Sensory Quality Aspects of Yoghurt

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Dairy Australia/NCDEA

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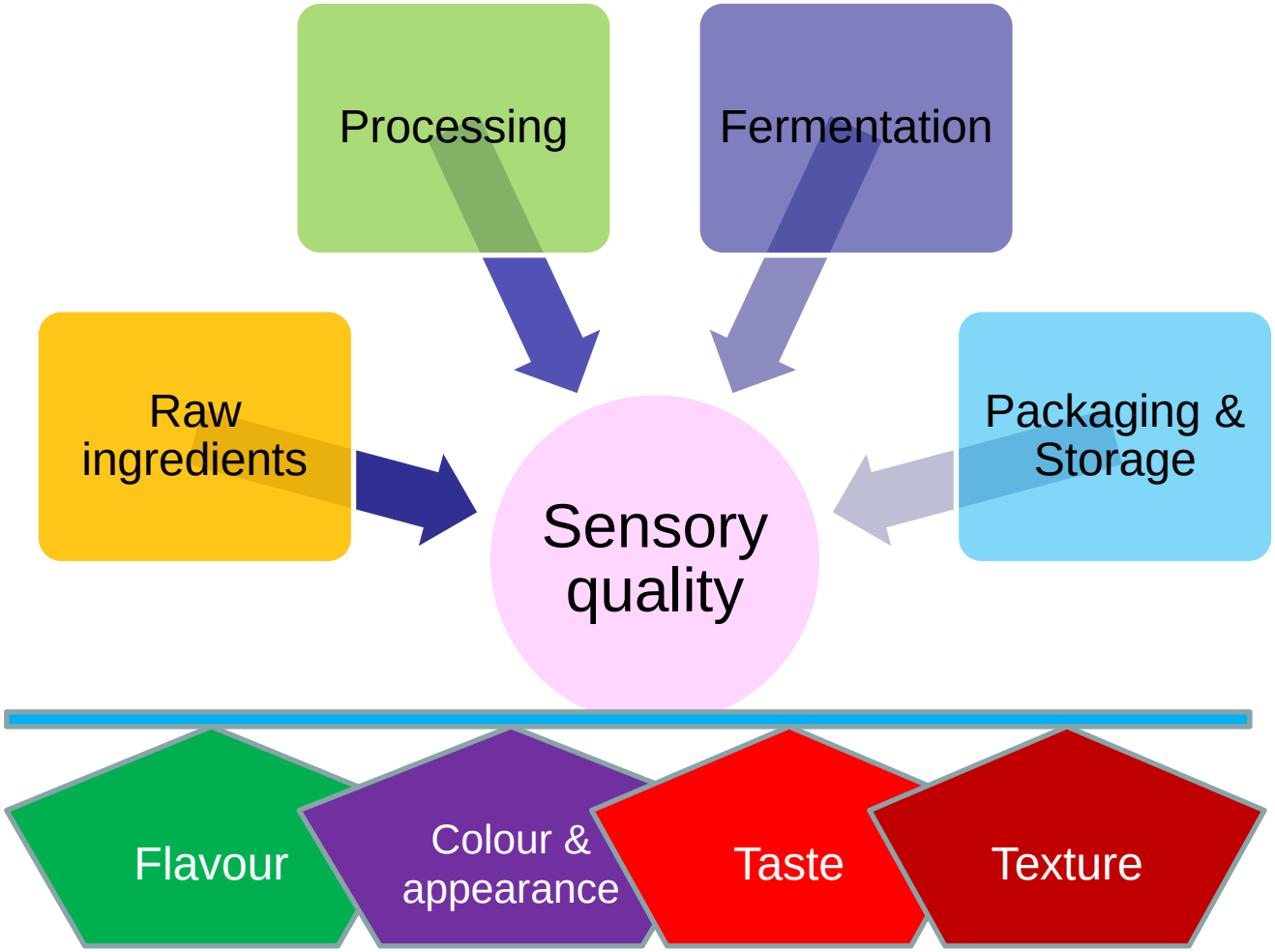
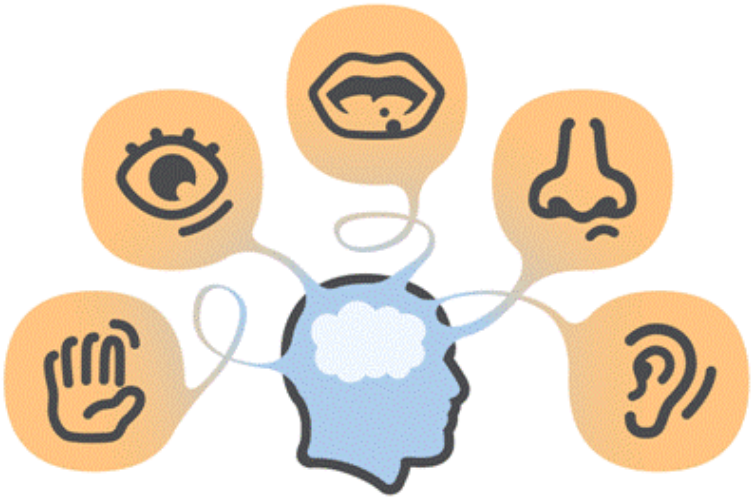
Sensory quality of yogurt – background



Sensory quality of yogurt – background

- Combination of
  - Flavour
  - Colour & Appearance
  - Taste
  - Texture
  - (Feel/Touch)
  - (Sound)



Characterising sensory quality of yogurt - background

- Flavour - chemical compounds in milk and those produced during processing and fermentation of milk
  - Instrumental methods
- Appearance - the colour and visual separation of whey
  - Functionality methods
- Texture - strength of the gel network
  - Instrumental methods
- Taste & flavour - acidicity, sweetness, bitterness etc
  - Trained & consumer sensory panels

Presentation Outlines

- Yogurt – definition, trends & products in Australia
- Factors affecting the quality of yogurt during manufacture
- Flavour compounds in yogurt
- Measuring physical properties
- Measuring consumer sensory properties
- Summary - quality defects in yogurt and possible causes for defects

Definition – FSANZ Standard 2.5.3 – Fermented Milk Products

- **Fermented milk** means a milk product obtained by fermentation of milk and/or products derived from milk, where the fermentation involves the action of micro-organisms and results in coagulation and a reduction in pH
- **Yoghurt** means a fermented milk where the fermentation has been carried out with lactic acid producing micro-organisms

