ผลิตภัณฑ์ นวัตกรรมอาหาร และโภชนาการสำหรับผู้สูงอายุ

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Outline

- Elderly population
- Physiological changes affecting nutritional status in the elderly
- Dietary recommendations for the elderly
- Food product development and innovation for the elderly

ELDERLY POPULATION

Definition of elderly

- WHO: age ≥60 years
- Developed countries (France, South Korea, Japan): age ≥65 years

  65-74 years = young old

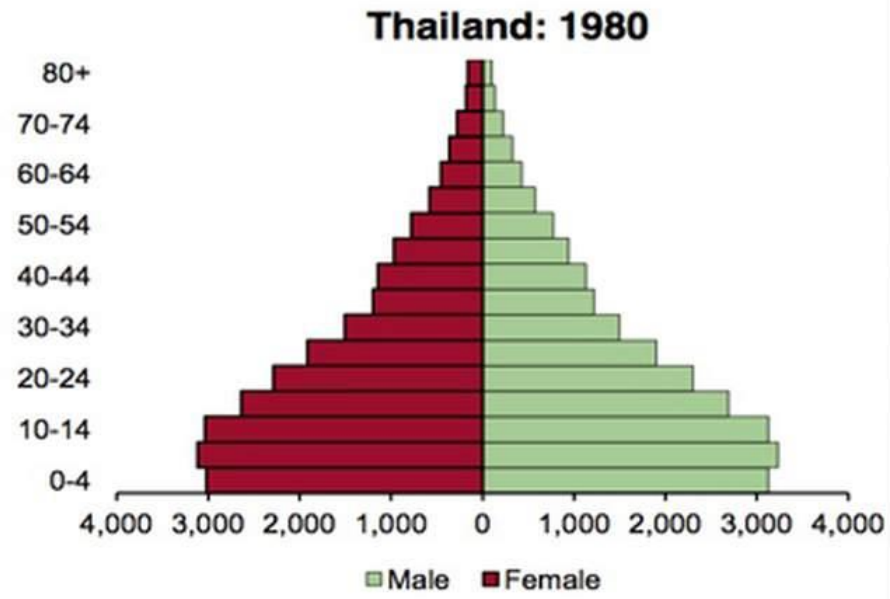
  75-84 years = aged

  ≥85 years = oldest old
- Developing countries: age ≥60 years
- African countries: age ≥55 years
- Thailand: age ≥60 years (National Aging Population Plan B.E. 2545-2564)

Thailand demographic profile

Population pyramid of Thailand, 1980

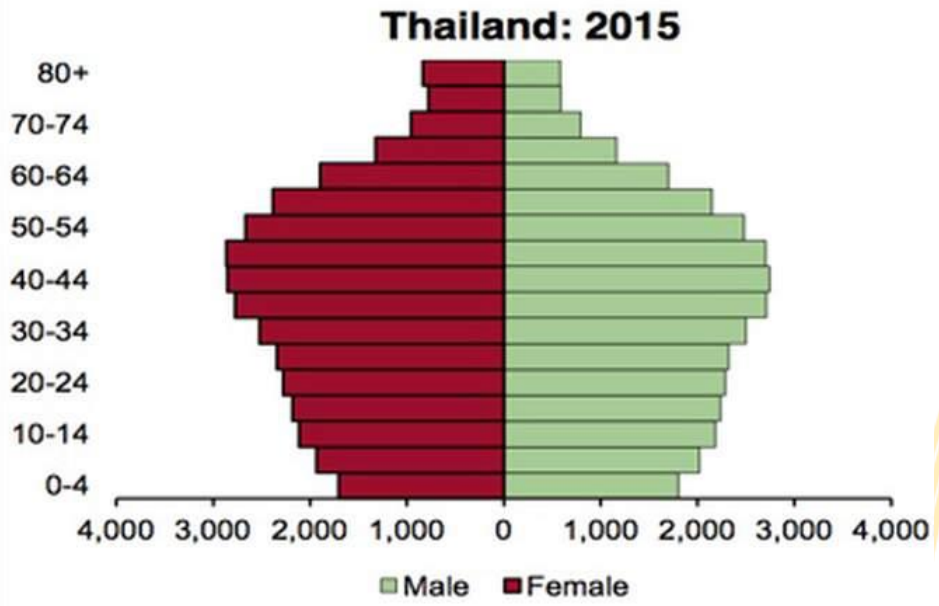
In thousands



Source: UN, Credit Suisse

Population pyramid of Thailand, 2015

In thousands



Source: UN, Credit Suisse

สังคมสูงอายุ

- **สังคมผู้สูงอายุ (Ageing society)**

  มีประชากรอายุ 60 ปีขึ้นไป >10% ของประชากรทั้งประเทศ หรือ

  มีประชากรอายุตั้งแต่ 65 ปี >7% ของประชากรทั้งประเทศ

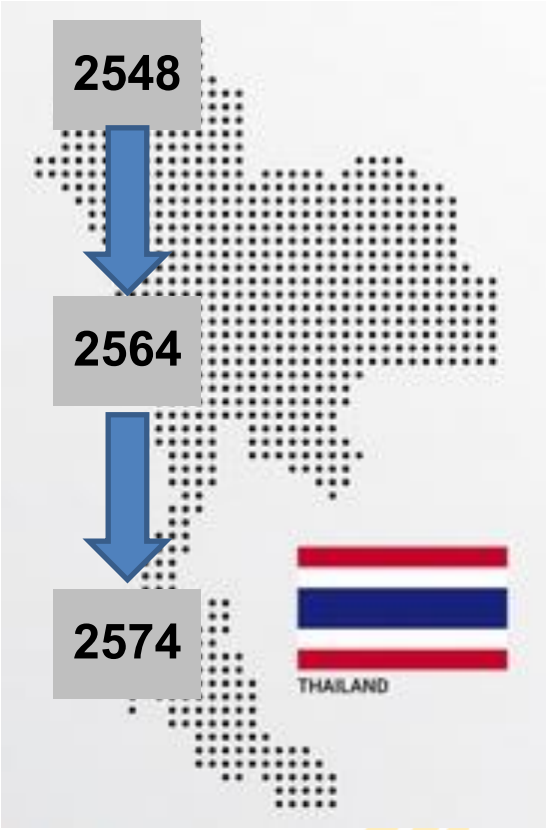
- **สังคมผู้สูงอายุโดยสมบูรณ์ (Aged society)**

