Life Cycle Energy and Climate Change Impact of Ready-Made Baby Food

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Outline

- Context
- Methodology
- Results
- Conclusions
UK baby food: A growing industry

- Highly processed ready-to-eat food
- Worth £656 million in 2014 with a growth of 29% since 2009

**Market share**

- Ready Made Meals: 83%
- Baby Snacks: 15%
- Baby Juices: 2%

UK Baby Food Market (Base: 513 products online)
Knowledge gap

- Only one study on energy consumption in baby food processing\(^2\).
- Market diversity: process design, packaging, ingredients.

**Ingredients**
- Beef: 11%
- Chicken: 8%
- Rice: 8%
- Oat: 11%
- Wheat: 21%
- Vegetables: 11%
- Fruits: 8%
- Milk: 8%
- Other: 17%

**Packaging**
- Box: 34%
- Jar: 30%
- Can: 14%
- Multiple: 2%
- Tray Meals: 8%
- Pot: 8%
- Pouch: 1%
- Multipack: 0%
Life cycle assessment of baby food

- Map out energy and material flows
- Assess environmental impacts
- Identify improvement opportunities
Goal and scope of study

- To assess life cycle energy consumption and climate change impact of ready-made baby foods
  - **Breakfast:** dry and wet porridge
  - **Lunch:** spaghetti Bolognese and vegetable lasagne
  - **Dinner:** apple, pear & banana; strawberry yoghurt

- Scope: from ‘cradle to grave’
  - Functional unit (unit of analysis): A meal consumed at home (125 g)
Breakfast: Porridge ingredients

Dry porridge:
- Water: 40%
- Sugar: 30%
- Milk powder: 20%
- Rice flour: 10%

Wet porridge:
- Water: 40%
- Sugar: 30%
- Milk powder: 20%
- Rice flour: 10%
- Full milk: 10%
- Oat flakes: 5%
- Barley: 5%
Lunch and dinner ingredients

- Spaghetti bolognese:
  - Barley: 17%
  - Dry Pasta production: 9%
  - Onion: 14%
  - Cheese: 27%
  - Sugar: 14%
  - Pear: 18%

- Veg lasagne:
  - Oat flakes: 17%
  - Carrot: 22%
  - Beef: 20%
  - Yoghurt: 19%

- Apple pear banana:
  - Rice flour: 38%
  - Tomato: 20%
  - Full milk: 42%

- Strawberry, yoghurt:
  - Corn flour: 30%
  - Zucchini: 22%
  - Milk powder: 10%
  - Palm oil: 37%
System boundaries

**Dry baby food**

Raw Materials → Extraction → Processing → Packaging → Waste

Milling → Dry mixing → Wet mixing → Cooking → Drum Drying

Retail → Waste

End of Life (EoL)

**Wet baby food**

Raw Materials → Extraction → Processing → Packaging → Waste

Milling → Mixing → Blend → Cooking

Sterilization → Packaging

Retail → Waste

End of Life (EoL)
Data sources

- Primary data
  - Market research
  - Modelling of manufacturing process

- Secondary data, adapted to UK conditions from:
  - Ecoinvent database
  - LCA studies
  - Government reports
Results: Porridge

Dry porridge
ADP fossil (kJ x 10)
102

Wet porridge
449

Dry porridge
GWP (g CO2 eq.)
142

Wet porridge
399

Graph showing the breakdown of ADP fossil and GWP for dry and wet porridge.
Sensitivity analysis: Porridge packaging

- Wet porridge, jar: ADP fossil (kJ x 10) = 449
- Wet porridge, pouch: GWP (g CO₂ eq.) = 501
- Wet porridge, jar: ADP fossil (kJ x 10) = 399
- Wet porridge, pouch: GWP (g CO₂ eq.) = 363

Legend:
- Yellow: Transport
- Orange: Manufacturing
- Green: Packaging
- Blue: Raw materials
- Brown: Retail
- Purple: Use
- Gray: EOL

Raw materials
Manufacturing
Retail
Use
EOL
Transport
GWP (g CO₂ eq.)
ADP fossil (kJ x 10)
Results: Lunch and dinner

- Spaghetti bolognese: 787 (Raw materials 420, Manufacturing 187, Use 80, Packaging 30, EOL 20)
- Veg lasagne: 614 (Raw materials 290, Manufacturing 150, Use 80, Packaging 20, EOL 20)
- Apple pear banana: 455 (Raw materials 275, Manufacturing 110, Use 70, Packaging 0, EOL 20)
- Strawberry, yoghurt greek: 456 (Raw materials 276, Manufacturing 110, Use 70, Packaging 0, EOL 20)
- Veg lasagne: 712 (Raw materials 330, Manufacturing 210, Use 180, Packaging 30, EOL 20)
- Apple, pear, banana: 489 (Raw materials 279, Manufacturing 150, Use 70, Packaging 30, EOL 10)
- Strawberry, yoghurt greek: 379 (Raw materials 209, Manufacturing 130, Use 40, Packaging 30, EOL 0)
Impacts of raw materials

Barley
Corn flour
Tomato
Beef
Cheese
Palm oil
Banana
Oat flakes
Dry Pasta production
Zucchini
Full milk
Yoghurt
Sugar
Strawberry
Rice flour
Carrot
Onion
Milk powder
Rapessed oil
Apple
Pear

Dry Porridge
Wet porridge
Spaghetti bolognese
Veg lasagne
Apple Pear Banana
Strawberry, yoghurt greek style
Dry Porridge
Wet porridge
Spaghetti bolognese
Veg lasagne
Apple Pear Banana
Strawberry, yoghurt greek style

ADP fossil (kJ x 10)
GWP (g CO2 eq.)
Conclusions

Porridge
- Wet porridge 3-4 times higher impacts than the dry option
- Hotspots: raw materials for dry (milk); manufacturing and packaging (wet)

Lunch
- Spaghetti ~2 times higher impacts than vegetable lasagne
- Hotspots: raw materials (tomato and beef) and manufacturing

Dinner
- Similar impacts
- Hotspots: manufacturing and packaging
Acknowledgements

• This work is funded by the UK Research Council as part of the UK Centre for Sustainable Energy Use in Food Chains (CSEF)

• Data for porridge processing provided by Birmingham University

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