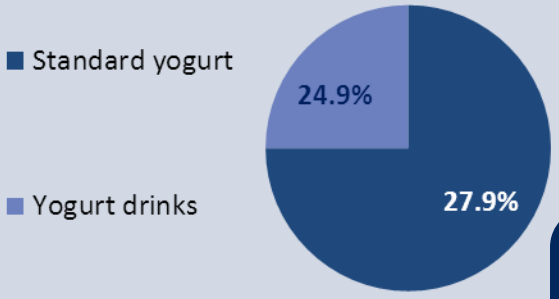
FSANZ – Standard 2.5.3 –Fermented Milk Products

- Fermented milk may contain other foods.
- Micro-organisms used in the fermentation of fermented milk must remain viable in the product
- Fermented milk and the fermented milk portion of a food containing fermented milk must contain each component shown below

Component or parameter	Proportion
Protein (measured as crude protein)	Min 3.0% w/w
pH	Max 4.5
Microorganisms from added culture	Min 10^6 cfu/g

Global yogurt market

Market value by category, 2011, global



Fastest growing categories by value, 2011–15, global

Standard yogurt	+4.43%
Yogurt drinks	+4.92%

Yogurt* represented $51bn in global spending in 2011

Top 10 markets by value ($m), 2011

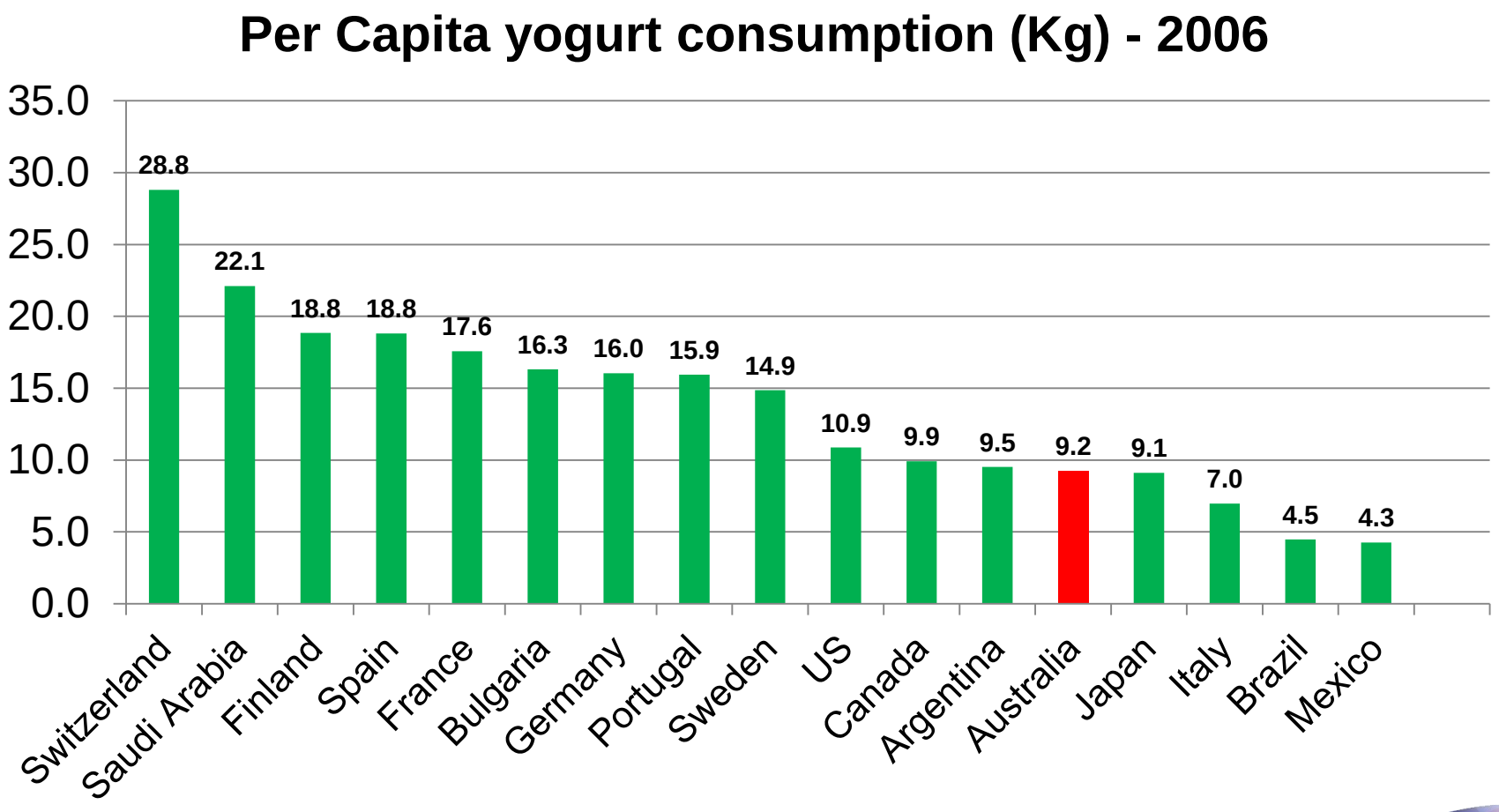
China	7491.5	Netherlands	2586.7
US	6252.3	Italy	2268.6
France	3131.4	UK	2019.0
Germany	3018.2	Brazil	1282.3
Japan	3014.5	Spain	1261.2

Top 10 markets by per capita expenditure ($), 2011

Netherlands	153.5	Norway	75.5
Slovenia	89.6	Denmark	60
Switzerland	86.4	Estonia	59.4
Ireland	78.3	Portugal	57.6
Finland	75.3	Belgium	56.9