  มีประชากรอายุ 60 ปีขึ้นไป >20% หรือ

  มีประชากรอายุ 65 ปี >14% ของประชากรทั้งประเทศ

- **สังคมผู้สูงอายุระดับสุดยอด (Super-aged society)**

  มีประชากรอายุ 65 ปีขึ้นไป >20% ของประชากรทั้งประเทศ

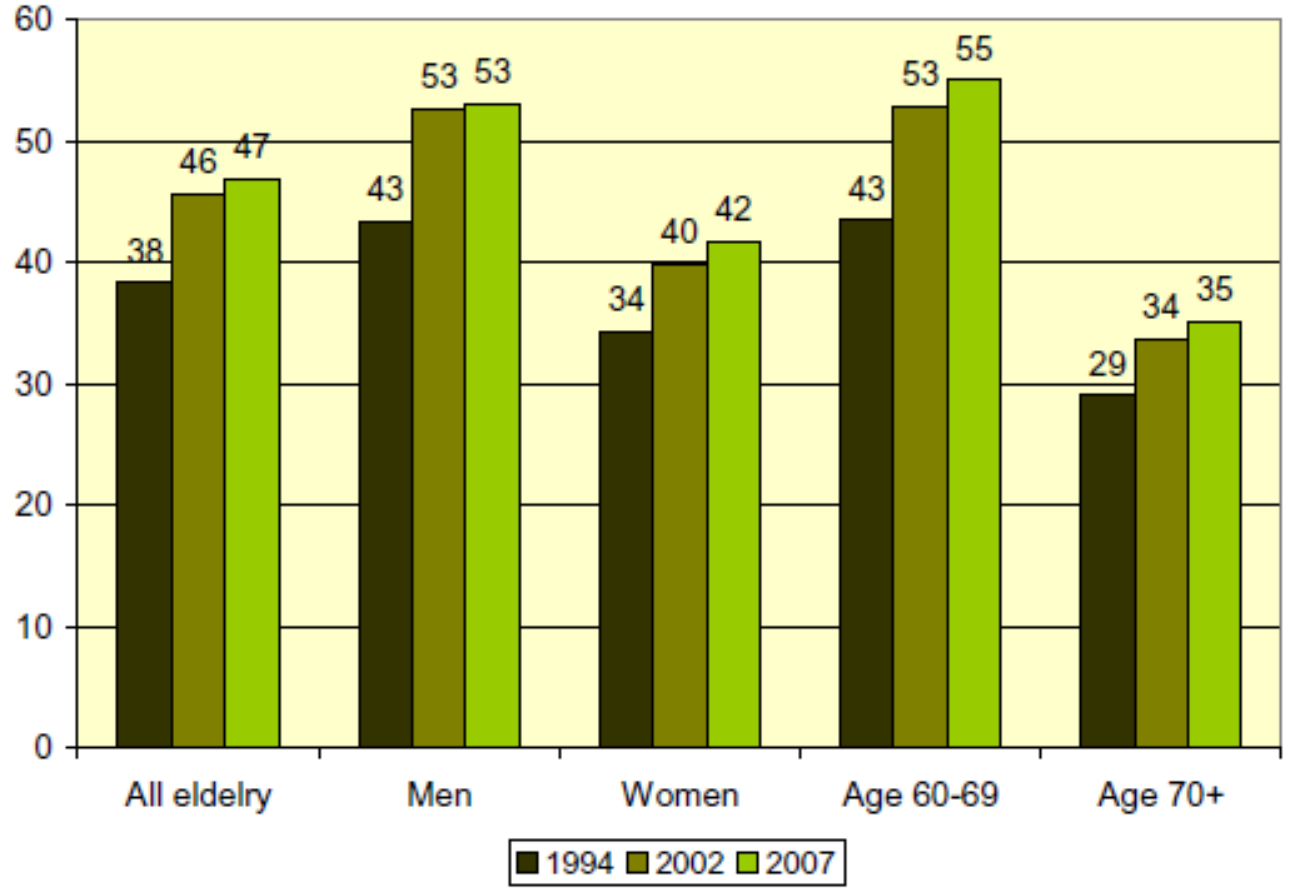


Source: United Nations 2015

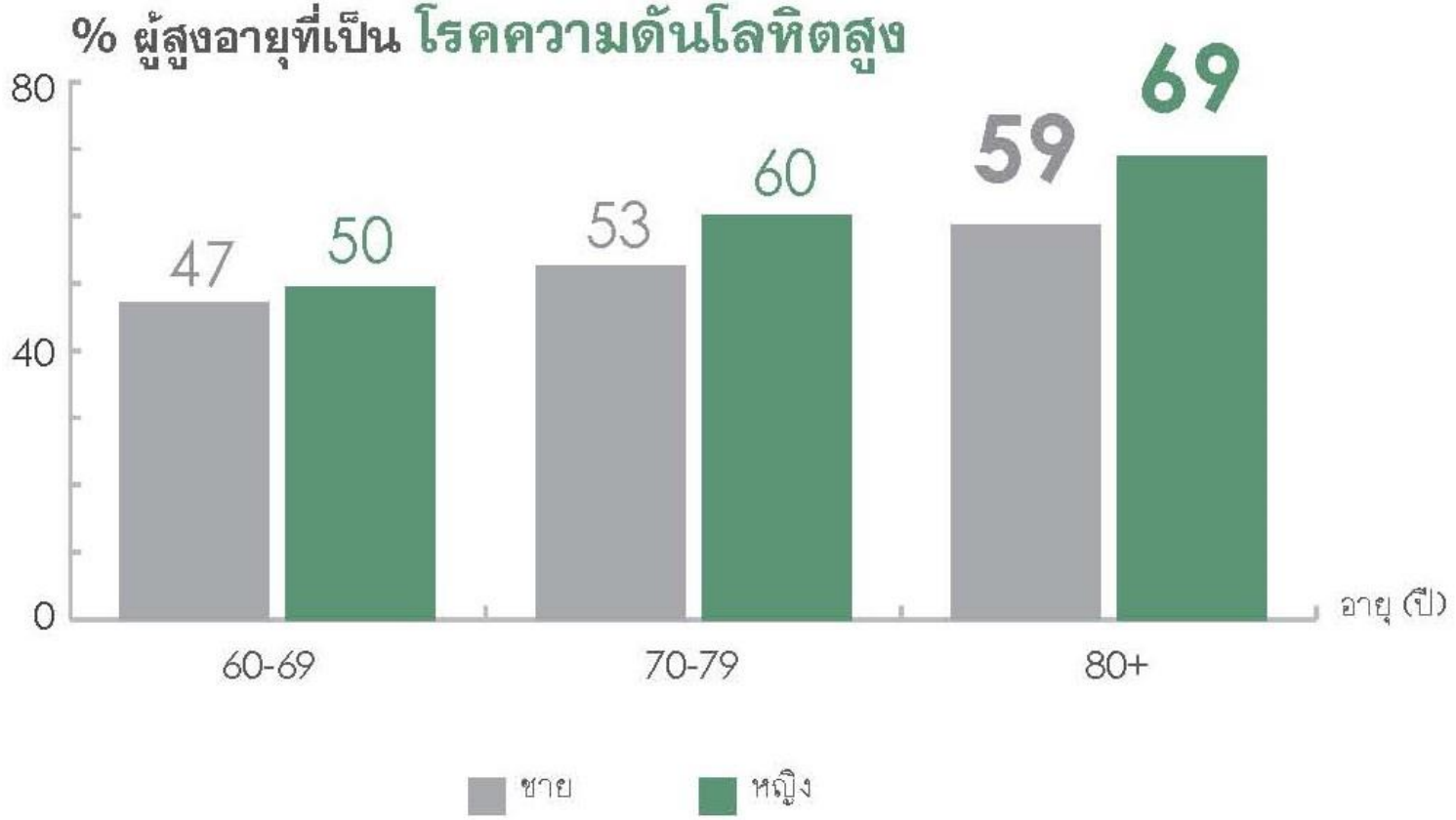
Grouping of elderly by health condition

Group	Heath condition	Eating ability
Society	Be able to help themselves	Be able to eat by themselves
Stay at home	Be able to help themselves in some activities	Need help in having meals
Stay on bed	Cannot help themselves	Need someone to feed

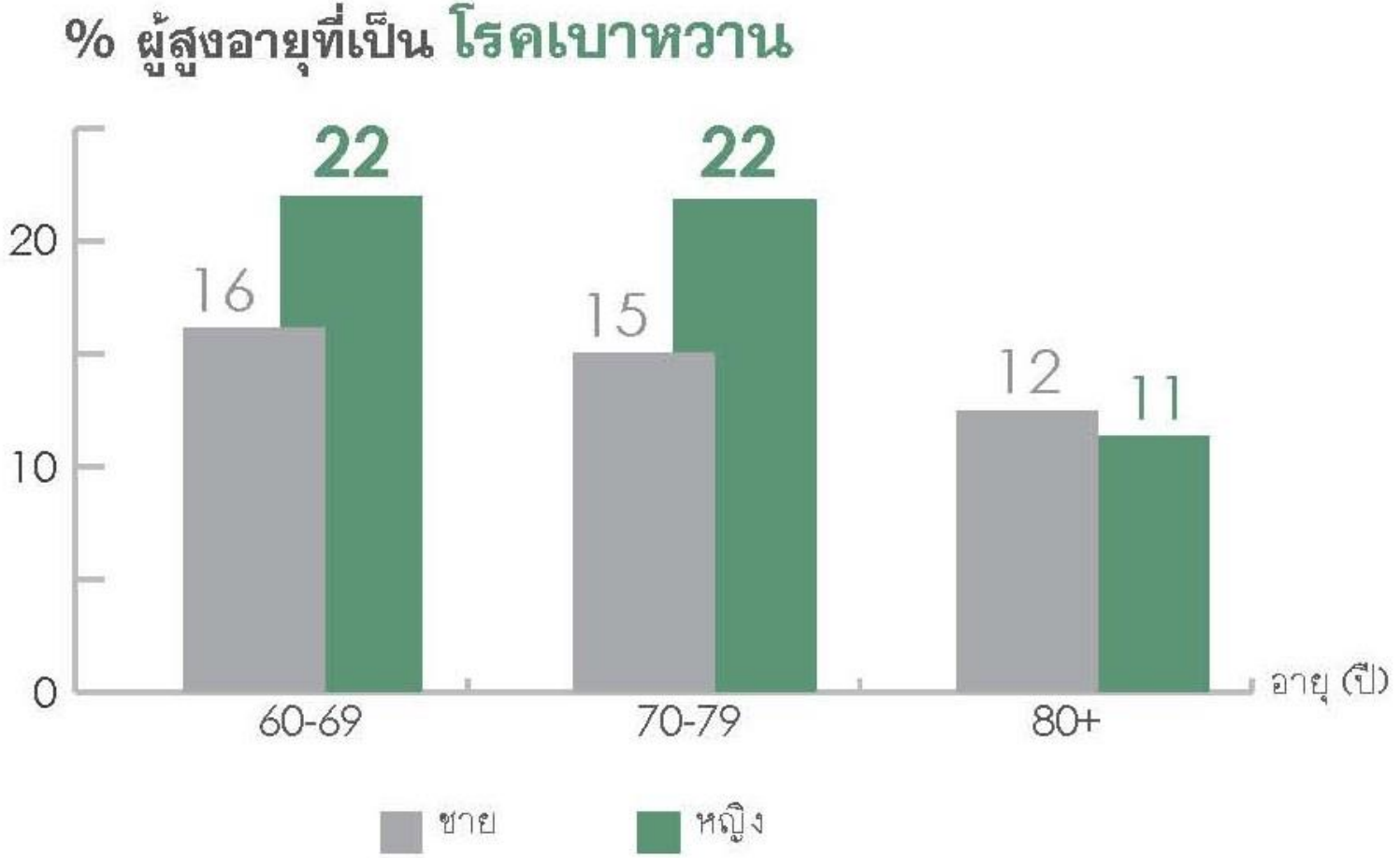
Percentage of Thai population age 60 and older with good or very good health condition



Source: 2007 Survey of Older Persons in Thailand



แหล่งข้อมูล: การสำรวจสุขภาพประชาชนไทยโดยการตรวจร่างกาย ครั้งที่ 5 (พ.ศ. 2557), สำนักงานสำรวจสุขภาพประชาชนไทย, สถาบันวิจัยระบบสาธารณสุข (สวรส.)



