

# Salt and fat reduction in puff pastry



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***FINAL PLEASURE Conference on  
SALT - SUGAR & LIPIDS Reduction in  
Foods***

***5<sup>th</sup> December 2014  
Brussels, Belgium***





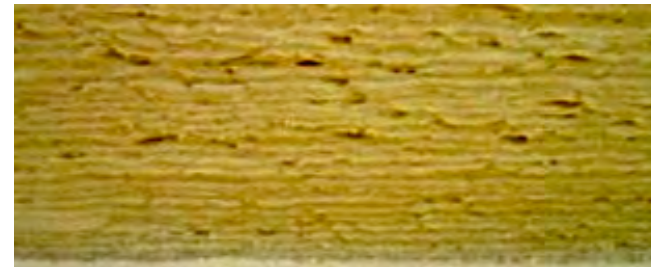
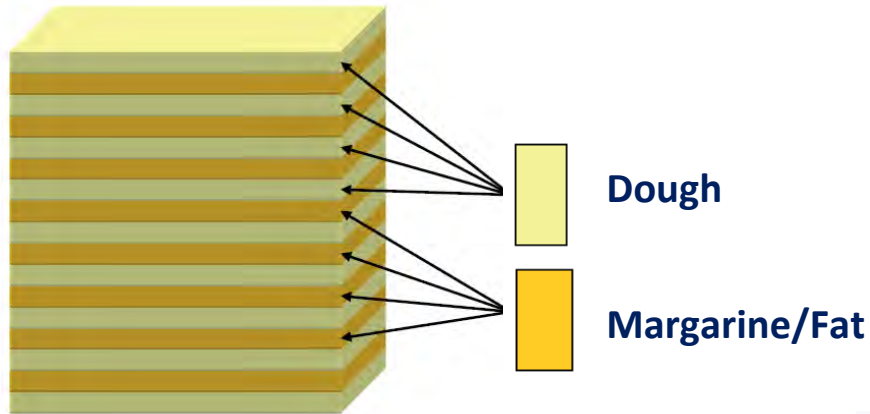
a light, flaky pastry made of a laminated dough containing several layers of fat

Croissant,  
Plunder

Sausage rolls, Pastete, Turnovers



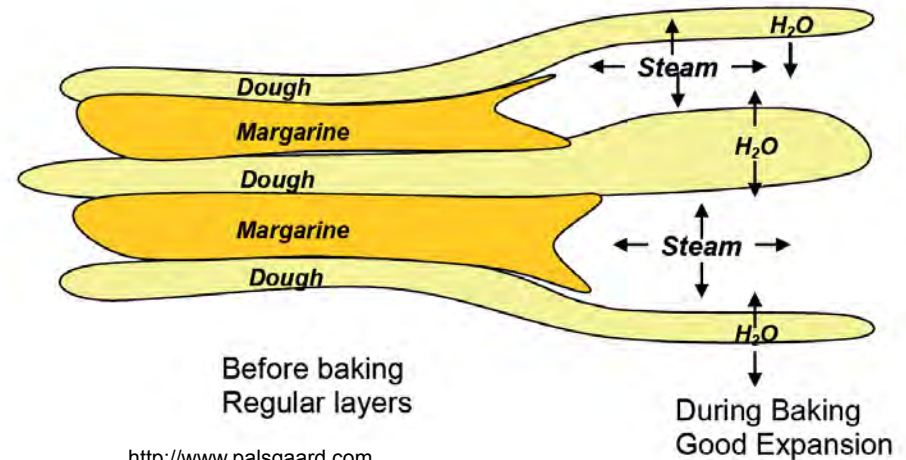
## Puff Pastry dough with layers of dough and margarine/fat



<http://www.palsgaard.com>  
Puff pastry margarine, Palsgaard Technical Paper, October 2011

- Plays key role in puff pastry
- Separation of dough layers during lamination process
- Important for mouthfeel, taste, structure of final product

## Puff Pastry dough during baking process



<http://www.palsgaard.com>  
Puff pastry margarine, Palsgaard Technical Paper, October 2011

## 2 ways of fat reduction

### Fat replacement

Partially or total

➤ Fat substitutes

e.g. "Olestra"

➤ Fat mimetics

e.g. inulin, carrageen, hydrocolloids based on CH

### Fat reduction



➤ Change only technological parameters :

**1. Number of layers**

**2. Final dough thickness**

**"Reduced in FAT"** (Regulation (EC) No. 1924/2006)

➤ **minus 30% fat** compared to similar product

➤ To comply with limit values fat level was reduced by up to 40%



# PLEASURE Salt in puff pastry

## Salt

- Important for dough structure (gluten strengthening)
- Acts as preservative (water activity)
- Overall flavour and salt perception

