Easy Opening and Legible Packaging: Senior’s Preferences and Limitations

Susanna Wenk, Christine Brombach, Gràcia Artigas, Eila Järvenpää, Nina Steinemann,
Katrin Ziesemer, Selçuk Yildirim

Institute of Food and Beverage Innovation
Zurich University of Applied Sciences
Wädenswil
Consumers’ Expectations

• Packaging is designed to be **functional** and to satisfy **specific needs** of the consumers in every respect

• Needs and consumer behavior change during the course of life

• Growing number of elderly adults over 65 years in European Member States population → shifts in consumer demand

(BAGSO, 2003)
Consumers’ Demands

• Important for food retailers and producers to
  - meet the needs of a growing market segment
  - understanding consumers’ preferences and choices

• Consumers’ choice of food and their purchase decisions are determined by
  - perceived functionality
  - openability
  - legibility
  - manageability of food packages

• 81% of elderly people questioned were
  - only partly satisfied or even
  - completely dissatisfied with commonly-used packaging

(BAGSO, 2003; IUFoST, 2014; Makely, 2002; Pro Carton, 2006)
Physical Transformations during Ageing

- Changes in functionality and physical strength occur during ageing
  - decrease in muscle strength and muscle mass
  - loss of strength and dexterity
  - restricted motility of the joints
  - pain-sensitive skin
  - difficulties when applying pressure with the hands
  - functional restrictions of the tactility
  - impaired visual capacity
  - changing cognitive aspects

(Marks et al., 2012; Meyer-Hentschel, 2006; Weineck, 2004)
Opening of Packaging

- Physical transformations create challenges and hurdles for elderly consumers

- Opening food packaging systems requires
  - Reading
  - Handling
  - gripping and pulling

⇒ many of the seniors have impaired opening capacity

- Packaging systems like jars or peelable trays, which require a coordinated two-handed process were often found to be particularly challenging

- Physical limitations may also lead to injuries when opening, reclosing, emptying or disposing of food packaging

(Heiniö et al., 2008; Marks et al., 2012)
Easy Opening

- Easy opening of packaging is an increasing demand among elderly people

- Packaging is regarded as easy to open if the large majority of testers can open it efficiently and effectively and are satisfied with the process (BSI, 2014)
Aim

Seniors over 65 years of age

- Manageability of food packaging systems
- Difficulties in the handling, legibility and openability of different food packaging

Selection of Packaging

Subjective evaluation:
Qualitative focus group discussions with seniors

Objective evaluation:
Quantitative measurements of the opening force

Propose recommendations for improvements in food packaging systems
Selection of Packaging

• Ten common food packaging systems with different opening mechanisms were selected

  - 4 packaging systems with torque closure

  - 2 pouches

  - 3 peelable packages with tab

  - 1 can
Focus Group Studies – Participants

• Two focus group sessions in the three countries Finland, Spain and Switzerland
  → a total of 62 participants

• Elderly people were recruited based on physical characteristics:

  - **Active elderly**
    · persons over 65 years old
    · living independently without any private health assistance
    · not using a meal service
    → certain amount of ability and self-care

  - **Unfit or frail elderly**
    · persons over 65 years of age
    · living independently but in need of a daily meal service
    · or alternatively living in residential care homes or retirement homes
    → some activities of daily living are impaired due to functional decline during aging
Hand Force Measurements of the Participants (1)

• Hand force of the participants was quantified
  - Sensor handle (Pablo® System, Tyromotion)
  - Measurements in duplicates for both categories of elderly people
  - Standard testing position: sitting with the arm bent at a 90° angle

• Measurement of the hand force with three types of grips
  - cylindrical grip
  - pinch grip
  - lateral pinch

Testing of the cylindrical grip
Hand Force Measurements of the Participants (2)

- Cylindrical grip allowed higher strength than the pinch grip or the lateral pinch
- Slight tendency that frail elderly possessed lower hand forces than active elderly
- Substantial ranges
  - A difference of 278.2 N was present between the highest and lowest value of the cylindrical grip in active elderly
  - has to be considered in the development of senior-focused packaging