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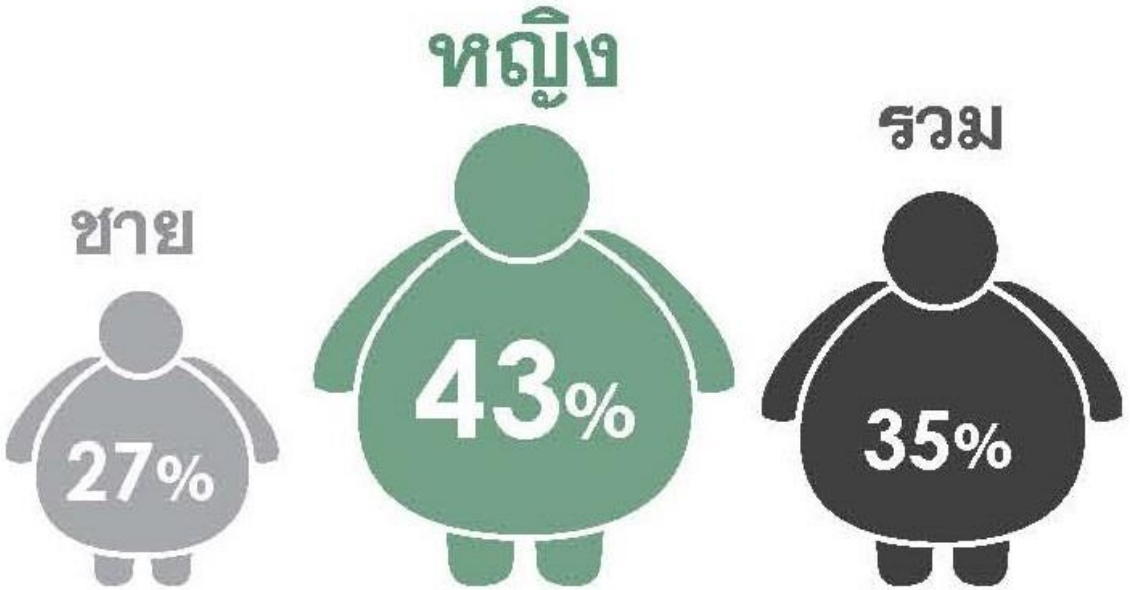
ผู้สูงอายุหญิงมี ภาวะอ้วน สูงกว่าผู้สูงอายุชาย



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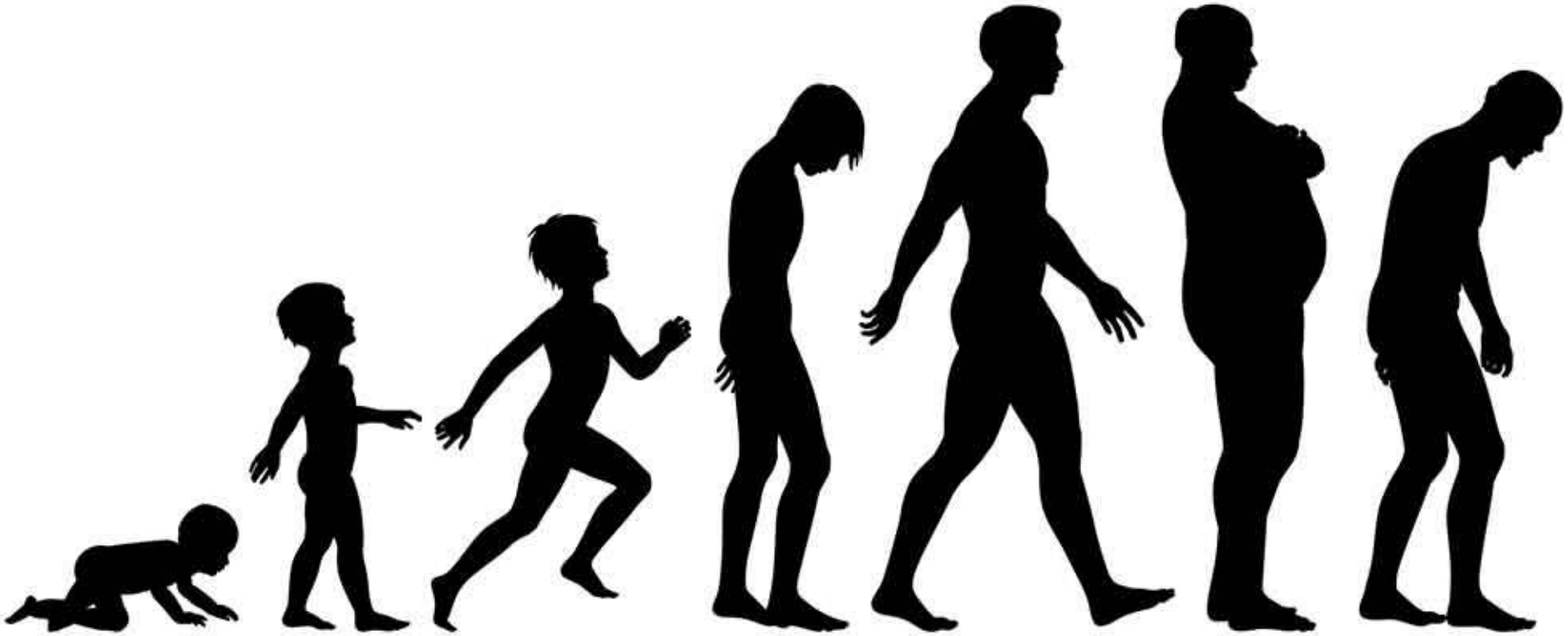
PHYSIOLOGICAL CHANGES AFFECTING NUTRITIONAL STATUS IN THE ELDERLY



Factors affecting nutritional status of elderly

- Physiological
  - ⇩Basal metabolic rate
  - ⇩ Sensory perception
  - ⇩ Number of teeth
  - ⇩ Saliva secretion
  - ⇩ Tongue pressure

  ⇩ Ability to chew and swallow
  - ⇩ Efficiency and function of body systems (skin, renal, musculoskeletal, cardiovascular, gastrointestinal)
  - Anorexia

Factors affecting nutritional status of elderly (Cont.)

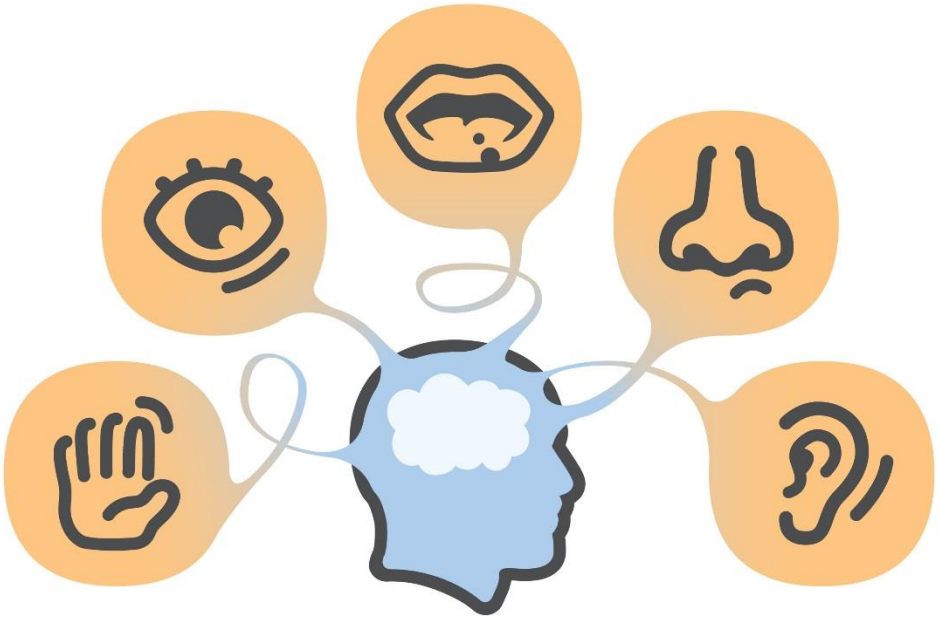
- Psychological
  - Depression
  - Loneliness
  - Dementia
  - Food preference
- Social and economical
  - Poverty
  - Transportation availability
  - Lack of knowledge in nutrition
  - Inadequate cooking skill
  - Lack of social support

Factors affecting nutritional status of elderly (Cont.)

- Cultural beliefs
  - Culturally appropriate food and dining settings
- Others
  - Medical conditions
  - Prescribed diets
  - Side effects of medication

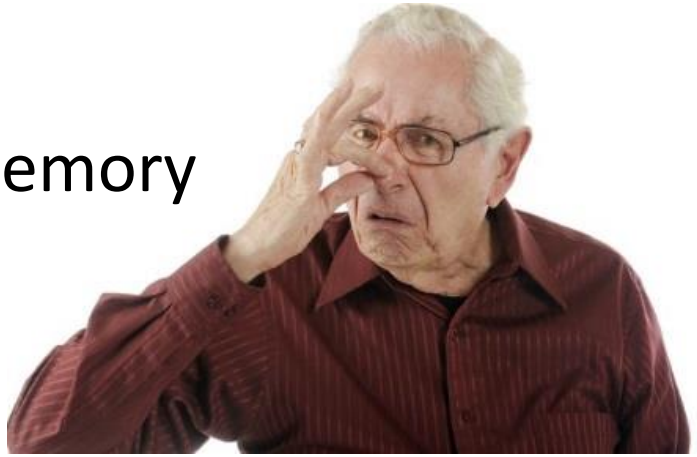
Age range that sensory changes accelerated

- Vision — mid-50s
- Hearing — mid-40s
- Touch — mid-50s
- Taste — mid-60s
- Smell — mid-70s



Olfactory loss

- Ability to detect
- Ability to identify: perception + memory



- Largely unaware
- More common than gustatory loss
- Lead to gustatory loss

Approximately 80% of taste disorders are totally smell disorders.