## Salt reduction

Regulation (EC) No. 1924/2006	Na (sodium) Na [g] x 2.54)	NaCl (Salt)	g salt/ 100 g product (x 0.8)*	salt [g] in 1500 g dough
normal salt content				20.38
<b>reduced in sodium/salt</b>	- 25% compared to similar product			15.25
	<b>≤ g/100g final product</b>		<b>max. g/100g final product</b>	
<b>low sodium/salt</b>	0.12	0.3048	0.244	5.43
<b>very low sodium/salt</b>	0.04	0.1016	0.081	1.80
<b>sodium-free/salt-free</b>	0.005	0.0127	0.010	0.22

\* 0.8 factor from uncooked to cooked PP dough (bake loss ~ 20%)

- Additionally: Investigation of **double** (1.8%) and **four times** (3.6%) the amount of salt

# PLEASURE Puff pastry production

## Basic recipe

Ingredients	weight [g]	%
Flour	970.2	43.3
<b>Salt</b>	<b>20.4</b>	<b>0.9</b>
Water	494.8	22.1
Lemon juice	14.6	0.7
<b>Dough total</b>	<b>1500</b>	<b>67.0</b>
<b>Roll-in fat</b>	<b>740</b>	<b>33.0</b>

Weigh in ingredients

Mix (5 min)

Rest (20 min RT)



Roll down to 2.50 mm

Folds: 2 double + 2 single turns, in between dough rest for 30 (90) min

Wrap fat into dough



Double turn = 4 fat layers



Single turn = 3 fat layers

Cut out samples 10 x 10 cm

Pastry rest over night at 4°C

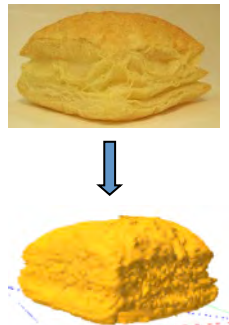
Bake at 210°C for 12 min





**VolScan**

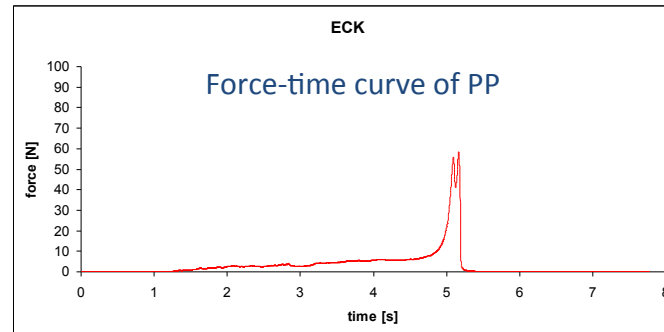
- Volume and the external structure of PP



**Texture Analyser (TA) attached with 2 different probes:**

**Extended Craft Knife (ECK) + Multiple Puncture Probe (MPP)**

- Firmness of PP



**C-Cell image analysis system**

- Internal structure of PP products  
(No. of cells, slice brightness)



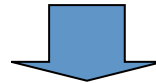
**Texture Analyser + Kieffer Rig**

- Resistance of dough



<http://128.121.92.221/media/Pictures-Used/kieffercropped.jpg>

54 puff pastry doughs with various fat contents, number of layers and final thicknesses



**Analysis**

**Properties**

**Sensory**

VolScan



Volume, lift



eyes

Texture Analyser



Texture, structure, „bite“



mouth, hands

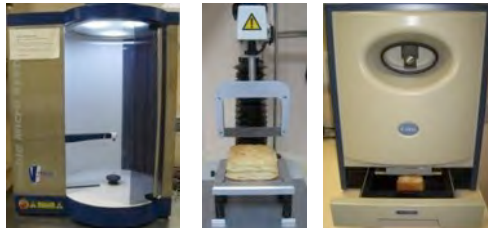
C-Cell



Internal structure



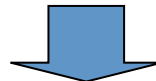
eyes, mouth



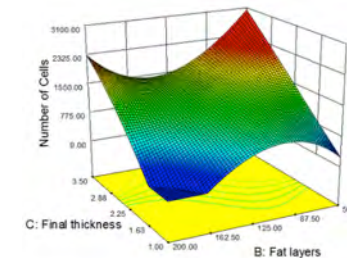
**Response Surface Methodology (RSM)**



**Threshold values/set scopes**



**Optimum parameters**





➤ Shelf life test: 4 weeks at 4°C and 5 weeks at -18°C

Test	Total bacterial count (TBC)	Lactic acid bacteria (LAB)	Yeasts
Agar	Plate count agar	MRS agar	Yeast agar
Additives	Cyclohexamide and Vitamins	Cyclohexamide	Chloramphenicol and Erythromycin
Technique	Spread plate	Spread plate	Spread plate
Incubation temperature	30°C	37°C	25°C
Incubation period	2 days	2 days	5 days
Incubation condition	Aerobic	Anaerobic	Aerobic