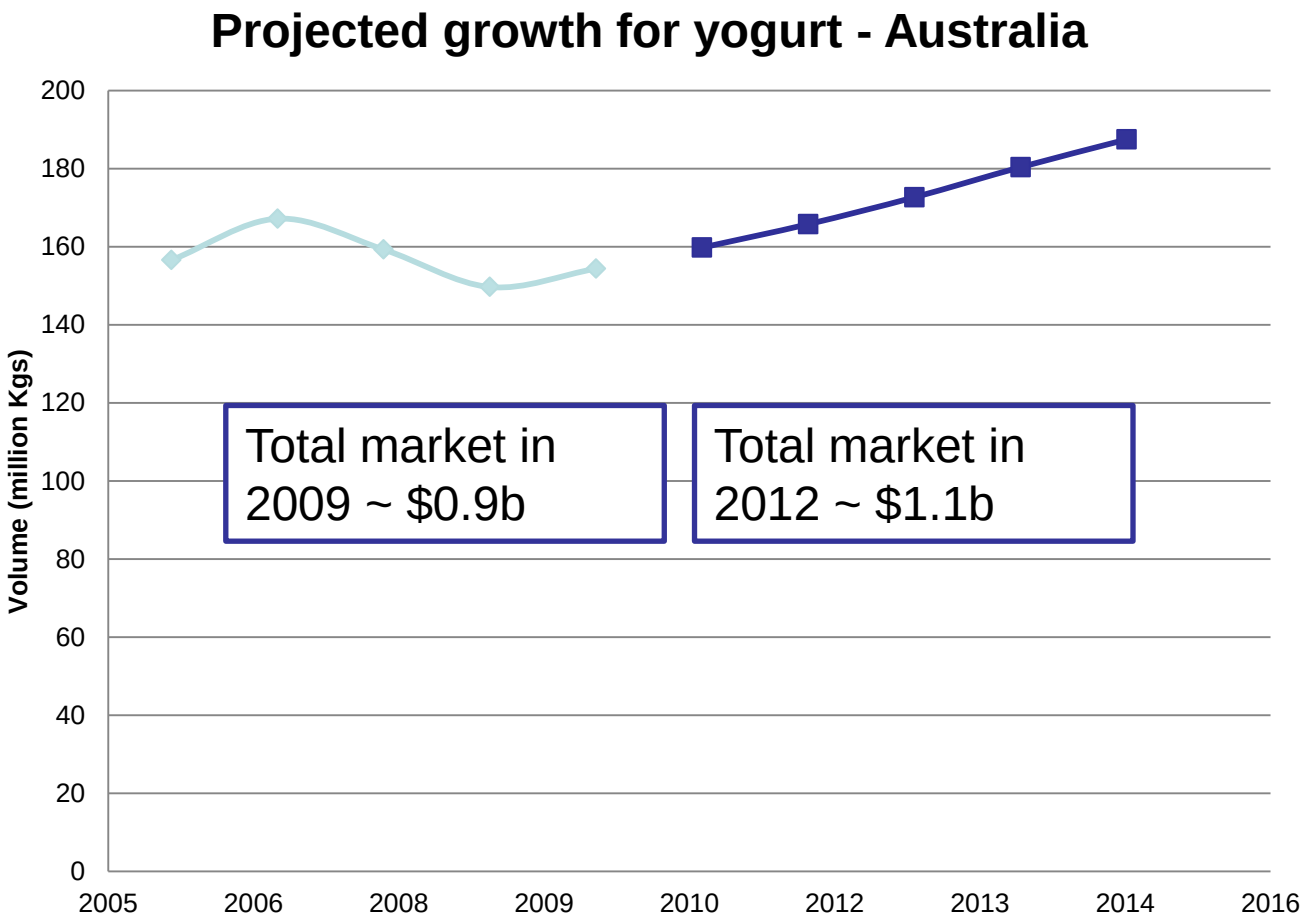
Datamonitor, 2012

Yogurt consumption



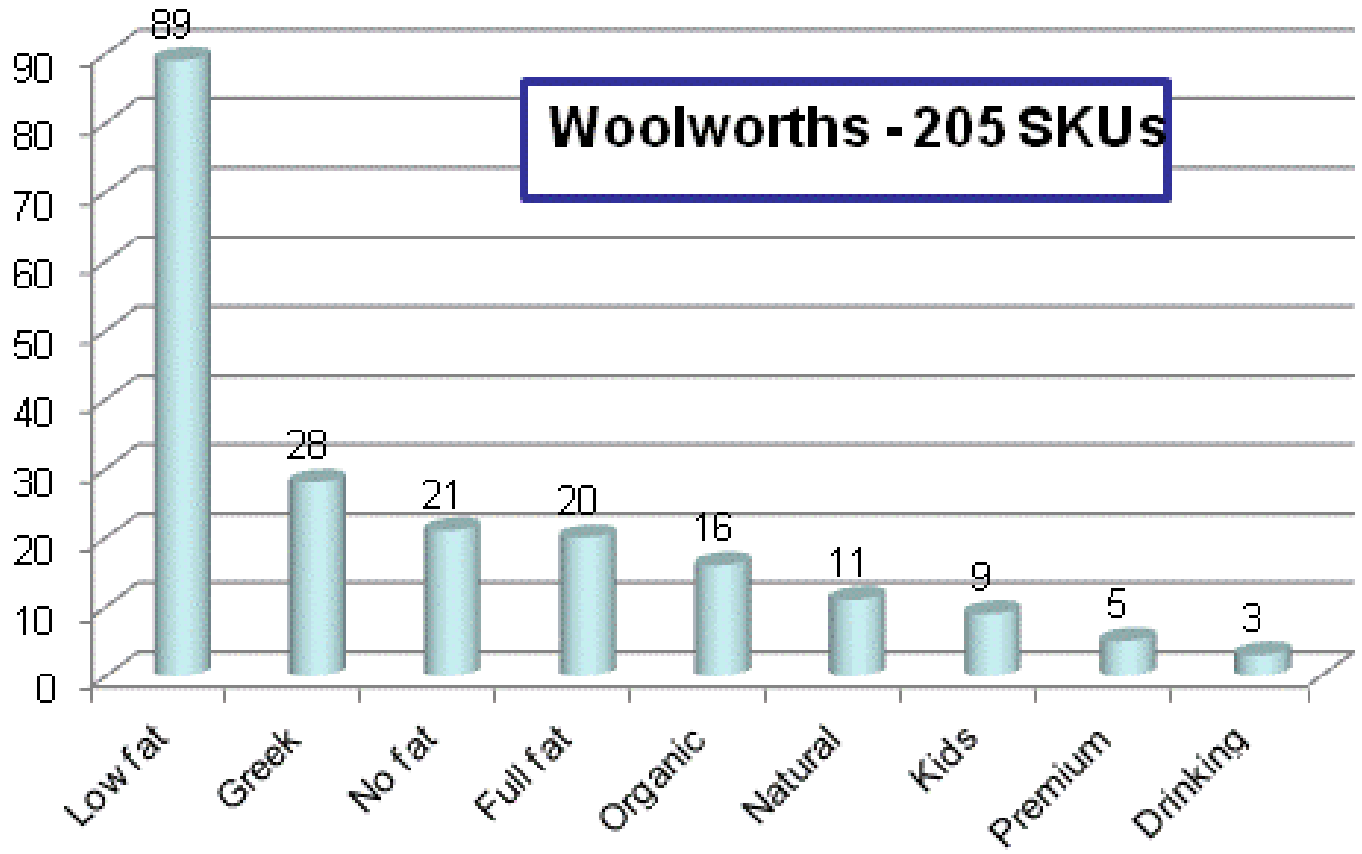
Source: Euromonitor

Market growth for yogurt

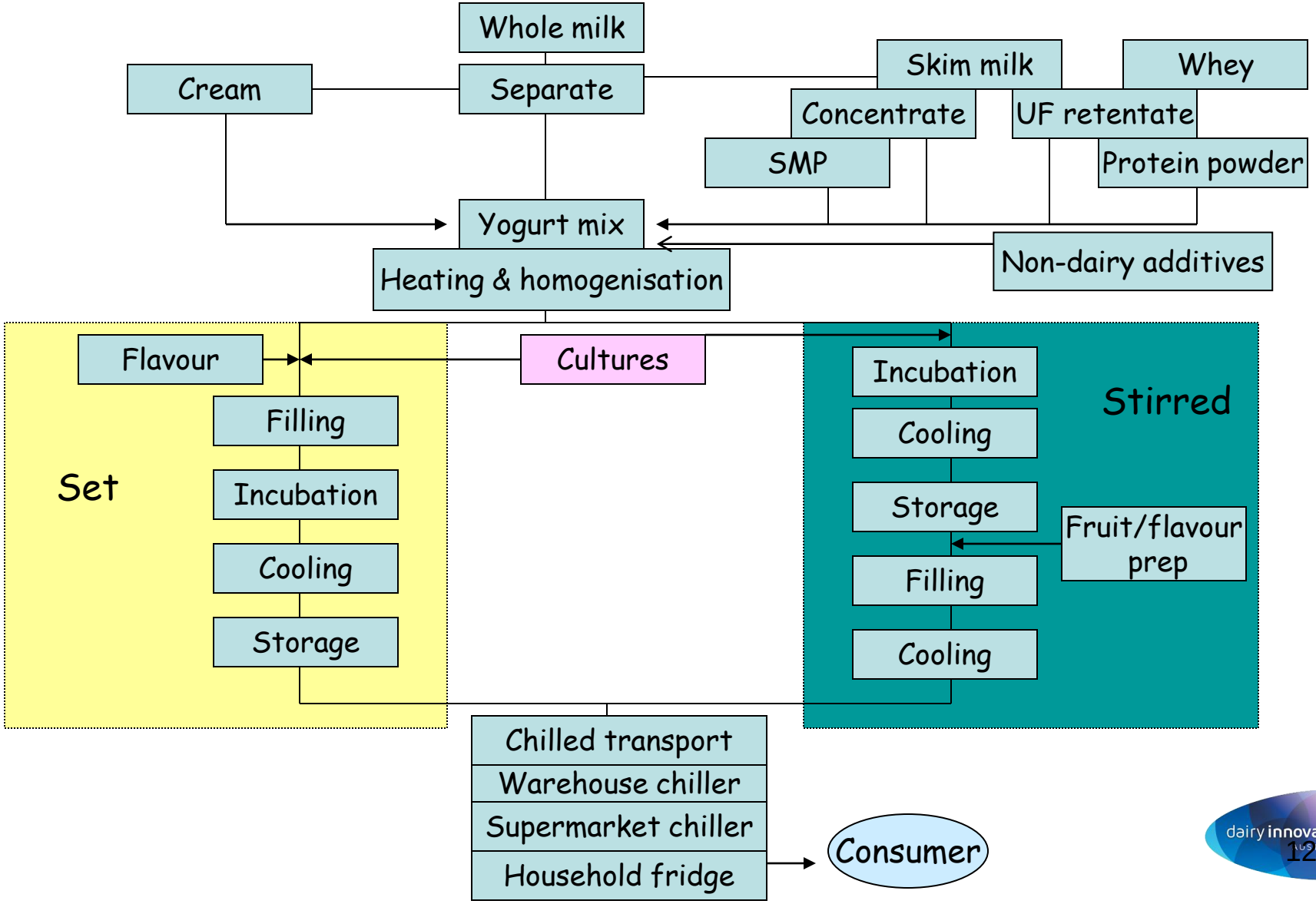


Datamonitor, 2012

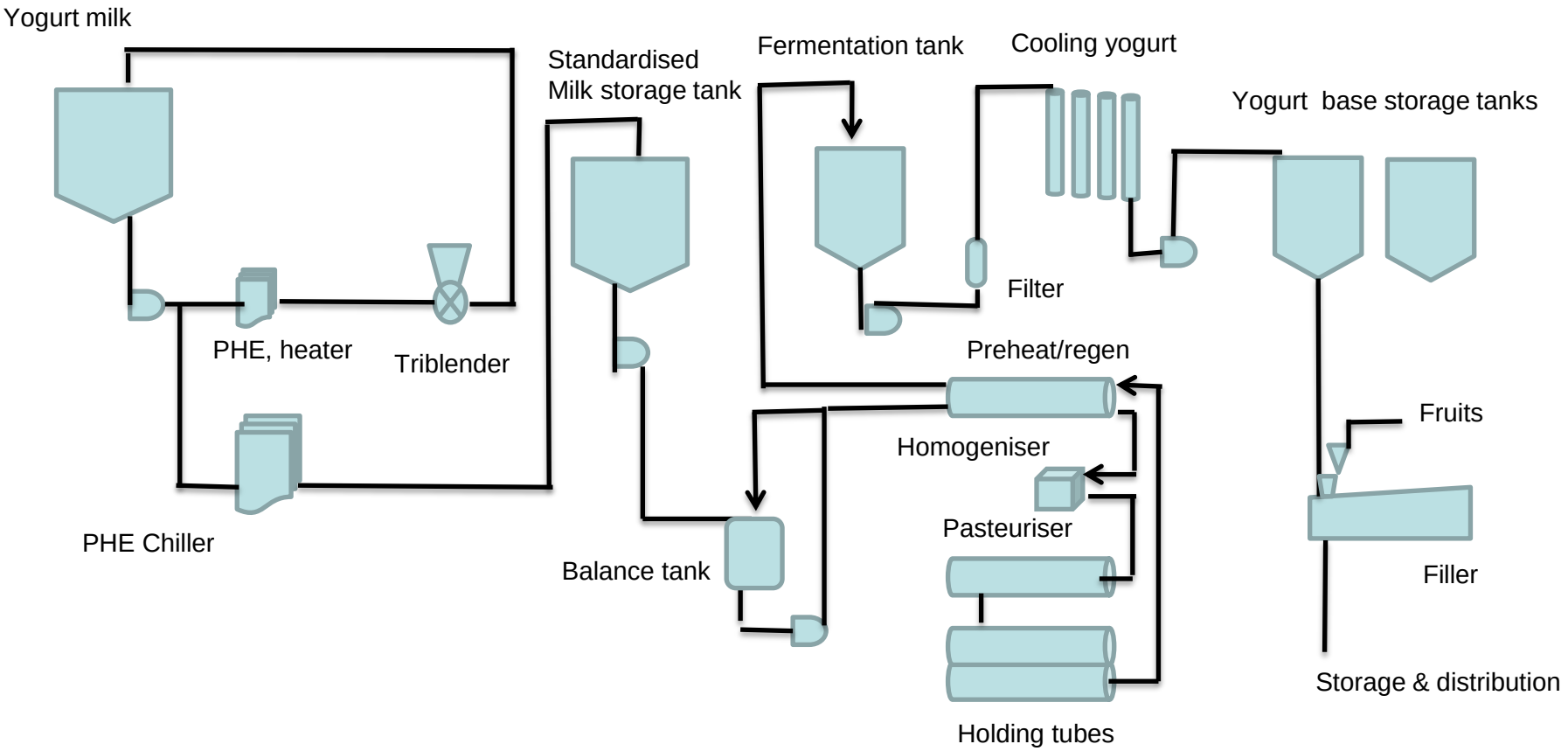
Yogurt types in Australia – August 2012



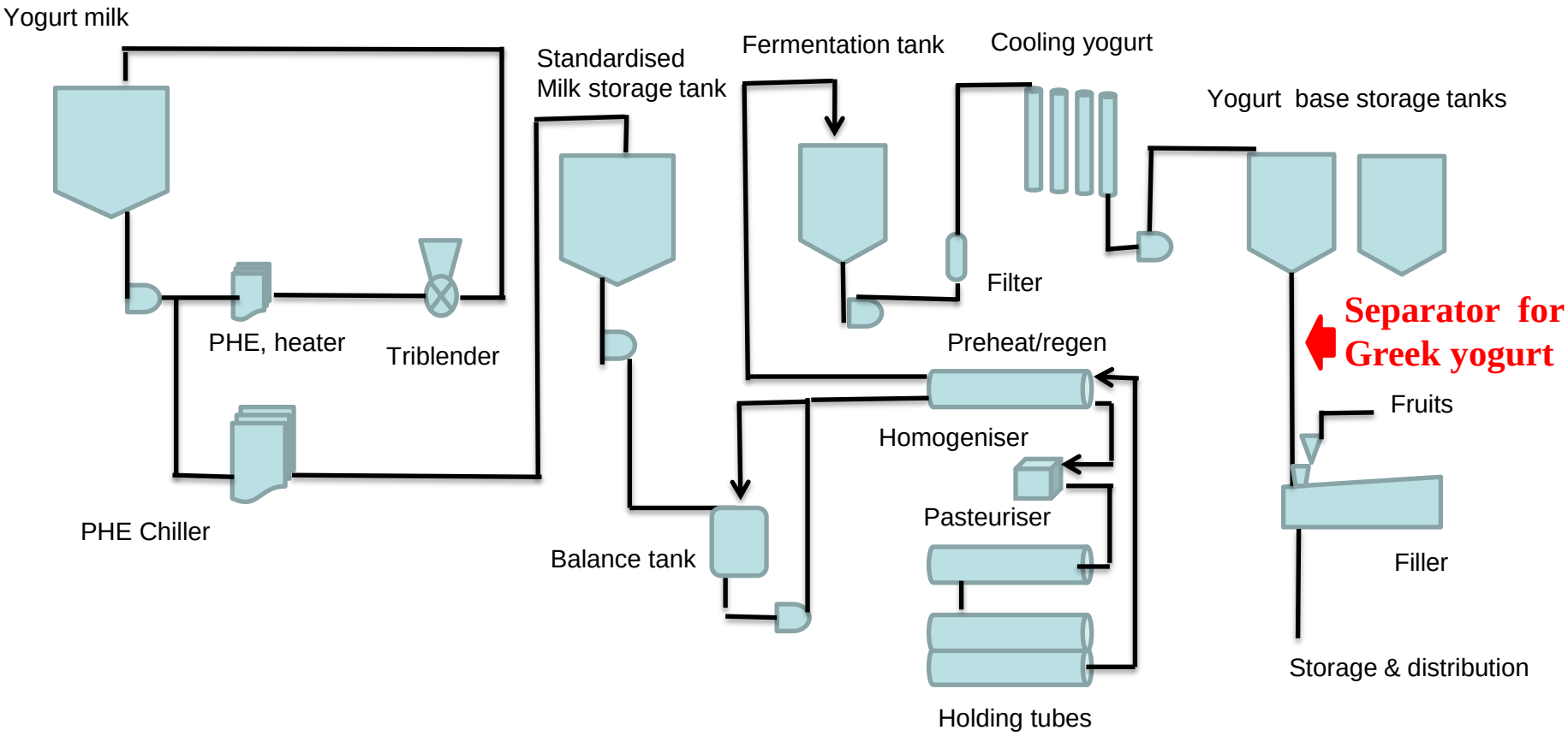
Basic scheme for yogurt manufacture



Basic factory layout for yogurt manufacture



Basic factory layout for yogurt manufacture



Factors affecting quality of yogurt

- Raw materials
  - Raw milk, skim milk, cream, sugar, cultures, milk concentrate, milk powders, fruit/fruit conserves, stabilisers, flavours and colours
  - All can contribute micro-organisms and chemicals that affect the quality
  - Changes in the source and supply will cause variation in factors that can influence shelf life
  - Partnerships with approved suppliers and agreed specifications are recommended

Factors affecting quality of yogurt

- Raw materials – Milk
  - Variability in protein, lactose, fat and microbial flora
  - Variability in breeds of cattle, season and region
  - Milking & storage conditions the farm
- Raw materials - cream
  - Depends on the quality of milk used for separation
  - Methods of handling before and after pasteurisation
  - Susceptibility to lipolysis due to high fat (potential for rancid taste)

