«Application of High Pressure Technology for the Development of Texture-modified Food for the Elderly and People with Dysphagia»

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Problem Statement:

Aging population is increasing rapidly, by 2025, the number of elderly worldwide is expected to reach more than 1.2 billion. 22% of the total population in Russia and 28.4% in Japan is over 60 years in 2019.

The number of people with specific nutritional needs, needs for preventive care and with chewing and swallowing impairments (dysphagia) is increasing.

Market and society demand for healthy foods for the elderly or populations with specific needs greatly exceeds available supply.

Providing the soft, palatable, and texture-modified foods for the elderly or specific population became an urgent task for the academia and food industry.

Objectives of the Study:

- Outline the situation with foods for the elderly in Russia and Japan
- Outline Japanese initiatives in the area of foods for specific nutritional and physiological needs of the elderly (Smile Care Food)
- Describe recent technological achievements for the texture-modified food
Main Aspects of Developing Healthy Foods for the Elderly

In Japan home-care elderly aged 65 and over have problems with:
- 70% - undernutrition
- 68% - chewing impairments
- 50% - swallowing impairments

Special regulation system SMILE CARE FOODS tailored for the people with chewing and swallowing dysfunctions and/or need for special nutrition was established in 2013.

Market of foods for people with mastication and swallowing dysfunctions alone has doubled since 2010 and is projected to amount to 27.1 billion JPY by 2025 (MAFF, 2020).

Loss of muscular body mass and bone mass
Diet with a high intake of protein, vitamin D, and calcium

Mastication and swallowing dysfunctions
Foods for patients suffering from dysphagia - soft, break down into small particles (e.g., <1.5 mm), moist, cohesive, easy to swallow

Gradual loss in sensory perception and appetite
Foods for the elderly - flavoursome and attractive with the addition of extra tastants and odorants

Other specific nutritional needs
Specific recommendations exposed to nutritional deficiencies

Need for texture-modified and special foods for the elderly

Figure 1. Main aspects to be considered in the design of healthy foods for the elderly (Aguilera et al., 2016)

High Pressure Technology is One of the Methods for Development of Texture-modified Products for Elderly
# Recent Applications of High Pressure for Development of Texture-modified Healthy Meat/Fish Products in Japan

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<th>Applications</th>
<th>HHP conditions</th>
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<td>Development of texture-modified meat products</td>
<td>Ground pork formulated with 1:0.5 or 1:1 (w/w) water, 1.5% NaCl and 0.05% rosemary followed by 400 MPa/20°C/20 min HHP</td>
<td>Gels with 1:1 (w/w) water treated with 400 MPa HHP were easy-to-swallow and left little residue in the oropharynx, it could be used as a dysphagia meat diet</td>
<td>The network of myosin filaments gave superior textural properties to meat gels for dysphagic patients</td>
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<td>Pork meat gel as a dysphagia diet Tokifuji et al. (2013)</td>
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<tr>
<td>Development of texture-modified meat products</td>
<td>Minced fish formulated with 1:0.5 (w/w), 1:1 (w/w) or 1:1.5 (w/w) water and 1.5% NaCl followed by 400 MPa/20°C/20 min HHP</td>
<td>Gels with 1:1 or 1:1.5 water treated with 400 MPa min HHP were evaluated to be moderately elastic and smooth and to be useful for a dysphagia diet and for elderly individuals</td>
<td>The HHP-induced fish gel was considered to be formed by irregular lateral associations of myosin filaments</td>
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<td>Minced fish meat gel as a dysphagia diet Yoshioka et al. (2016)</td>
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<td>Development of low salt, low phosphate, low fat meat products</td>
<td>Ground beef formulated with 0-2% NaCl and 0-0.5% SPP followed by 100-200 MPa/20°C/10 min HHP</td>
<td>150 MPa HHP can be adapted to reduce salt and phosphate contents in low fat beef gels with acceptable organoleptic and functional properties</td>
<td>HHP modified protein structure, promoting the cohesive properties of meat particles and improving the functionality</td>
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<td>Sodium-reduced meat gel Maksimenko et al. (2019)</td>
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Figure 2. Application of high pressure technology for development of texture-modified meat products.
Implications

- Industry and academia should align their efforts to meet the demands of aging society

Conclusions

- Both Russia and Japan are urged to cope with the aging population needs
- The fastest aging country - Japan - is forced to be an innovation leader both in research and production of nutritional and healthy food for the elderly
- System of health foods: **FOSHU, FOSDU products; Smile Care Foods** – foods for preventive care and special healthcare needs (including mastication and swallowing dysfunctions)
- **Japanese market** of foods for people with mastication and swallowing dysfunctions alone is projected to amount to **27 billion JPY** by 2025
- Russian market of functional foods for the elderly is underdeveloped (3-5% of the functional food market)
- **High pressure processing** proved to be a feasible approach to develop texture-modified products and health products with reduced content of food additives while maintaining better quality characteristics

**High Pressure Technology** opens various opportunities for challenges of food industry
- We suggest further study of the **High Pressure Technology** as one of the effective methods for the development of:
  - Healthy foods with novel textures
  - Foods for the elderly and population with specific health needs (including mastication and swallowing dysfunctions)
  - Food products with reduced content of food additives