Medical conditions that affect the senses of taste or smell

Neurological
- Alzheimer's disease
- Bell's palsy
- Damage to the chorda tympani
- Epilepsy
- Head trauma
- Korsakoff's syndrome
- Multiple sclerosis
- Parkinson's disease
- Tumours and lesions

Nutritional
- Cancer
- Chronic renal failure
- Liver disease
- Niacin deficiency
- Vitamin B12 deficiency

Endocrine
- Adrenal cortical insufficiency
- Congenital adrenal hyperplasia
- Panhypopituitarism
- Cushing's syndrome
- Diabetes mellitus
- Hypothyroidism
- Kallman's syndrome
- Pseudohypoparathyriodism
- Turner's syndrome

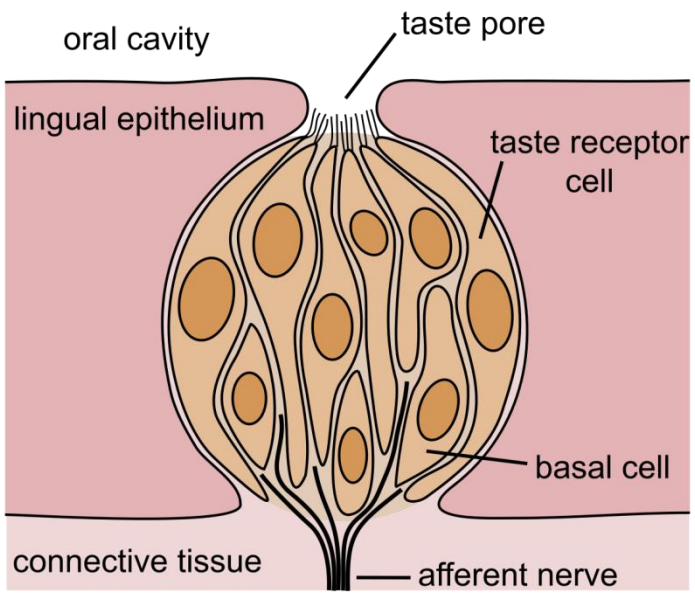
Local
- Allergic rhinitis, atopy, and bronchial asthma
- Sinusitis and polyposis
- Xerostomic conditions including Sjogren's syndrome

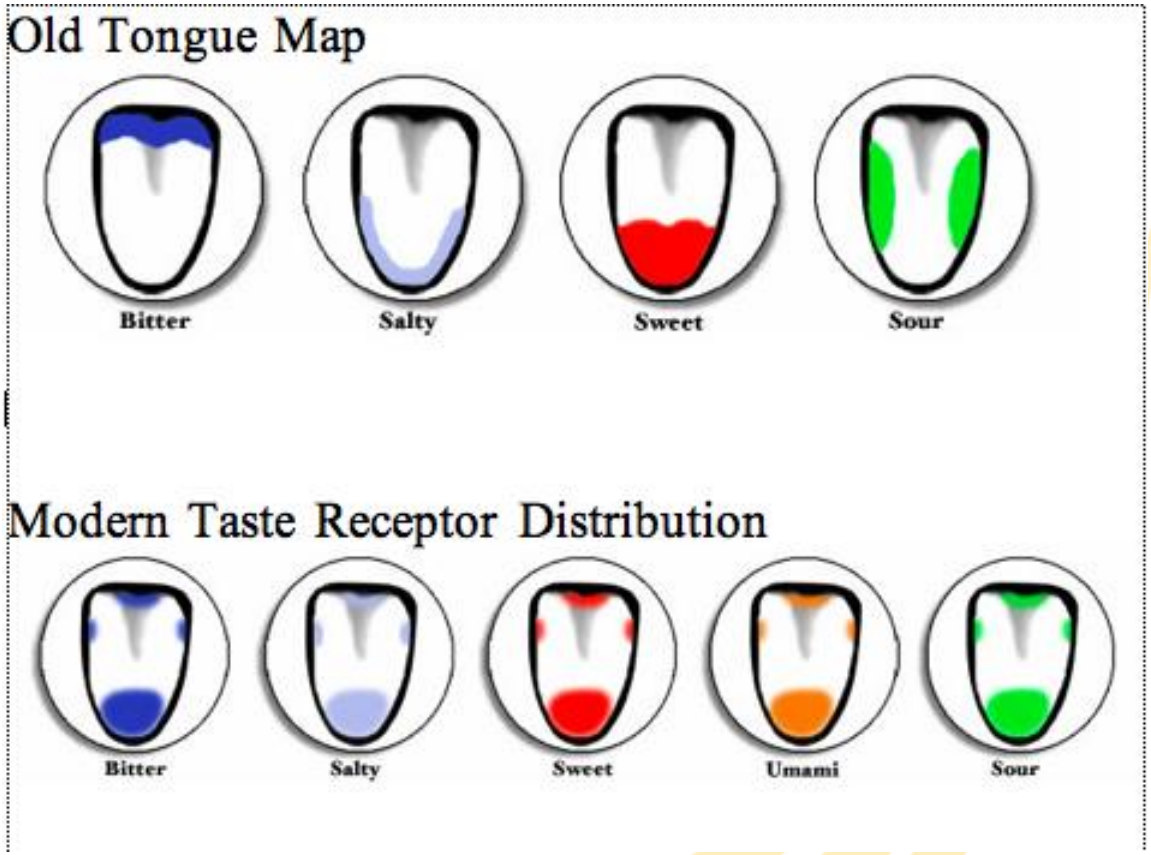
Viral infections
- Acute viral hepatitis
- Influenza-like infections

Boyce JM, Shone GR. Effects of ageing on smell and taste. Postgrad Med J 2006;82:239–241.

Gustatory loss

- Decreased number of taste buds
- Decreased taste sensitivity: bitter > sweet > salty



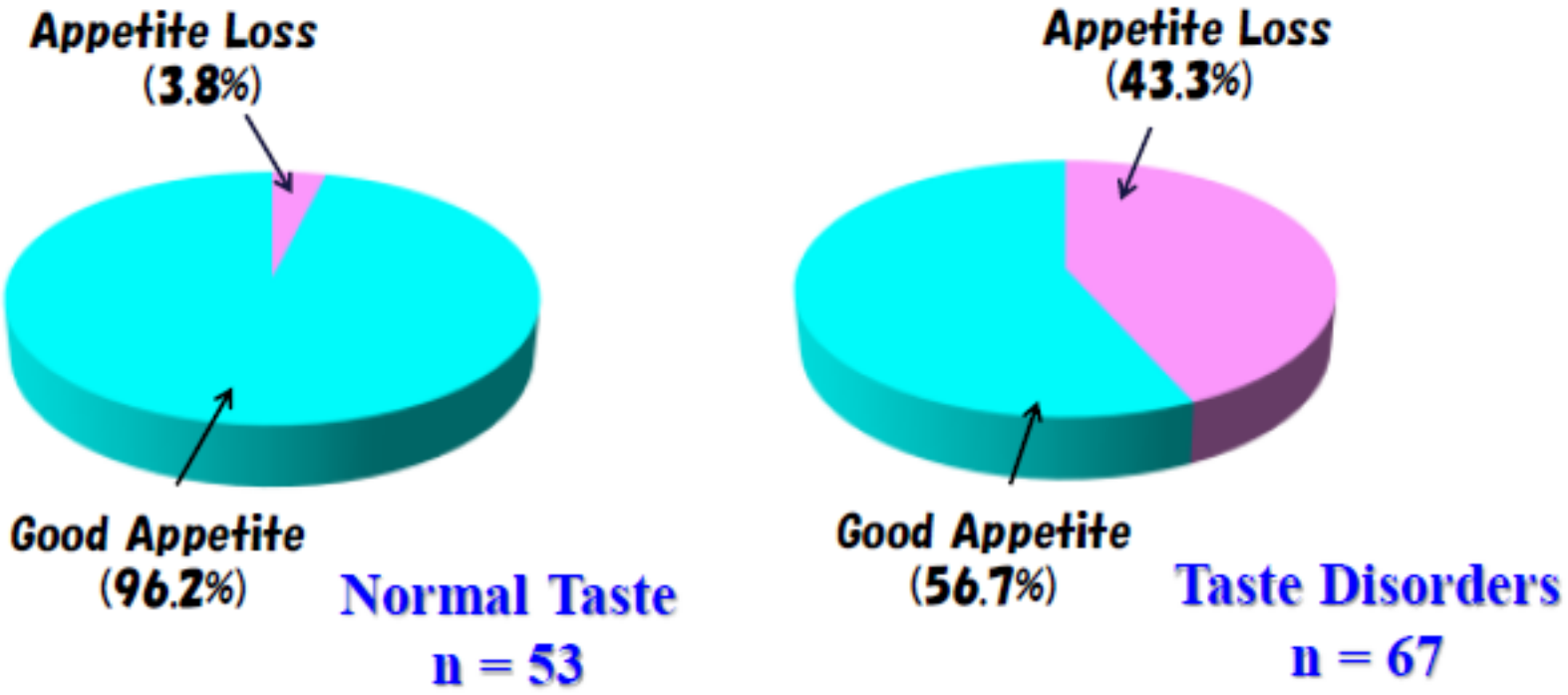


Disorder of taste

- Ageusia - Inability to taste
- Hypogeusia - Decreased ability to taste
- Dysgeusia - Distorted ability to taste

Relationship between taste sensitivity and appetite of the elderly

(mean 74.1-year-old, n=120)

