FROZEN AND CHILLED

READY-MEALS (RMs)

~ AN OVERVIEW ~

Ronan Gormley
The National Food Centre
Dunsinea, Castleknock
Dublin, Ireland

Tel: +353-1-805 9500
Fax: +353-1-805 9550
E-mail: r.gormley@nfc.teagasc.ie
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APPROACH

- Market
- PPP and TTT factors
- R&D at the NFC
- Conclusions

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MARKET (MEuro) for RM

<table>
<thead>
<tr>
<th></th>
<th>Frozen</th>
<th>Chilled</th>
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<tbody>
<tr>
<td>UK</td>
<td>890</td>
<td>830</td>
</tr>
<tr>
<td>FR</td>
<td>380</td>
<td>380</td>
</tr>
<tr>
<td>DE</td>
<td>260</td>
<td>64</td>
</tr>
</tbody>
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UK MARKET for RM

- Growth/annum: frozen (10%); chilled (15%)
- One retailer controls 50% of chilled
- 50% of frozen is private label
- 80% of chilled is private label
- Retailer ‘pull’ a huge factor

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FR and DE MARKETS for RM

- FR
  - 10% is private label

- DE
  - Mostly owned by a frozen home delivery company
DYNAMIC GROWTH OF RMs IS DUE TO LIFESTYLE CHANGES

- RMs are foods to fit lifestyles
- Working couples ↑
- Convenience requirements ↑

PPP and TTT

<table>
<thead>
<tr>
<th>Product</th>
<th>Process</th>
<th>Package</th>
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<tbody>
<tr>
<td></td>
<td>➔ Influence shelf-life safety and quality</td>
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<td></td>
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<tr>
<td>Time</td>
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<tr>
<td></td>
<td>➔ Influence shelf-life and safety</td>
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<tr>
<td>Temperature</td>
<td></td>
<td></td>
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<tr>
<td>Tolerance</td>
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RMs REQUIRE HIGH QUALITY INGREDIENTS

<table>
<thead>
<tr>
<th>Protein + Carbohydrate + Vegetable + Sauce</th>
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<tbody>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Beef</td>
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<tr>
<td>Pork</td>
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<tr>
<td>Chicken</td>
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<tr>
<td>Fish</td>
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</tbody>
</table>
MEAL ASSEMBLY (automated)

- Protein: cook, freeze (IQF)/chill
- Vegetables: cook; freeze (IQF)/chill
  - deliver frozen/chilled to trays
- Sauce: cook; blast-chill
- Carbohydrate: cook; blast-chill
  - deliver chilled to trays

PROCESS

- Frozen
  - Compact plate freezer for regularly shaped trays
  - In-line spiral blast freezer for high volume applications (-18°C in 1.5h)
  - Cryogenics (LN) for low volumes

- Blast chilling

- Freeze-chilling

- Heat treatment (ambient stable)

TIME-TEMPERATURE-TOLERANCE

<table>
<thead>
<tr>
<th>Frozen RMs</th>
<th>Chilled RMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>in-factory (3w±2d to 6w)</td>
<td>shelf life (6d)</td>
</tr>
<tr>
<td>in-depot (10d)</td>
<td>range produced daily</td>
</tr>
<tr>
<td>in-store (7d)</td>
<td>logistics challenge</td>
</tr>
<tr>
<td>shelf-life &gt; 1y</td>
<td>very vulnerable</td>
</tr>
</tbody>
</table>
PACKAGE

- Microwavable; ovenable; boilable
- PET for trays
- PE - nylon for B in B
- New films (with rubberizer) retain their functionality (-40°C to -200°C)

SAFETY

- RMs follow the 'normal' rules for frozen and chilled foods

FREEZE-CHILLING OF RM COMPONENTS (NFC)

Freeze-chilling involves:
- freezing and frozen storage
- thawing and chilled storage

CHILLED FOODS are for the perfectionist!
FREEZE-CHILLING:

- streamlines production
- improves logistics/flexibility
- enables 'chilled' products to reach more distant markets
- labelling and use-by date issues must be addressed

EFFECT OF FREEZE-CHILLING

Four comparisons:
- Freeze-chill 7 days at -28°C
  5 days at 4°C
- Freeze 7 days at -23°C
- Chill 5 days at 4°C
- Prepare and test as fresh

Products under test:
- Mashed potato
- Salmon
- Broccoli
- Ready meals
CONCLUSIONS

- RMs are 'lifestyle' foods
- RMs are showing dynamic growth
- PPP and TTT factors apply
- The 'rules' of frozen/chilled foods apply
- Quality is very good
- A competitive sector