Quality of milk is crucial for final yogurt flavour

- Milk is an extremely complicated entity which is comprised of lipids, proteins, carbohydrates, and minerals, and over 400 volatile compounds have been identified in milk products
- The underlying flavor of yogurt arises principally from the native volatile constituents in cow's milk, influenced by pasteurization, fermentation, processing, and storage. A large number of the volatile organic compounds found in yogurt are not produced by the starter bacteria but originate from the milk

Quality criteria for raw milk

- Low natural microflora
- Free from antibiotics, sanitising chemicals
- No contamination from mastitis milk and colostrums
- Free from rancidity
- Free from bacteriophages
- Free from hormones
- Stored below 5C

ABC flavour defects in raw and/or pateurised milk

- **A**bsorbed/Transmitted
- **B**acterial/Microbial
- **C**hemical/Enzymatic/Processing
  - A
    - Feedy, barny, cowy, weedy, unclean, lacks freshness, stale, refrigerator/cooler odors
  - B
    - Acid, bitter, malty, lacks freshness, unclean, fruity/fermented, putrid and rancid
  - C
    - Cowy (ketosis), salty, rancid, bitter, oxidized, sunlight, foreign, astringent, medicinal, flat, cooked

Factors affecting quality of yogurt

- Raw materials – concentrates
  - Manufactured by either evaporation or membrane concentration
  - Quality of raw milk is important
  - Handling conditions before, during and after concentration
  - Heat stability of milk
  - Microbial flora should be low in thermodurics
  - Cooling rate and concentration factor can adversely affect the flavour and textural attributes

Factors affecting shelf life of yogurt

- Raw materials –fruits
  - Major areas of concern microbiological quality, fruit ripeness, freshness, presence of pesticides & other agrochemicals
- Raw materials – other ingredients
  - Source of ingredient, approval of supplier, identification of critical control points (CCPs), and hygiene standards are all important

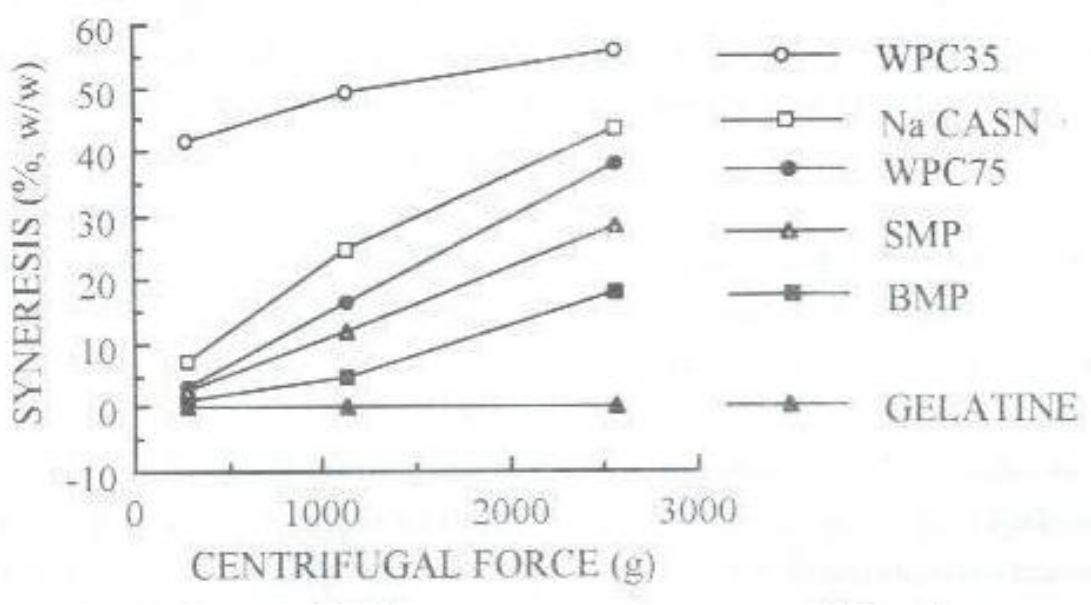
Effects of non-dairy raw materials on sensory of yogurt

Additive	Yogurt	Sensory effects	Reference
Inulin fibre (1%, 2%)	Low fat	No effect for 1, 7 and 14 days	Mazloomi etal 2011
Strawberry vs apple	2.5% fat	Strawberry preferred over apple	Vahadi etal 2008
Soluble (inulin) vs insoluble (grains) fibre	Regular and 30% reduced sugar	Soluble fibre preferred over insoluble in reduced sugar yogurt	Hoppert etal 2013
Apple, bamboo and wheat fibre	Strained yogurt	Bamboo and wheat fibre preferred over apple fibre	Seckin & Baladura, 2012
Chitosan (nano-powdered)	Normal fat	Low levels (0.3 and 0.5%) acceptable	Seo etal 2009
Anti-oxidant (wine grape pomace)	Low fat yogurt	1% addition preferred over 2%	Tseng & Zhao, 2013

Role of milk solids

- Skim milk powder, whey protein concentrates, Caseinates, etc
  - Improves the gel strength and consistency of yogurt
  - Helps in controlling the whey/serum separation
  - Criteria for selection depend on the cost, availability and desired functionality