# Results

## FAT REDUCTION in Puff Pastry

**Optimum parameters for fat reduced (40%) puff pastry**

**Full fat PP (old) – Control**



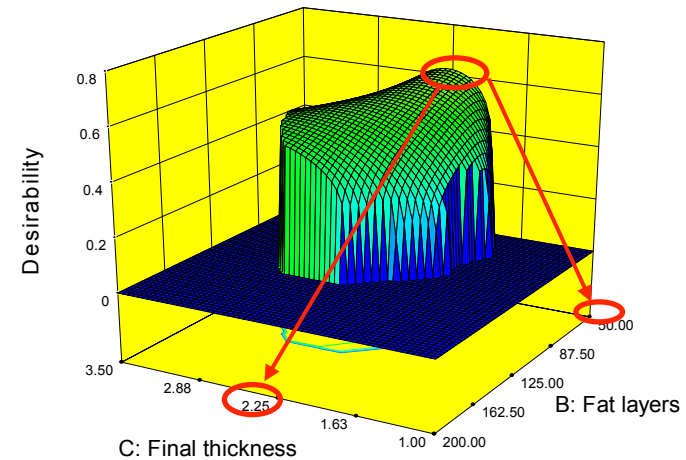
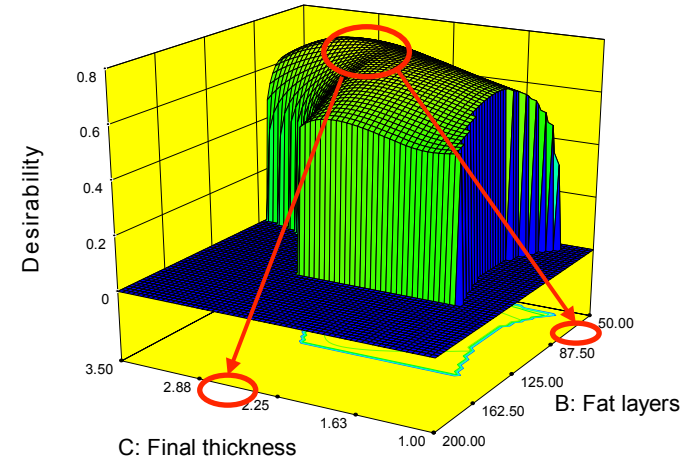
**Full fat PP (improved)**