<table>
<thead>
<tr>
<th>Category</th>
<th>Cylindrical Grip</th>
<th>Pinch Grip</th>
<th>Lateral Pinch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active elderly</td>
<td>229.2</td>
<td>106.0 - 384.2</td>
<td>69.7</td>
</tr>
<tr>
<td>(n=10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frail elderly</td>
<td>152.9</td>
<td>63.7 - 264.3</td>
<td>43.7</td>
</tr>
<tr>
<td>(n=8)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Focus Group Studies – Discussion Topics with the Participants

• Focus group sessions in all three countries were conducted accordingly
  - moderated by a researcher
  - a protocol was written during the session
  - videos of participants handling food packages recorded

• Discussion of different topics
  - General difficulties with food packaging
  - Legibility of text and pictogram on packaging
  - Identification and understanding of the opening mechanism

• Observations
  - Identification and understanding of the opening mechanism
  - Ability to physically open and use the packaging

Check for legibility
General Difficulties with Food Packaging

• No country-specific differences between the elderly people from Finland, Spain and Switzerland

• Similar problems, needs and expectations were expressed by all elderly people

• Most frequently mentioned general difficulties with food packaging:
  - poor gripping options on the packaging
  - slippery packaging material
  - ripping of the packaging film
  - too great exertion of force needed
  - necessity of tools
  - risk of injuries
Legibility of Text and Pictogram on Packaging

• The ability to read written text on packaging was very individual and dependent on the visual faculty of the participants.

• Often a difference was recognizable between the active elderly and the frail elderly.

• Font size
  X difficulties from a font size of the lower case letters of 1.5 mm or less
  ✔ Pictograms are much easier to see

• Reflecting packaging material
  X written text more difficult to read on shiny packaging material
  ✔ Matt material such as the paper label on the jars

• Color contrast
  ✔ Dark colors on a white background
  X White or light colors on a dark background as well as light colors on a light background
Opening of Packaging Systems with Torque Closure

- Differences between the two categories of elderly people, as well as for the different torque closures

- PET bottle with a screw cap
  - poor grip possibilities
  - strength needed
  - rather difficult to open

- PET bottle with a larger screw cap
  - larger cap
  - grooved rim
  - more easily grabbed and turned compared to a standard model
  - additional peelable foil underneath the cap as first opening guarantee reduces the necessity of strong tightening

- Jar with twist-off lid
  - packaging type was popular
  - bigger diameter of the twist-off lid of the jar → poor handling and increased torque
  - many of the elderly were not able to open the jar

- Stand-up pouch with twist-off cap
  - small cap size
  - difficult to grip
  - in particular frail elderly could only open the closure with effort
Opening of Pouches

- Pouches
  - used for the most various foods
  - principally a familiar packaging system
  - varying forms

Metallized pouch with sealed seam at the upper edge

- inexperienced with the opening principle
- difficult and unpredictable opening procedure
- high initial force
- sudden rip of the sealed seam
  → risk of spilling the contents

Stand-up pouch with a small indentation on each side

- opening with an easy grip
- rather low force
- user-friendly and pleasurable
Opening of Thermoformed Trays and Containers

- Thermoformed trays
  - Mainly used for sliced cheese, meat products or pre-prepared meals
  - Very popular
- Containers
  - Used for various food types
  - Very popular and regularly used

Thermoformed tray
- difficulties in recognizing the opening tab
- small tab, difficulties in gripping
- difficult to detach from the tray

Thermoformed tray “Easy to Open”
- Opening mechanism was easily recognised
- enlarged tab and peel corner
- could be easily gripped
→ appreciated and favored over the standard tray

Container with aluminium foil lid
- regularly used by all participants
- good grip during tearing (aluminium)
- opened relatively well by everybody
Opening of Cans

• Cans
  - well-known packaging system in every country
  - concept of the ring-pull opening mechanism was clear for everybody
  - strongly associated with negative experiences

Ring-pull can

• very individual handling of the opening mechanisms
• difficulties in opening the packaging
Measurement of the Opening Forces of Packaging Systems with Torque Closure