Yogurt syneresis – effect of milk solids



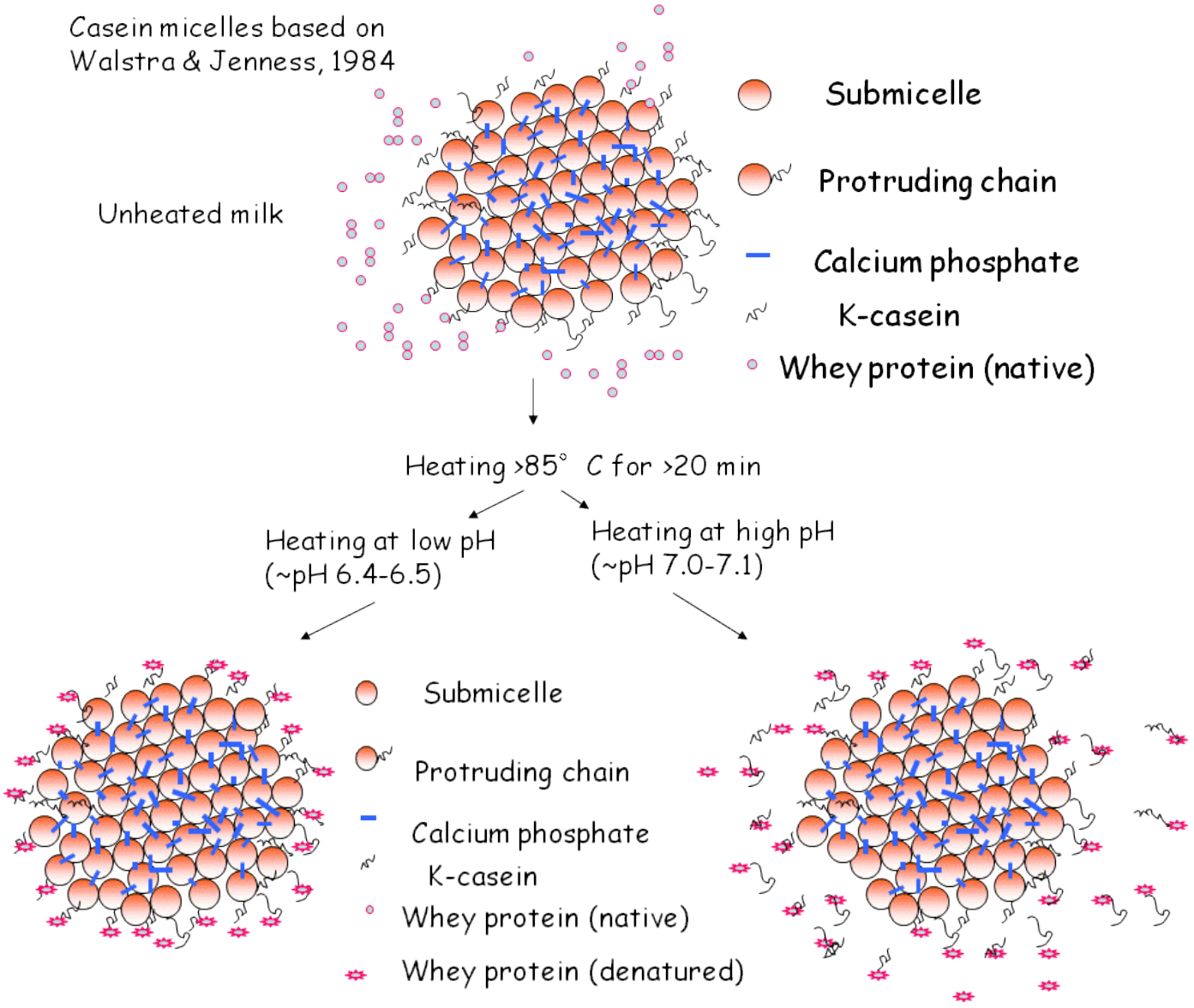
2% fat, 5% protein fortification, Syneresis : 15 g sample, centrifugation 10°C, weighing supernatant

Guinee et al, 1994 2nd Food Ingredients Symposium

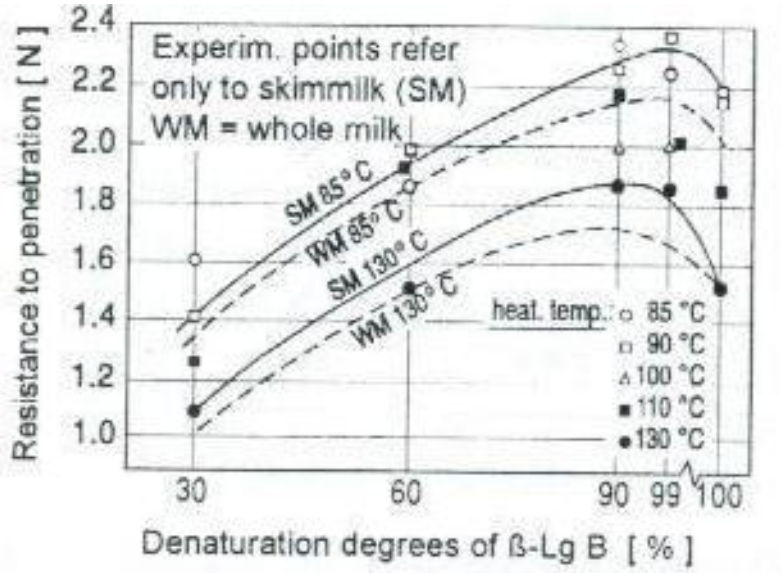
Heat treatment of yogurt milk

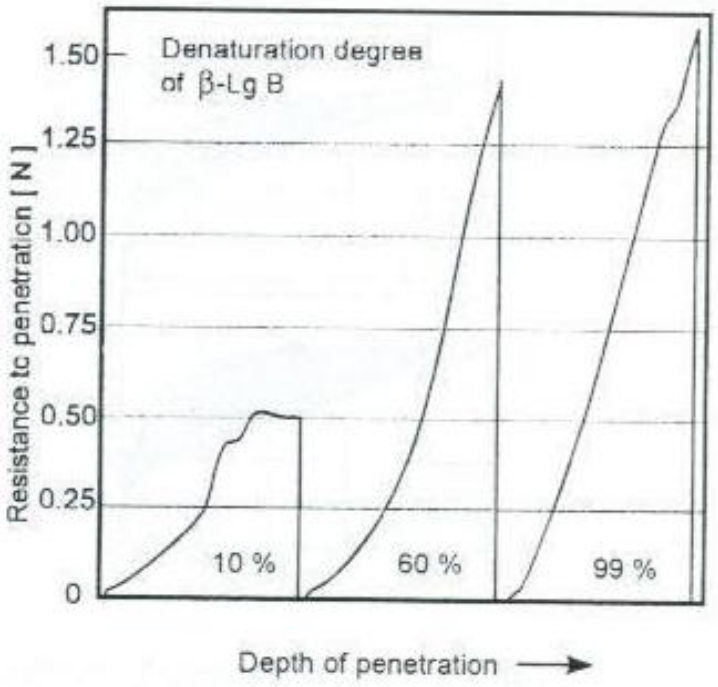
- Yogurt milk is heated at high temperature before starter inoculation
  - Destroys the potential competition for starter bacteria
  - Helps in enhancing the firmness of yogurt gel through denaturation of whey proteins and casein-whey protein interaction
  - Reduces the tendency for whey/serum separation by yogurt during storage
  - Conditions: 85°C/30 min, 90-95°C/5-10 min, 110-120/20-30 s