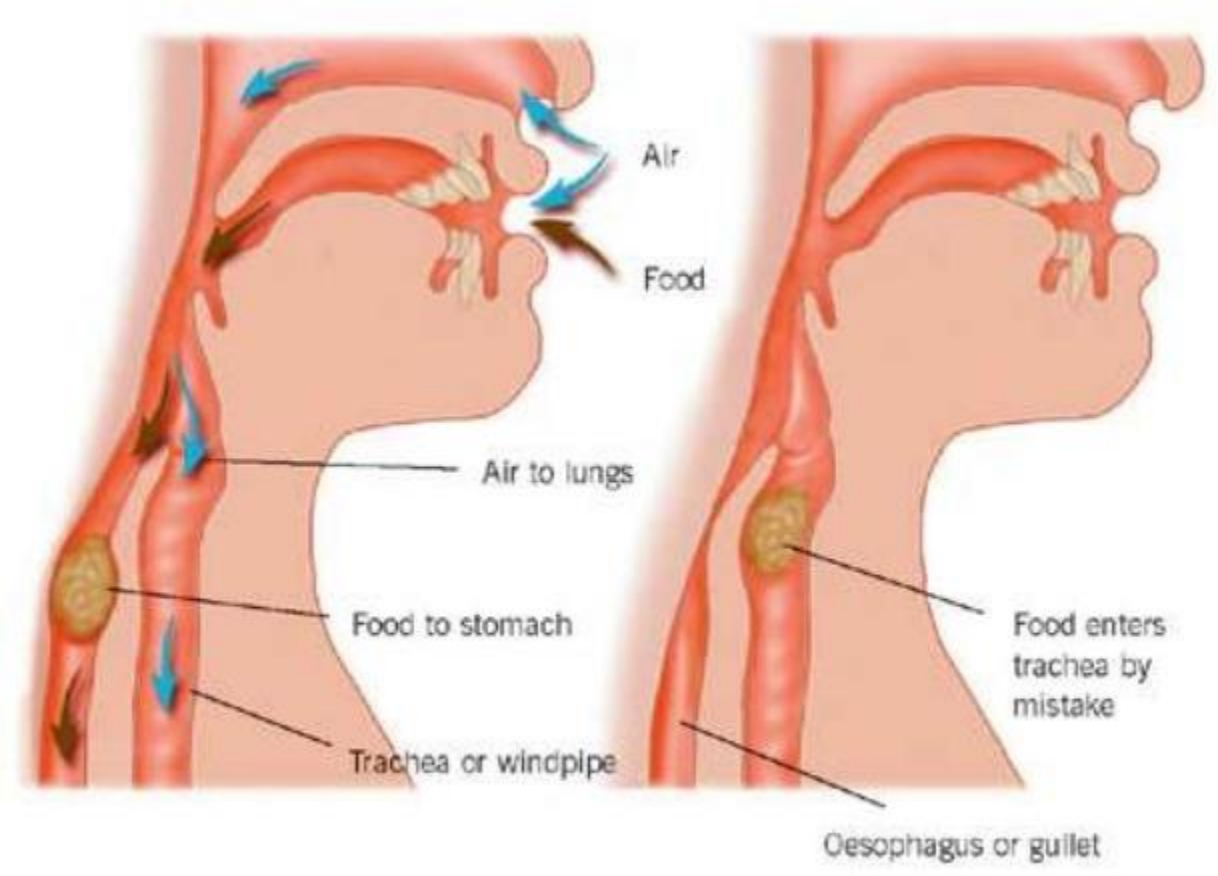


Assoc. Prof. Dr. Noriaki Shoji, Tohuku University, Japan

Reduced mastication ability

- Less number of teeth
  - 4 out of 10 Thai elderly have <20 teeth
  - Female > Male
- Less saliva secretion (30% decrease at age >65)
  - Decreased taste and smell sensitivity
  - Increased difficulties of eating and swallowing
- Less tongue pressure
- Less biting and chewing forces

Swallowing problems



Swallowing problem (Cont.)

- Slower swallowing
- Difficult/ hard to initiate swallowing *"Dysphagia"*
- Swallowing disturbances in pharyngeal stage
- Increased risk of airway penetration

↓

Overt coughing or choking with oral intake

↓

Aspiration pneumonia

↓

Weight loss due to inadequate nutritional intake

Dysphagia in Thai elderly

กลุ่มประชากรผู้สูงอายุ	ความชุกภาวะกลืนลำบาก (ร้อยละ)
ทั่วไปในชุมชน	40
เข้ารับการรักษาในโรงพยาบาล	30
ในสถานพักฟื้น	68
โรคหลอดเลือดสมอง	64
โรคพาร์กินสัน	52-82
โรคอัลไซเมอร์	84

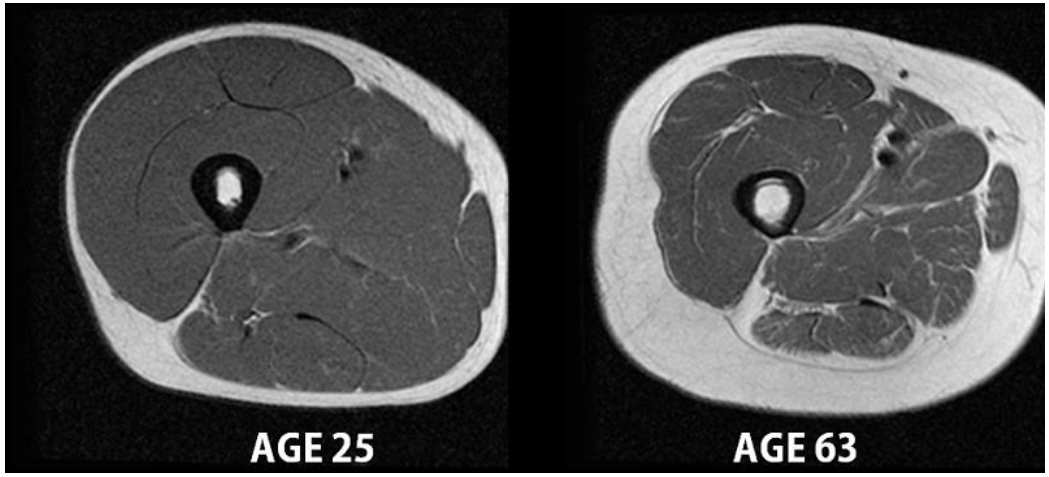
ปิยะภัทร เดชพระธรรม. ปัญหาการกลืนในผู้สูงอายุ. เวชศาสตร์ฟื้นฟูสาร 2556; 23(3): 73-80

Reduced sensory-specific satiety

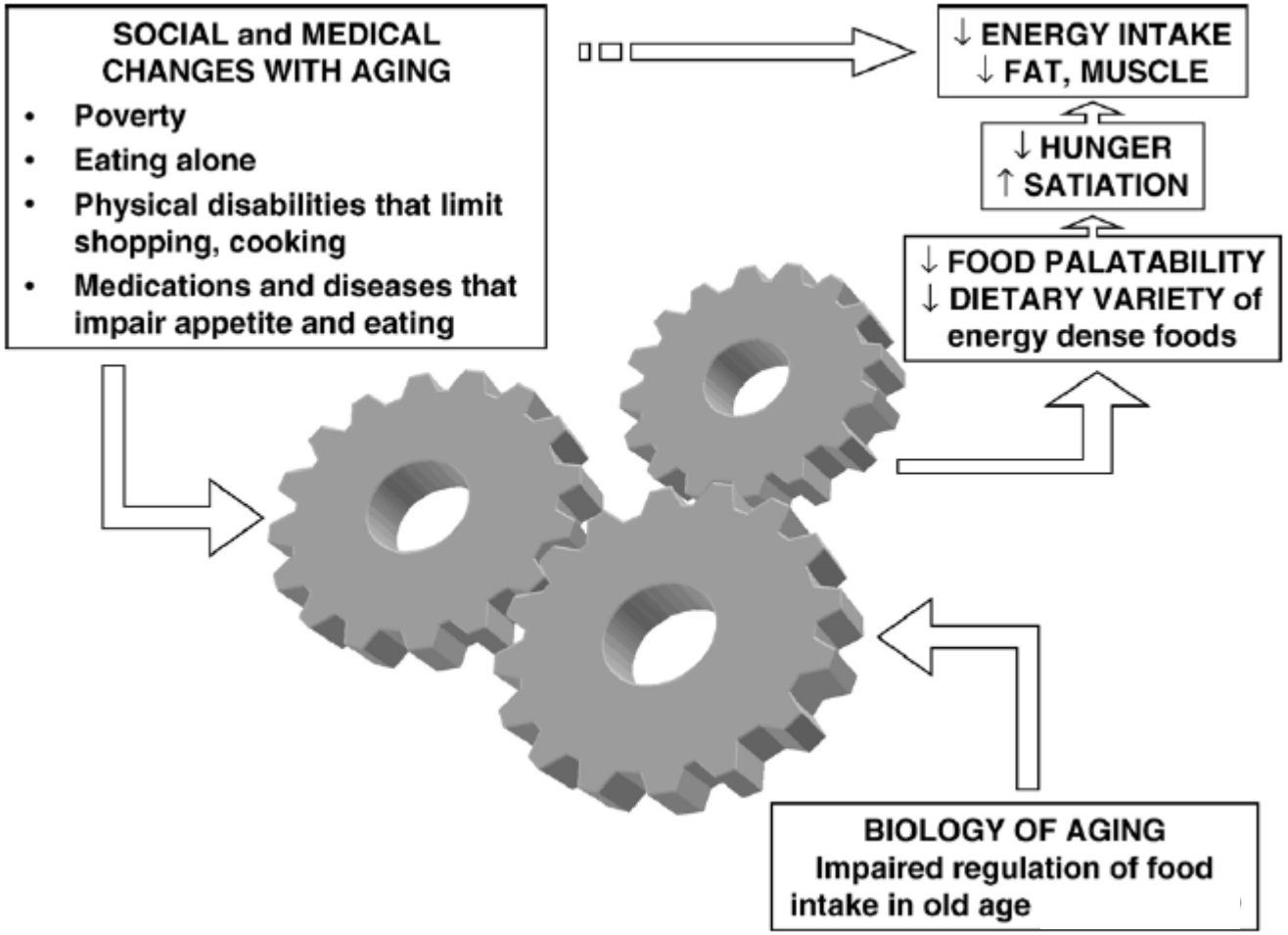
- Less of a reduction in the pleasantness of the food recently consumed ➔ Monotonous diet
- Did not relate to loss of sensor function
- Respond less to menu variety
- More satisfied with single-item entrée bowls than multi-component meals

Change in body composition

- Loss of lean body mass due to loss of skeleton muscles mass and function *"Sarcopenia"*
- Loss of body water and bone content
- Increase in body and visceral fats
- Total body weight may not change



Anorexia of aging



Hays NP, Roberts SB. The anorexia of aging in humans. Physiology & Behavior . 2006; 88: 257–266.