**Fat reduced (40%) PP**

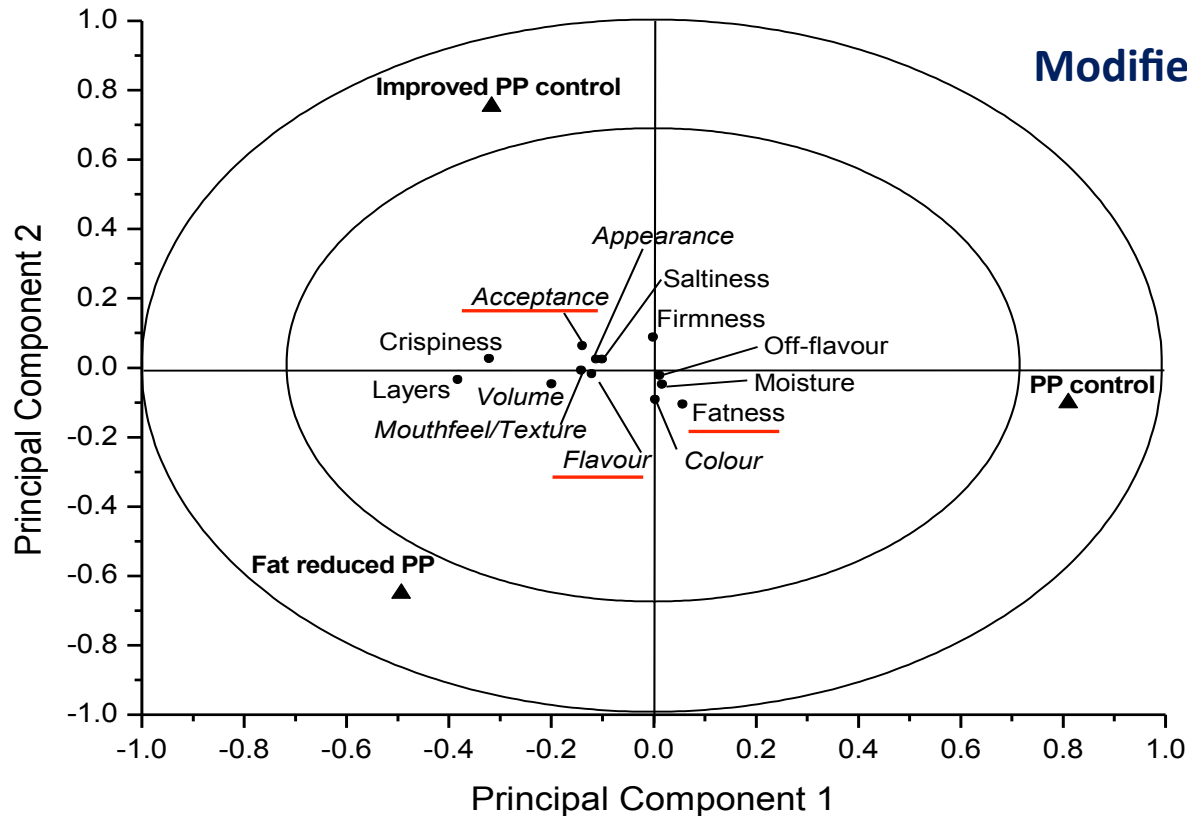


Desirability plots (RSM) → highest plateaus represent optimal parameters





# PLEASURE Sensory of fat reduced PP (n = 60) - Results



- Consumer accepted **improved PP control** and **fat reduced (40%) PP** (positively correlated)
- **No significant correlations to fatness**
- **Fat reduction of PP by 40% was successful!**



ANOVA-partial least squares regression (APLSR) correlation loadings plot for puff pastry (PP) samples.  
 ▲ = samples, ◆ = sensory attributes (cursive style: hedonic attributes, not cursive: intensity attributes)

Sample	PP control	Improved PP control	Fat reduced PP
Liking of Flavour	-0.0195 *	0.1247 ns	0.0292 *
Overall Acceptability	-0.0103 **	0.1246 ns	0.0128 *
Fatness	0.4047 ns	-0.4934 ns	-0.3588 ns

# Results

## SALT REDUCTION in Puff Pastry



# PLEASURE Salt reduction (Dough) - Kieffer extensibility rig

## Force [N]

Higher force → dough is more resistant

## Distance to rupture [mm]

Lower extensibility → dough can be stretched less

- **No significant differences** in force and distance for **all salt reduced** doughs (40, 60 min)
- **Higher salt content** showed **significant higher resistance to rupture** (all rest periods)
- **No technical limitations for salt reduced doughs**





## Salt reduction in full fat PP (compared to control)

- **No significant differences** in **total firmness** and **specific volume** (salt red. PP)
- “**No salt**” PP showed **decrease in volume** and **increased firmness**
- **Lift decreased** and **firmness increased** with increasing salt level (**2x** and **4x salt**)



PP full fat, 30% salt reduced

## Salt reduction in fat reduced (40%) PP (compared to control)

- **Salt reduction** (30%) is possible without significantly affecting **total firmness**
- But: **lower specific volume** and **lower maximum lift**
  
- “**No salt**” and “**very low salt**” PP (full fat/fat red.) are **poor in taste**



PP 40% fat reduced, 30% salt reduced



- **No significant differences for all attributes**
- **No significant recognition of reduced salt content**
- Consumer → **no significantly higher salt perception** for PP with salt located in roll-in fat
- **Positive correlation to overall acceptability** for salt reduced doughs
- **Salt reduction by 30% in fat red. PP was successful**



## PLEASURE Microbiological analysis - Results

- **pH** → Slight acidity by addition of citric acid from lemon juice
- **Water activity (aw): high** → Products tend to be highly perishable
- Dough with added **alcohol** → **significantly reduced bacterial numbers** each week
- Frozen dough complied the required alarm values → in the range of week 0
- Very few **Lactic acid bacteria (LAB)** were detected occasionally
- **Yeast** levels indicator for good manufacturing practises
- Alcohol addition adequately reduced yeast growth

- **Successful fat reduction** in model PP by **40%**
- Sensory study showed high acceptance towards **fat reduced PP**
- **Salt reduction (30%)** in PP is possible without major deviations to control
- **Salt and fat reduced PP** were overall accepted by consumer panel
- Puff pastry dough is a **highly perishable** product
- Salt reduction has low impact on microbiologically shelf life
- **Ethanol** and **freezing** are effective methods for **extending the shelf life**
- **Bacteria may adversely affect** the **physicochemical properties** of the puff pastry



# Thanks to ...

**University College Cork**  
Prof Elke Arendt  
Christoph Silow  
Inken Rethwisch  
Jamie O'Connor  
Susann Fellendorf



## Funding

This work was funded by the PLeASURe Project of the European Union.

# and you!



**UCC**

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University College Cork, Ireland



**PLEASURE**

*novel processing approaches for the development  
of food products low in fat, salt and sugar reduced*



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1 December 2014

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