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**«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



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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)

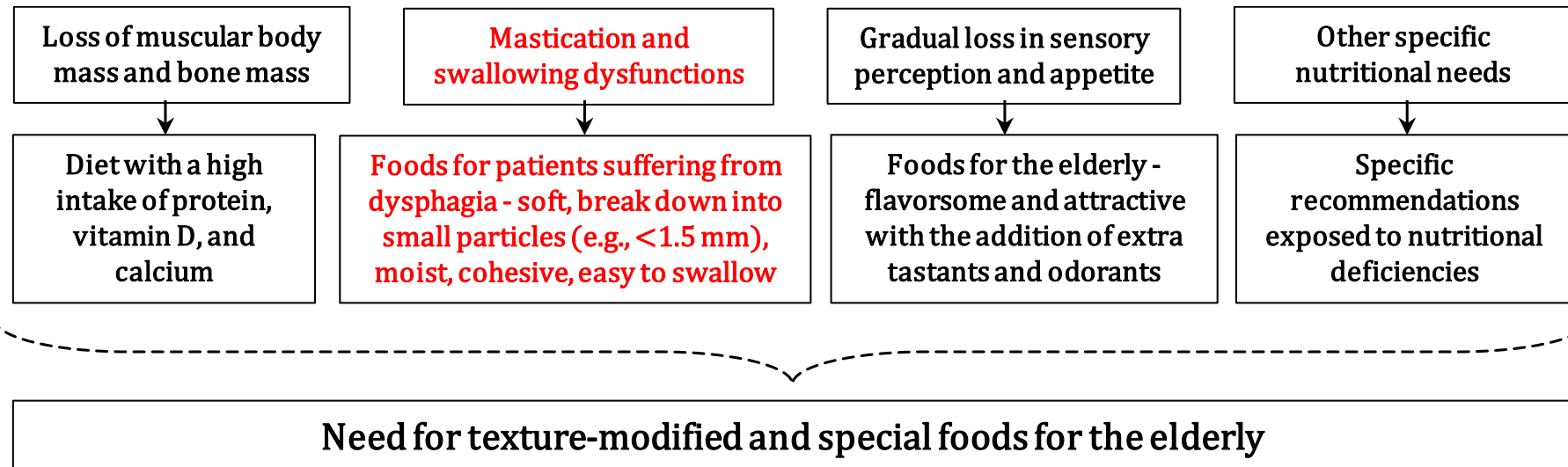


Figure 1. Main aspects to be considered in the design of healthy foods for the elderly (Aguilera et al., 2016)

High Pressure Technology is One of the Methods for Development of Texture-modified Products for Elderly



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Recent Applications of High Pressure for Development of Texture-modified Healthy Meat/Fish Products in Japan

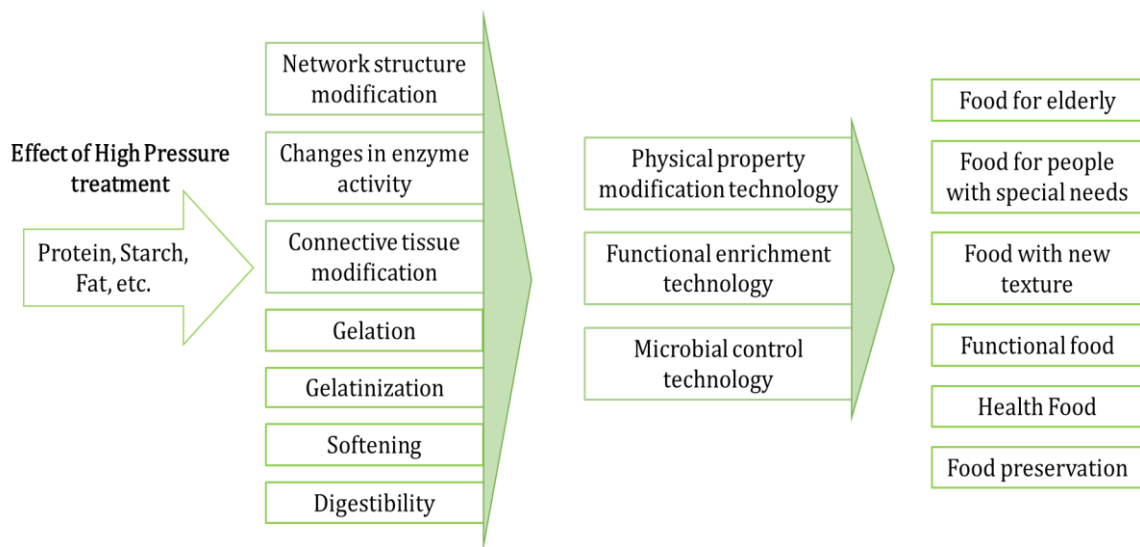
Applications	HHP conditions	Achievements	Proposed mechanism
Development of texture-modified meat products Porkmeat gel as a dysphagia diet Tokifuji et al. (2013)	Ground pork formulated with 1:0.5 or 1:1 (w/w) water, 1.5% NaCl and 0.05% rosemary followed by 400 MPa/20°C/ 20 min HHP	Gels with 1:1 (w/w) 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	The network of myosin filaments gave superior textural properties to meat gels for dysphagic patients
Development of texture-modified meat products Minced fish meat gel as a dysphagia diet Yoshioka et al. (2016)	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°/20 min HHP	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	The HHP-induced fish gel was considered to be formed by irregular lateral associations of myosin filaments
Development of low salt, low phosphate, low fat meat products Sodium-reduced meat gel Maksimenko et al. (2019)	Ground beef formulated with 0-2% NaCl and 0-0.5% SPP followed by 100-200 MPa/20°C/ 10 min HHP	150 MPa HHP can be adapted to reduce salt and phosphate contents in low fat beef gels with acceptable organoleptic and functional properties	HHP modified protein structure, promoting the cohesive properties of meat particles and improving the functionality

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**



- **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**

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