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DIETARY RECOMMENDATIONS FOR THE ELDERLY

Energy requirements in elderly

- Decreased energy requirement due to:
  - Decrease in physical activities
  - Decrease in basal metabolic rate (BMR): 2% reduction every 10 years of age
- Caloric needs reduces 2-8% every decade past age 20
  - Age 52-75: 90% of energy requirement for adults
  - Age >75: 75% of energy requirement for adults

Recommendation for caloric intake

- FAO/WHO
  - 5% reduction every 10 years of age until 59
  - 10% reduction for 60-69
  - 20% reduction for ≥70
- Bureau of Nutrition, Department of Health, Ministry of Public Health
  - 100 kcal reduction every 10 years of age
  - But not less than 1,200 kcal

ค่าพลังงานที่ผู้สูงอายุควรได้รับ

- 1,400 กิโลแคลอรี สำหรับผู้สูงอายุชาย-หญิงวัย 60-80 ปีที่มีกิจกรรมเบา
- 1,600 กิโลแคลอรี สำหรับผู้สูงอายุหญิง 60-80 ปี ที่มีกิจกรรมปานกลาง
- 1,800 กิโลแคลอรี สำหรับผู้สูงอายุชาย 60-80 ปี ที่มีกิจกรรมปานกลาง

1,400 กิโลแคลอรี

1,600 กิโลแคลอรี

1,800 กิโลแคลอรี

Population nutrient intake goals

Dietary factor	Goal (% of total energy, unless otherwise stated)
Total fat	15–30%
Saturated fatty acids	<10%
Polyunsaturated fatty acids (PUFAs)	6–10%
n-6 Polyunsaturated fatty acids (PUFAs)	5–8%
n-3 Polyunsaturated fatty acids (PUFAs)	1–2%
Trans fatty acids	<1%
Monounsaturated fatty acids (MUFAs)	By difference[a]
Total carbohydrate	55–75%[b]
Free sugars[c]	<10%
Protein	10–15%[d]
Cholesterol	<300 mg per day
Sodium chloride (sodium)[e]	<5 g per day (<2 g per day)
Fruits and vegetables	⩾400 g per day
Total dietary fibre	From foods[f]
Non-starch polysaccharides (NSP)	From foods[f]

WHO

อายุ 6 ปีขึ้นไป

ที่มา คู่มือแนวทางปฏิบัติการบริโภคอาหารเพื่อสุขภาพที่ดีสำหรับผู้สูงอายุไทย: 2558.

โภชนบัญญัติ 9 ประการสำหรับผู้สูงอายุ

ข้อปฏิบัติการบริโภคอาหารเพื่อสุขภาพที่ดีของผู้สูงอายุไทย

- กินอาหารให้หลากหลายในสัดส่วนที่เหมาะสมและหมั่นดูแลน้ำหนักตัว
- กินข้าวเป็นหลัก เน้นข้าวกล้อง ข้าวขัดสีน้อย
- กินพืชผักและผลไม้ตามฤดูกาลให้มากเป็นประจำ
- กินปลา ไข่ เนื้อสัตว์ไม่ติดมัน ถั่วและผลิตภัณฑ์เป็นประจำ
- ดื่มนมและผลิตภัณฑ์เป็นประจำ
- หลีกเลี่ยงอาหาร ไขมันสูง หวานจัด เค็มจัด
- ดื่มน้ำสะอาดให้เพียงพอ ควรหลีกเลี่ยงเครื่องดื่มรสหวาน
- กินอาหารสะอาด ปลอดภัย
- งดหรือลดเครื่องดื่มที่มีแอลกอฮอล์

การดื่มนมวัวสำหรับผู้สูงอายุ

สำหรับผู้สูงอายุไทย ปริมาณสารอาหารอ้างอิงที่ควรได้รับประจำวัน (DRI) ที่ใช้ในการวิเคราะห์ครั้งนี้ ใช้ค่า Thai DRI 2003 ได้ปริมาณอาหารในแต่ละกลุ่ม 3 ระดับพลังงาน คือ 1400, 1600 และ 1800 กิโลแคลอรี โดยปริมาณอาหารที่แนะนำให้บริโภคในแต่ละกลุ่มที่คำนวณไว้มี 3 กรณี คือ

- กรณีที่ 1 ผู้สูงอายุดื่มนมวัวได้วันละ 2 แก้ว (ค่า DRI ของแคลเซียม เท่ากับ 1,000 มก.)
- กรณีที่ 2 ผู้สูงอายุดื่มนมวัวได้วันละ 1 แก้ว และกินอาหารอื่นที่เป็นแหล่งแคลเซียม (กรณีค่า DRI แคลเซียม = 650 มก.) หรือกินแคลเซียมเสริมอีก 500 มก. (กรณีค่า DRI แคลเซียม = 1,000 มก.)
- กรณีที่ 3 ผู้สูงอายุไม่ดื่มนมวัว ต้องกินแคลเซียมเสริม 750-1,000 มก. ต่อวัน (ค่า DRI แคลเซียม = 1,000 มก.)
- ในกรณีที่ผู้สูงอายุดื่มนม 1 แก้ว หรือไม่ดื่มนมเลย การแนะนำปริมาณอาหารมีการปรับเปลี่ยนหลายกลุ่ม เนื่องจากต้องทดแทนสารอาหารที่ขาดไป คือ พลังงาน แคลเซียม โปรตีน และวิตามินบี2 ดังนั้น จึงได้ข้อแนะนำแล้วแต่กรณี

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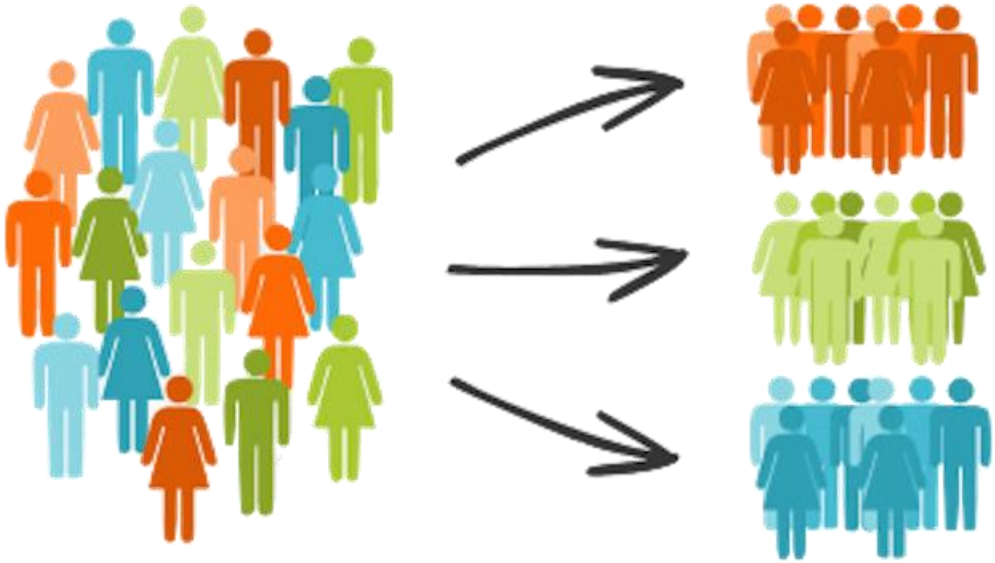
FOOD PRODUCT DEVELOPMENT AND INNOVATION FOR THE ELDERLY

Every old person is not the same!

All these ladies are in their 60s…

SEGMENTATION

- Demographic
- Geographic
- Behavioral
- Psychographic



PERSONALIZATION

Factors leading to different needs for food

- Physiological condition
- Health problems
- Physical condition
- Lifestyle
- Income
- Education

Food product for elderly

- Sensory aspects
  - Provide similar appearance and taste to normal food
  - Flavor/odor/ taste
  - Easy to chew and swallow, do not cause suffocation
- Nutrient and composition
  - Healthy and nutritious, nutrient-dense
  - Prevention/care of chronic diseases (salt, sugar, fat, cholesterol, electrolytes)
  - Easy to digest

Food products for elderly (Cont.)

- Ease of preparation and consumption
  - No pot cooking
  - No need to clean up
- Packaging
  - Easy to open package
  - Realistic portion size
- Labeling
  - Presentation
  - Readability
- Compatibility with lifestyle and culture

NUTRITIONAL QUALITY

Nutritional quality

- Loss appetite
- Reduced energy requirement
- Unchanged or increased essential nutrients requirement

Nutrient-dense food
Nutrient-enriched food

Food/nutrient restriction
due to physiological condition
and diseases

Nutrients of concern during aging

- Energy (underweight)
- Protein
  - Protein quality
  - Branched-chain amino acids
- Carbohydrate
  - Glycemic index
- Fat
  - Fatty acid composition
  - Cholesterol
- Water (dehydration)
- Dietary fiber (bowel movement)

Nutrients of concern during aging (Cont.)

- Calcium (bone)
- Iron (anemia)
- Magnesium (body fluid)
- Potassium
- Sodium
- Vitamin Bs
  - Vitamin B12 (memory loss)
- Fat soluble vitamins
  - Vitamin D (bone)

SENSORY QUALITY

Management of taste and smell disorders

- Add extra flavor to food
  - Use herbs, flavor-enhancing ingredients to increase the flavor of foods without increasing sodium content
  - Avoid bland foods
- Compensate for the loss of taste by using contrasts in texture, temperature and flavor in preparing foods
  - Make foods look appealing
  - Separate foods on the plate
  - Vary the textures of foods

Flavor enhancement

- Effective in improving food preference and increase energy intake of elderly

- Flavoring (natural, synthesis)
- Flavor enhancers
  - Supplement, enhance, or modify the original taste or aroma of a food but do not have a characteristic taste or aroma of their own
  - Umami compounds