- Quantitative measurements of the force needed to open the packaging types with torque closures
  - manually-operated digital torque tester (Tornado, Mecmesin)
  - rotation of 15 rpm

Video Bottles
Opening Force Progression of Packaging Systems with Torque Closure

- Different opening force progressions depending on the type of closure and its diameter

Example: Opening force progression of PET bottles with a larger screw cap diameter of 40 mm

1. Starting torque
2. Detachment of the cap
## Opening Forces of Packaging Systems with Torque Closure

<table>
<thead>
<tr>
<th>Packaging type</th>
<th>Opening force (Nm)</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard PET bottle with screw cap (30 mm)</td>
<td>1.54 ± 0.19</td>
<td>✔</td>
</tr>
<tr>
<td>PET bottle with a larger screw cap (40 mm)</td>
<td>0.58 ± 0.10</td>
<td>✔✔</td>
</tr>
<tr>
<td>Jar with twist-off lid (85 mm)</td>
<td>6.08 ± 0.51</td>
<td>XX</td>
</tr>
<tr>
<td>Stand-up pouch with twist-off cap (14 mm)</td>
<td>0.46 ± 0.06</td>
<td>X</td>
</tr>
</tbody>
</table>

- Packaging systems with torque closure
  - generally regarded as being challenging
    - elderly consumers might not be successful in opening the packaging just because they are unable to exert sufficient force
- Ability to open a torque closure is influenced by
  - diameter of the closure
  - coefficient of friction between the hand and the closure
Measurement of the Opening Forces of Peelable Packaging

- Quantitative measurements of the force needed to open the peelable packaging
- material testing machine („Zwicki-Line 500 N“, Zwick GmbH & Co. KG)
- testing speed of 600 mm/min and a tear angle of 135° conforming to DIN standard
- measurement of peel initiation force, average peeling force and ultimate peel force
Opening Force Progression of Pouches

• The opening force progression of the two examined pouches differed considerably

Example: Opening force progression of stand-up pouches with a small indentation on each side

1 Peel initiation force
## Opening Forces of Pouches

<table>
<thead>
<tr>
<th>Packaging type</th>
<th>Opening force</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-up pouch with a small indentation on each side</td>
<td>8.69 ± 2.15 N</td>
<td>✔✔</td>
</tr>
<tr>
<td>Metallized pouch with sealed seam at the upper edge</td>
<td>20.94 ± 2.32 N</td>
<td>X</td>
</tr>
</tbody>
</table>

- Pouches
  - showed significantly different opening forces
    → metallized pouch with sealed seam showed 2.4 times higher initial force than the stand-up pouch
  - dependent on the opening mechanism
  - assessment accordingly to the opening force
Opening Force Progression of Thermoformed Trays and Containers

- The opening force progression of the different peelable packaging varied widely

Example: Opening force progression of thermoformed trays «easy to open»

1 Peel initiation force
2 and 3 Increase of the opening force at the corners of the packaging
4 Tearing-off force, which in this case equals the ultimate peel force
## Opening Forces of Thermoformed Trays and Containers

<table>
<thead>
<tr>
<th>Packaging type</th>
<th>Opening force Peel initiation force</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoformed tray</td>
<td>12.69 ± 2.04 N</td>
<td>X</td>
</tr>
<tr>
<td>Thermoformed tray “easy to open”</td>
<td>22.49 ± 1.62 N</td>
<td>✔</td>
</tr>
<tr>
<td>Container with aluminium foil lid</td>
<td>13.88 ± 1.24 N</td>
<td>✔</td>
</tr>
</tbody>
</table>

- Peel initiation force of the tray “easy to open” was 1.7 times higher than of the standard tray.
- Assessment not accordingly to the opening force.
  → opening of the “easy to open” tray was assessed as being achievable with a rather low force required.

### Ability to open a torque closure is influenced by
- size of the tear tab
- material used
- geometry of the packaging
Opening Force Progression of Cans

- Opening of the ring-pull can consisted of two sub-steps: pulling up of the pull ring and pulling off of the lid.
- Because of the limitations of the material testing machine the pulling off of the lid could not be measured.

