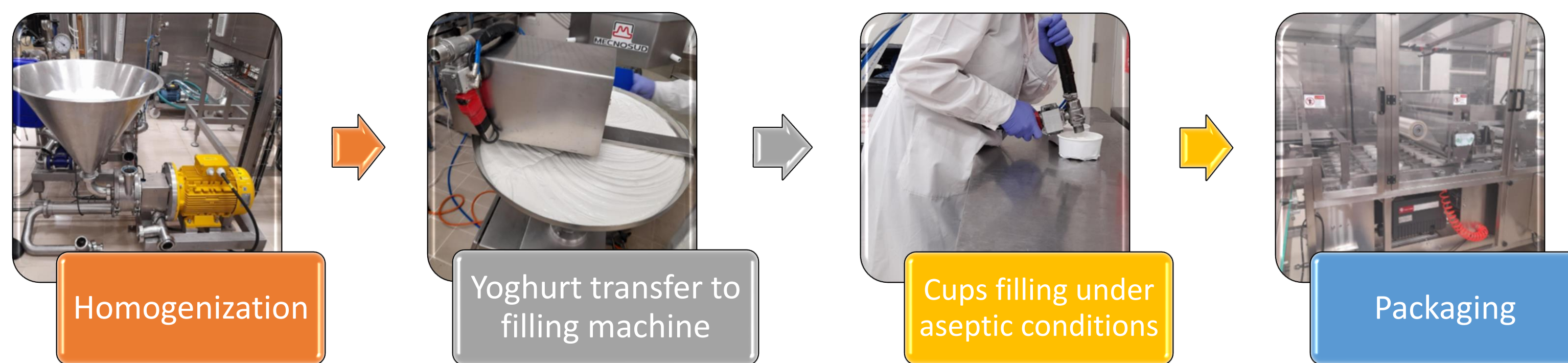


Figure 2: Indicative processing steps of yoghurt pilot scale production

CONCLUSIONS

Probiotic strains of *Bifidobacterium lactis* encapsulated in prebiotic matrices, could be innovative ingredients of new functional food products presenting acceptable viability during products' shelf life.

The new Greek strained yoghurt enriched with encapsulated probiotic cultures was rated as "accepted" in all sensory parameters.

Future *in vivo* and *in vitro* clinical trials should investigate possible biological actions of the new product.

RESULTS

Greek strained yoghurt samples enriched with probiotic cultures encapsulated in whey protein:inulin matrices were developed. These cultures derived from Greek dairy products, infants' intestine and selected commercial probiotic strains. Probiotic strains demonstrating the best biological action in breast and colon cancer cell lines were:

- *Lactobacillus plantarum* (ATHUBA 3001): isolated from Greek dairy products
- *Bifidobacterium lactis* (BLa80): commercial strain

The above-mentioned strains were studied separately and in mixtures as well. The sample that performed best regarding product's shelf-life and probiotics' viability was the commercial *Bifidobacterium lactis* (BLa80), which was finally selected for sensory evaluation and pilot-scale production.

Table: Microbial counts from the stability test expressed in log CFU/g

	Control (yoghurt culture)		<i>Lactobacillus plantarum</i> ATHUBA 3001		<i>Bifidobacterium lactis</i> BLa80		ATHUBA 3001-BLa80 70%-30%		ATHUBA 3001-BLa80 30%-70%	
	t=0	t=15	t=0	t=15	t=0	t=15	t=0	t=15	t=0	t=15
Temperature	4°C									
Day	t=0	t=15	t=0	t=15	t=0	t=15	t=0	t=15	t=0	t=15
Total <i>Lactobacillus</i> spp. including <i>L. bulgaricus</i>	8.48	7.87	8.48	7.58	3.48	7.80	3.48	8.28	8.48	8.78
<i>Lactobacillus plantarum</i> (ATHUBA 3001)	<2	<1	4.81	4.34	<2	<1	4.71	4.57	4.53	4.45
<i>Bifidobacterium lactis</i> (BLa80)	<1	<1	3.00	<1	3.15	7.18	7.45	6.30	7.40	6.43
Contamination flora (Y/M, enterococci)	<2	2.30	3.71	4.61	<2	2.30	4.65	3.90	4.23	3.98
pH	4.59	4.26	4.54	4.64	4.46	4.39	4.46	4.46	4.51	4.45