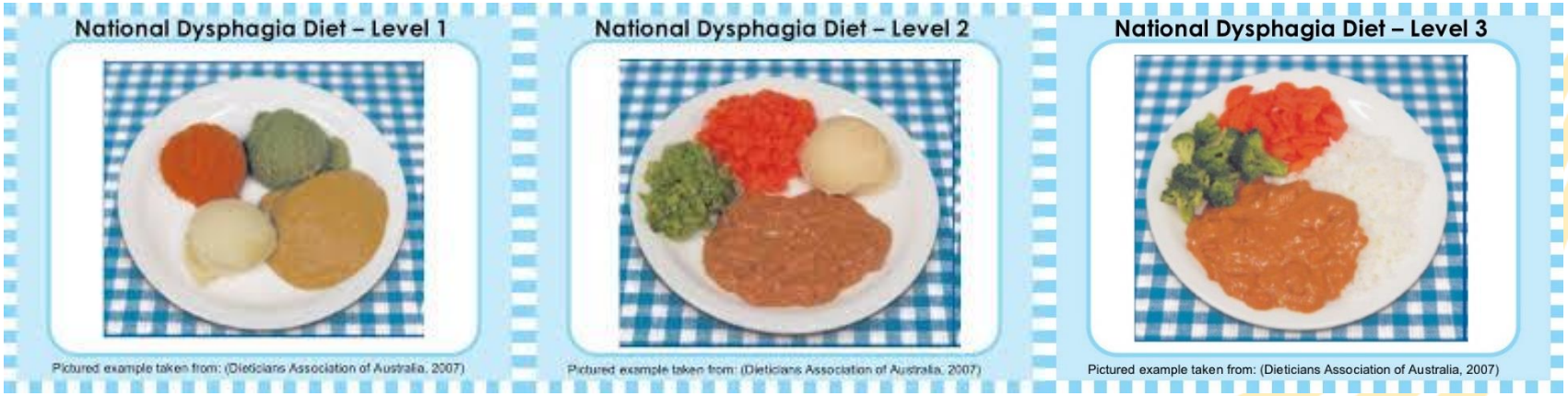
Swallow-safe textural properties

- Soft
- Moist
- Homogeneous
- Cohesive
- Slippery
- Non-sticky
- Non-adhesive
- Easily broken fibers

Cichero JAY. Adjustment of food textural properties for elderly patients. Journal of Texture Studies 2016; 47: 277–283.

American Dietetic Association's National Dysphagia Diet

NDD Level		Characteristics
1	Dysphagia Pureed	Very cohesive, pudding-like, does not require chewing
2	Dysphagia Mechanically Altered	Semisolid, requires chewing ability
3	Dysphagia Advanced	Soft solid, requires more chewing



New grouping of thickening level proposed by Japanese Society of Dysphagia Rehabilitation

	Level 1 Mildly thick	Level 2 Moderately thick	Level 3 Extremely thick
Features (in swallowing)	• Appropriate to express by 'drink' • Spreadable in the mouth • *Toromi* not being concerned about for some liquids depending on the kind, taste, and temperature • Large force unnecessary in swallowing • Easy to swallow through a straw	• Viscous to be detected • Appropriate to express by 'drink' • Smooth but not so spreadable in the mouth • Cohesive on the tongue • Perceiving a resistance to swallow through a straw	• Apparently viscous to be detected • Easy to form bolus • Appropriate to express by 'eat' using a spoon • Difficult to swallow through a straw
Features (in appearance)	• Easy to slide on spoon surface when tilted • Flowing quickly through inbetw-een forks • Trace of flow on cup surface when tilted to pour off	• Slidable on spoon surface when tilted • Flowing slowly through in-between forks • Thin film formation on cup sur-face when tilted to put off	• Shape retention and resistant to slide on spoon surface when tilted • Cannot flow through in-between forks • Not flowing out of cup when tilted or flowing slowly as one cohesive bolus
Viscosity (mPas)*	50-150	150-300	300-500
LST value (mm)†	36-43	32-36	30-32

*Measuring at 50/s at 20C

†Pouring 20 ml sample into a cylinder of 30 mm in diameter, drawing it up, and measuring the length of the spread after 30 sec or determination of Line Spread Value.

Funami T. The formulation design of elderly special diets. Journal of Texture Studies. 2016; 47:313-322.

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International Dysphagia Diet Standardization Initiative

IDDSI
International Dysphagia Diet Standardisation Initiative

How to compensate for chewing and swallowing dysfunction?

- Physical properties of food
  - Taste and smell
  - Texture: hardness, viscosity, cohesiveness
  - Appearance
- Food preference
  - Culture, experience, memory
- Diet environment
  - Cleanliness
  - Posture
  - Socialization

Prof. Yoshiaki Yamada, Tokyo Dental College, Japan

Modulation of swallowing

- Sensory input (olfaction, taste, texture, etc.)
- Central coordination within brain
  - Pleasantness/Unpleasantness
  - Like/Dislike
- Food components
  - Basic taste: umami
  - Trigeminal sensation: red pepper (capsaicin, capsiate), mint (menthol), wasabi (arylisothianate)
- Odorants (black peppers aroma)




Texture modification

- Modification of rheological properties (viscosity, thickness, consistency)
  - Size reduction, mincing
  - Texturizing: hydrocolloids, enzymes
  - Processing
- Factors affecting rheological properties
  - Composition
  - Serving temperature
  - Storage time

Processing technologies for texture modification

- Enzymatic treatments
- High pressure processing
- Pulsed electric field
- Sonication
- 3-D printing
- Electrospinning

Aguilera JM, Park DJ. Texture-modified foods for the elderly: Status, technology and opportunities. Trends in Food Science & Technology 2016; 57:156-164.

Texture modifier

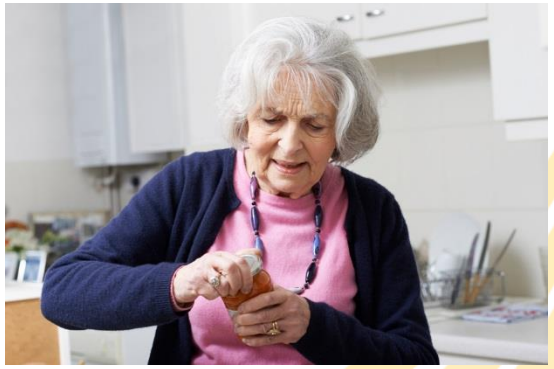
- Thickening agents: xanthan, gellan, gelatin, glucomannan, alginate, carrageenan, carboxymethyl cellulose

Texture-modified food

PACKAGING AND LABELING

Universal design for packaging

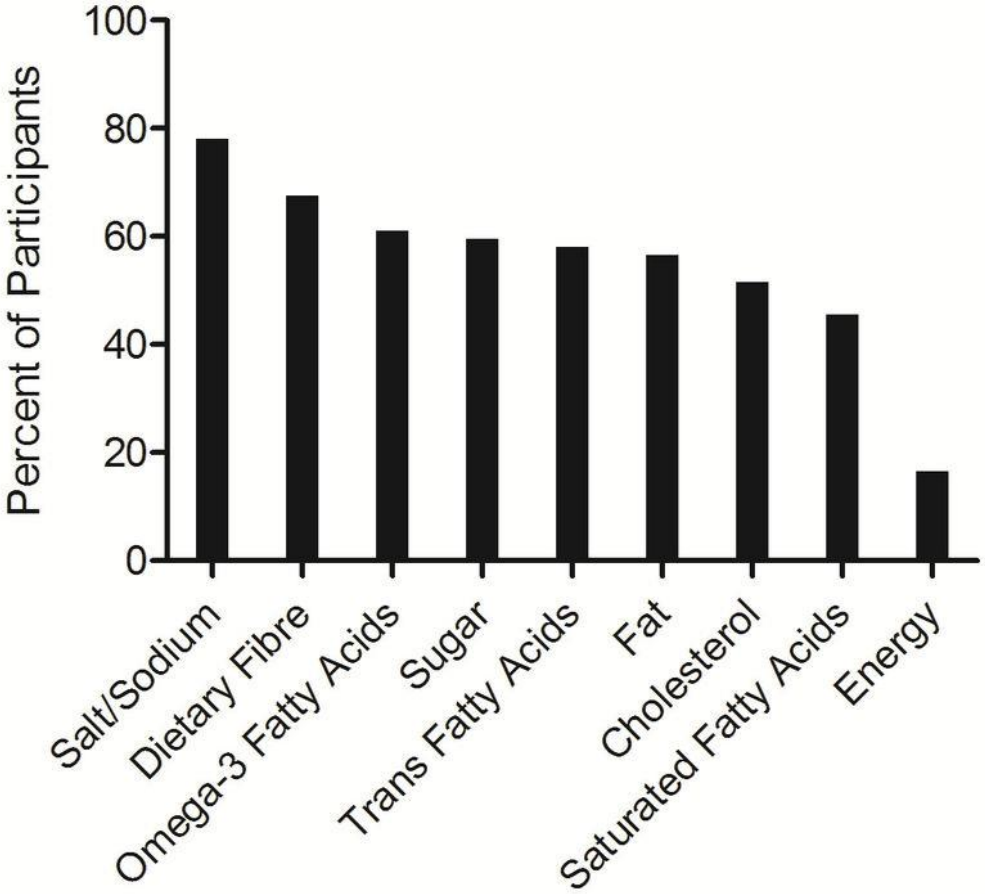
- Clear detail of food and ingredient list
  - Layout
  - Font
  - Color contrasts
  - Claims
- Contain visual symbols
- Easy to open/use, table-ready
- Easy to carry/handle/squeeze
- Safe to use
- Resealable
- Disposable



Labeling and claims

- ~~"Food for the elderly"~~
- ~~Rational claims~~
  - "Increase your muscle strength"
- Emotionally meaningful claims
  - "Increase your wellbeing"
- ~~Unfamiliar, scientific name of functional ingredients~~
  - β-glucan
- Common, understandable name of functional ingredients
  - Dietary fiber