Example: Opening force progression of the pulling up of the ring-pull of ring-pull cans

1 Pull up force
### Opening Forces of Cans

<table>
<thead>
<tr>
<th>Packaging type</th>
<th>Opening force Starting force</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring-pull can: ring pull</td>
<td>49.51 ± 10.32 Nm</td>
<td>X</td>
</tr>
<tr>
<td>Lid of the ring-pull can</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

- Cans
  - only openable with much effort or even not openable
  - Consistent to the very high initial force required to pull up the ring-pull of the can
Accessibility of Packaging

• Assessment of the openability is very subjective

• Differences between the two categories of elderly people, as well as for the different packaging types

• From the consumer side of view, certain packaging types were considered as clearly easier to use and more appropriate in the everyday life of an elderly person than others

1 PET bottle with a larger screw cap and a peelable aluminium foil with tab underneath
2 Stand-up pouch with a small perforation on each side
3 Container with aluminium foil lid
4 Thermoformed tray “Easy to Open”
Influences on the Accessibility of Packaging

- Accessibility of packaging is influenced by:
  - Required opening force
    → opening force as one indicator for the ease of opening of packaging
    → reduction of the force for improved manageability

- Additionally very strongly influenced by
  - various design factors
  - properties of packaging material
  - packaging process, especially the sealing process
  - consumer’s experiences
Recommendations for the Accessibility of Packaging

• All substeps of an opening process have to be considered in the design of user-friendly and easy to open packaging
  - Legibility of available information
  - Recognition of the opening mechanism
    → visualization can be achieved by highlighting the opening mechanism with shapes or colors
    → description of the mechanism by use of pictograms
  - Opening of the packaging
    → substantial ranges of hand strength have to be considered when developing senior-focused packaging
  - Emptying and reclosability of the packaging
    → a complete emptying of the packaging has to be possible in a simple way
# Recommendations for the Accessibility of Packaging

<table>
<thead>
<tr>
<th>Packaging systems</th>
<th>Packaging systems with torque closure</th>
<th>Peelable packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottles with screw cap</td>
<td>Stand-up pouches with twist-off cap</td>
<td>Containers with lid</td>
</tr>
<tr>
<td>Jars with twist-off lid</td>
<td></td>
<td>Thermoformed trays</td>
</tr>
</tbody>
</table>

## Requirements and recommendations

<table>
<thead>
<tr>
<th>Packaging form</th>
<th>Packaging material</th>
<th>Opening mechanism</th>
<th>Opening force</th>
<th>Legibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>· No completely round shape to ensure a good grip</td>
<td>· Increased coefficient of friction between hand and torque closure</td>
<td>· Easy to grip diameter of the torque closure</td>
<td>· Sufficient and deep grooves or grasping protrusions</td>
<td>· Reduction of the starting torque</td>
</tr>
<tr>
<td>· Contoured form of the packaging</td>
<td></td>
<td></td>
<td></td>
<td>· Font size: minimum size of the lower case letters of 1.5 mm (font size 9pt) for reading text</td>
</tr>
<tr>
<td>· Possibility of a counter support on the container</td>
<td>Material with a high friction coefficient</td>
<td>· Sufficiently large, distinct indentations</td>
<td>· Colored marking</td>
<td>· Font: straight fonts with familiar characters and without serifs; capital and small initial letters</td>
</tr>
<tr>
<td>· Possibility of a counter support on the lower part of the tray</td>
<td></td>
<td>· Large tear tab</td>
<td>· Laser perforation of the peel contour</td>
<td>· Color: clear contrasts; easy distinguishable colors; red, orange and yellow coloring; non-reflecting labels/packaging material</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Large tear tab and peeling corner</td>
<td></td>
<td>· Design: Packaging designed to be simple and clear. Only most substantial information in the local language; structured layout; application of precise, sufficiently large illustrations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Good accessibility of the whole surface area of the tab</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Easy Opening Systems already on the Market – Examples from CH
Thank you for your attention

This project has received funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement n° 311754