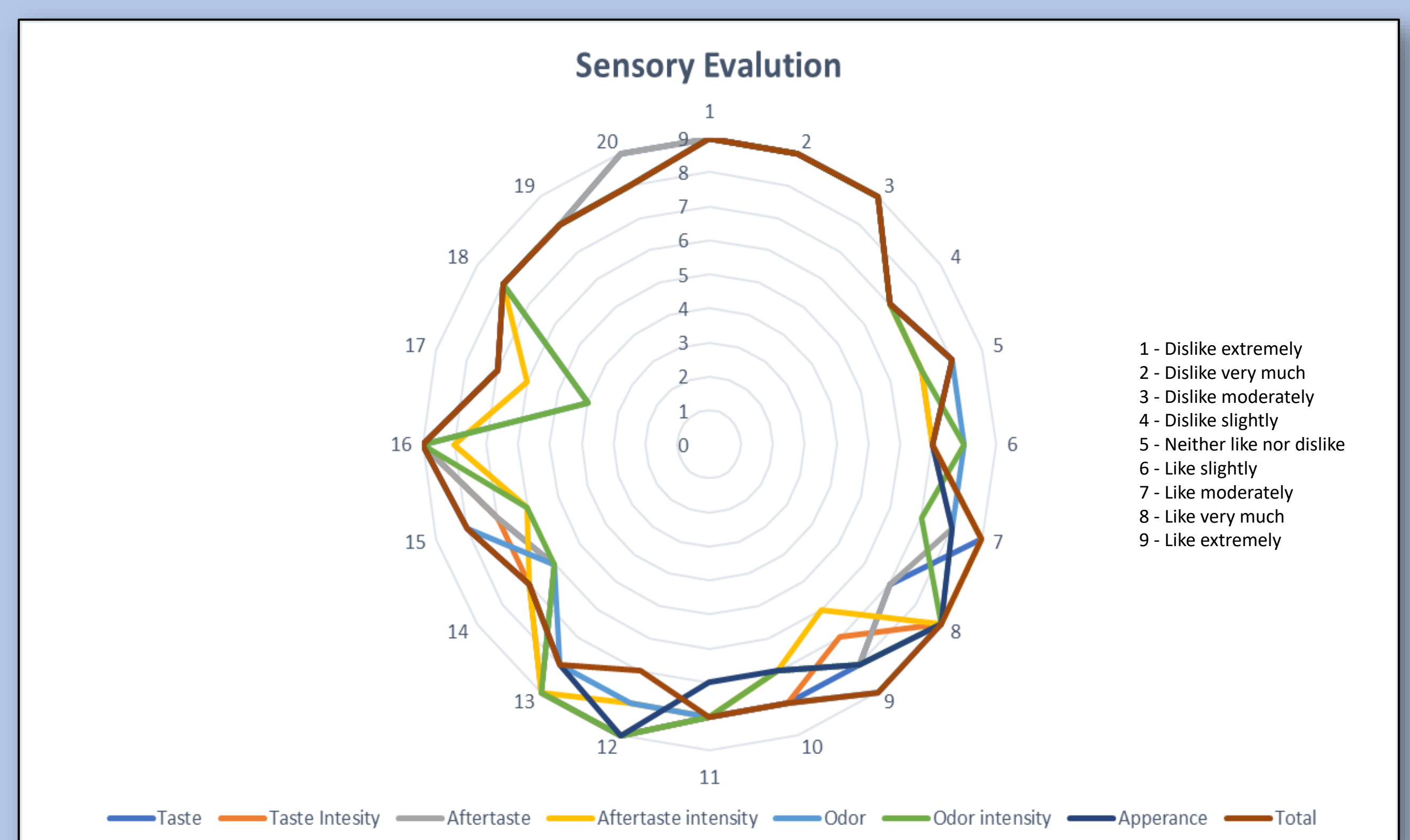


Figure 3: Sensory Evaluation results using 9-point hedonic scale