Nutrient content claim would increase elderly's functional food consumption



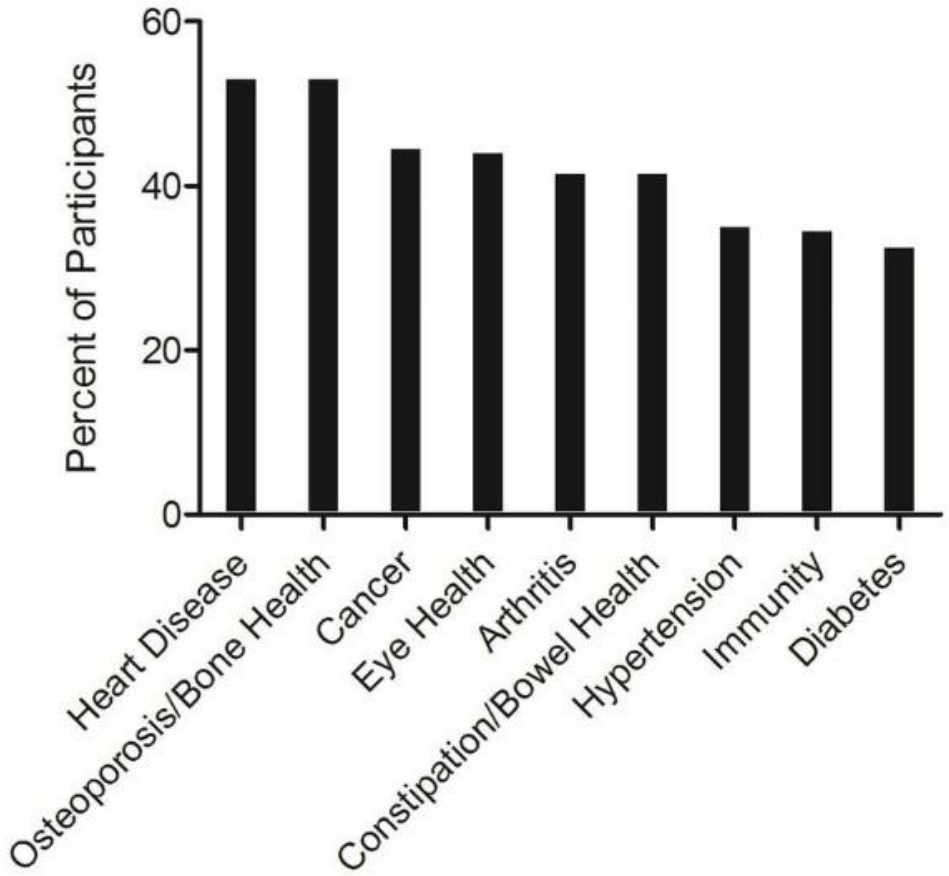
Vella MN, Stratton LM, Judy Sheeshka J, Duncan AM. Functional food awareness and perceptions in relation to information sources in older adults. Nutrition Journal 2014; 13:44. https://doi.org/10.1186/1475-2891-13-44.

Nutrient function claim would increase elderly's functional food consumption

Function or biological role	Percent of participants (n = 200)
Helps lower cholesterol	60.5
Factor in the formation and maintenance of bones and teeth	56.5
Dietary antioxidant	55.5
Factor in the maintenance of good health	44.5
Helps build antibodies	44.5
Promotes regularity	42.5
Helps build and repair body tissues	40.0
Aids in maintaining the health of skin and membranes	34.0
Aids in red blood cell formation	34.0

Vella MN, Stratton LM, Judy Sheeshka J, Duncan AM. Functional food awareness and perceptions in relation to information sources in older adults. Nutrition Journal 2014; 13:44. https://doi.org/10.1186/1475-2891-13-44.

Risk reduction claim that would increase elderly's functional food consumption



Vella MN, Stratton LM, Judy Sheeshka J, Duncan AM. Functional food awareness and perceptions in relation to information sources in older adults. Nutrition Journal 2014; 13:44. https://doi.org/10.1186/1475-2891-13-44.

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FOOD PRODUCTS FOR ELDERLY

Food product for elderly

- Ordinary food
  - Regular food that provide nutritional and physical quality meeting the need of elderly
- Universal design food
  - Food developed for elderly who need caretaker (stay-at-home or stay-on-bed)
- Food of special dietary uses: medical food, blenderized food for nasogastric tube feeding

Ordinary food

- Nutrient-enriched
- Low/reduced sodium
- High dietary fiber
- High calcium
- Containing bioactive compounds

Nutrient-enriched food

- Nutrient dense
- Look just like normal food products
- More acceptable as source of nutrients to elderly than traditional food supplements
- Not all combinations of base product and functional ingredients are well-accepted by consumers

High protein products for elderly

High Protein Pastry

- 18% protein (milk, pea, lupine)
- Less sugar and fat

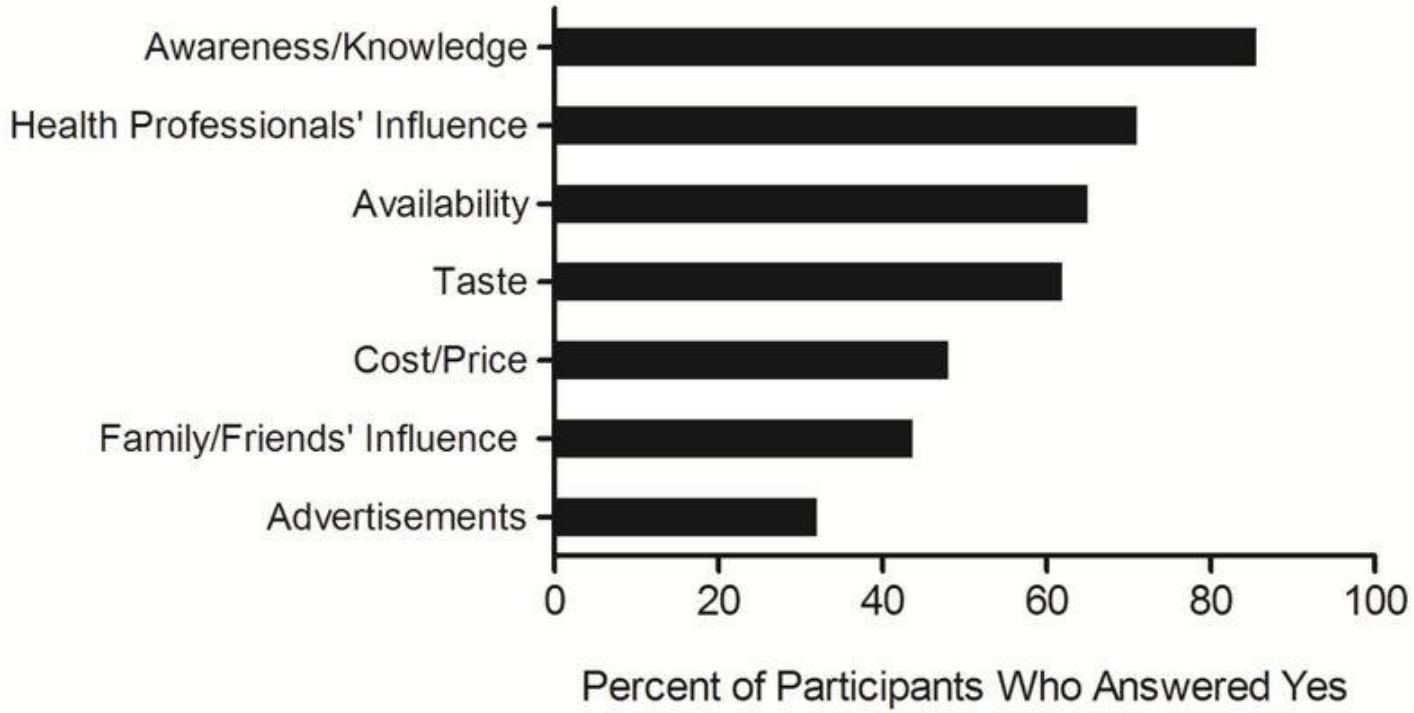
Protein-enriched vegetable soups and fruit juices

- 7% protein

Trends of functional food for elderly

- Food for heart (energy, cholesterol, potassium)
- Food for digestive system (probiotic, dietary fiber)
- Food for bone (calcium, vitamin D)
- Food for brain and memory (omega-3 fatty acids)
- Food for joint (glucosamine)
- Food for skin (collagen, antioxidant)
- Food for eyesight (vitamin A, antioxidant)
- Food for prevention/care of chronic diseases

Factors reported to increase elderly's functional food consumption



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Universal Design Food

- For daily meals or people who need nursing cares
- Good for a wide range of people due to its ease of consumption
- Concerning difficulties of chewing and swallowing
- Classified into 4 groups depending on the hardness and stickiness of the foods
- Special mark on the packages

Universal Design Food (Cont.)

CALSSIFICATIONS				
Classification	Standard Of Chew	Standard Of Swallow	Hardness (N/m^2)	Products
区分1 容易にかめる ABLE TO CHEW EASILY	Contain hard and big ingredients, a little hard to swallow	Able to swallow commonly	$5x10^6$	Rice porridge, omelet, grilled fish
区分2 歯ぐきでつぶせる ABLE TO SMASH WITH GUMS	Contain hard and big ingredients, not easy to swallow	Depends on ingredients, hard to swallowing	$5x10^4$	Rice porridge, boiled fish, soft omelet
区分3 舌でつぶせる ABLE TO SMASH WITH TONGUE	Contain soft and small ingredients, easy to swallow	Have experience hard to swallow water or liquid ingredients	Sol: $1x10^4$ Gel: $2x10^4$	Rice congee, boiled fish, scrambled egg
区分4 かまなくてよい ABLE TO SWALLOW WITHOUT CHEW	Hard to swallow if contain solid food	Hard to swallow water or liquid ingredients	Sol: $3x10^3$ Gel: $5x10^3$	Rice gruel, steamed egg

Universal Design Food (Cont.)

Food for dysphagia

亀田製菓

ข้าวต้ม

ホリカフーズ

Protein-reinforced porridge

ข้าวเกรียบญี่ปุ่น

東洋クリエート

甘酒 jelly

Prof. Dr. Yoshiaki Yamada, Tokyo Dental College, Japan

Thickened fluids and puree desserts

Technological challenges

- Products with functional ingredients
- Products with reduced fat/salt/sugar
- Non-traditional processing technology
- Masking of off-flavor
- Texturization
- Consumer acceptability

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