Major changes in proteins during heat treatment of milk



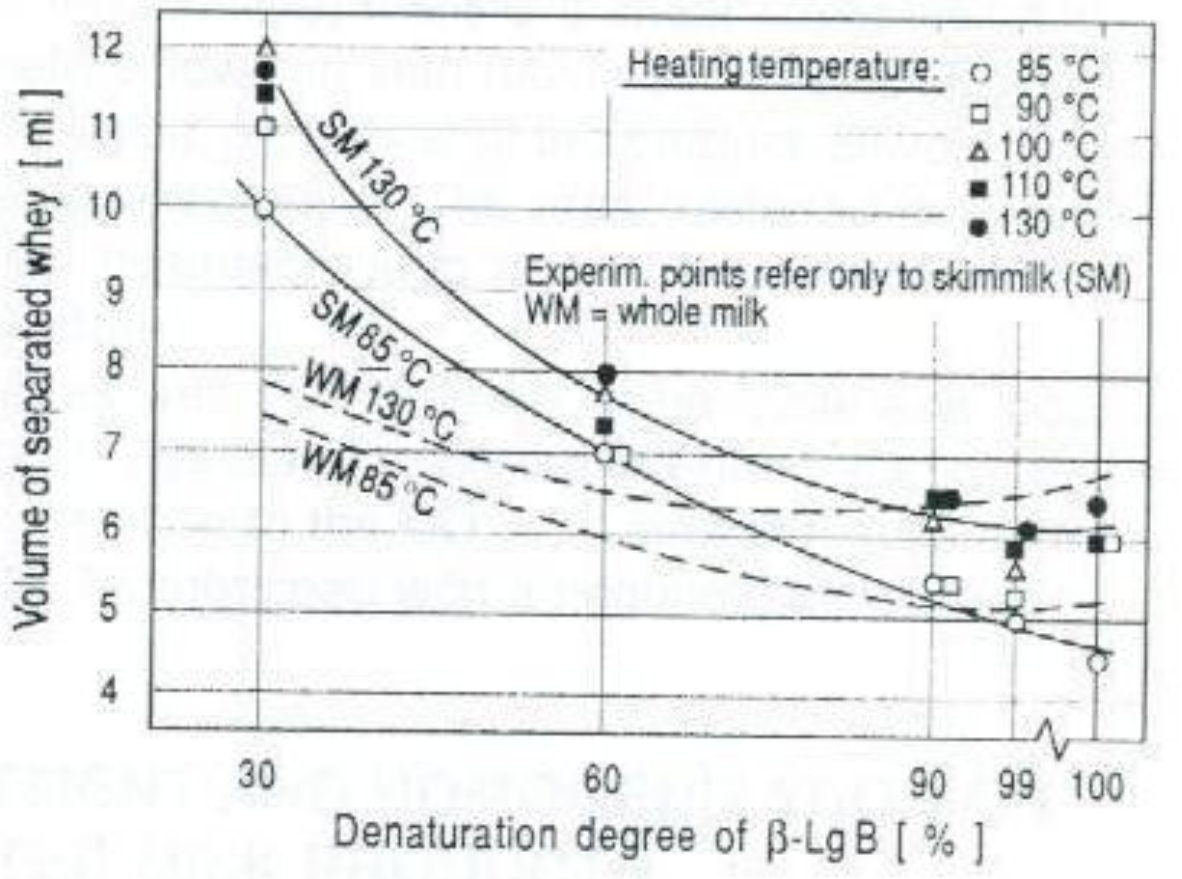
Effect of WP denaturation





Kessler (1998) IDF special issue 199802

WP denaturation – effect on syneresis

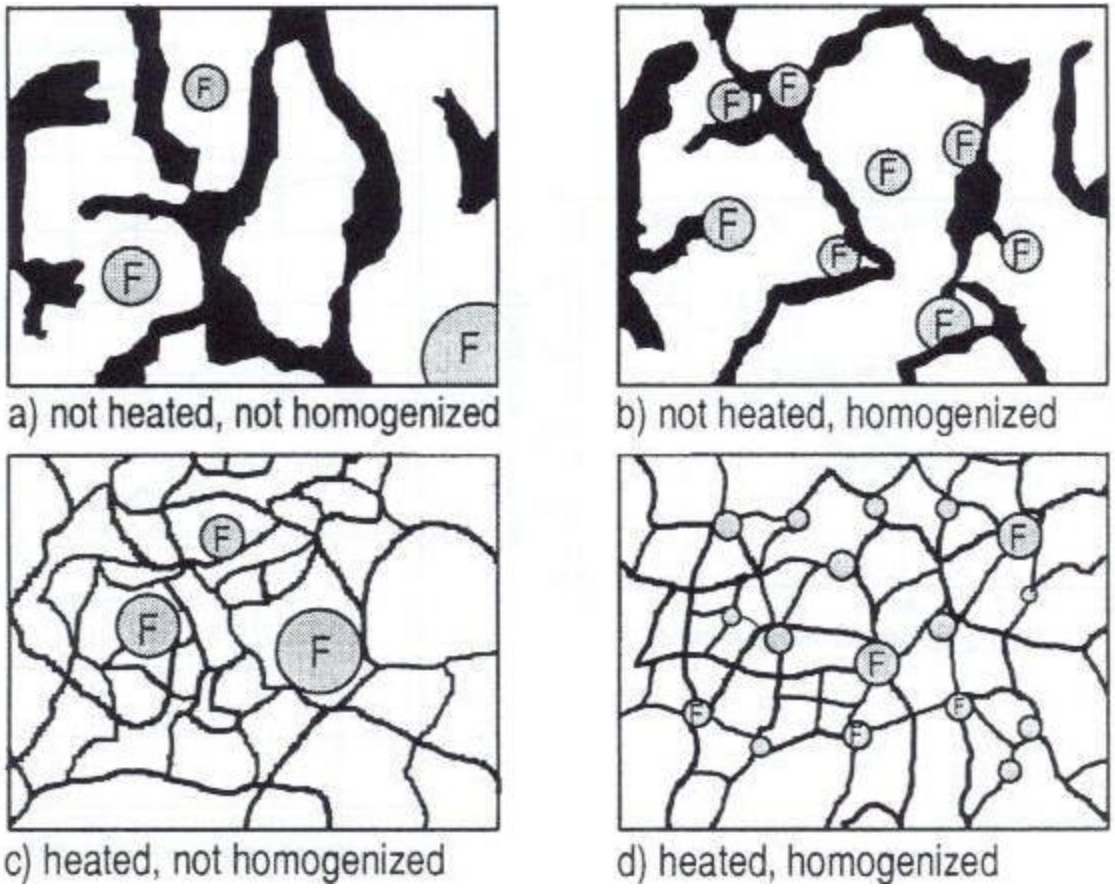


Kessler (1998) IDF special issue 199802

Influence of homogenisation

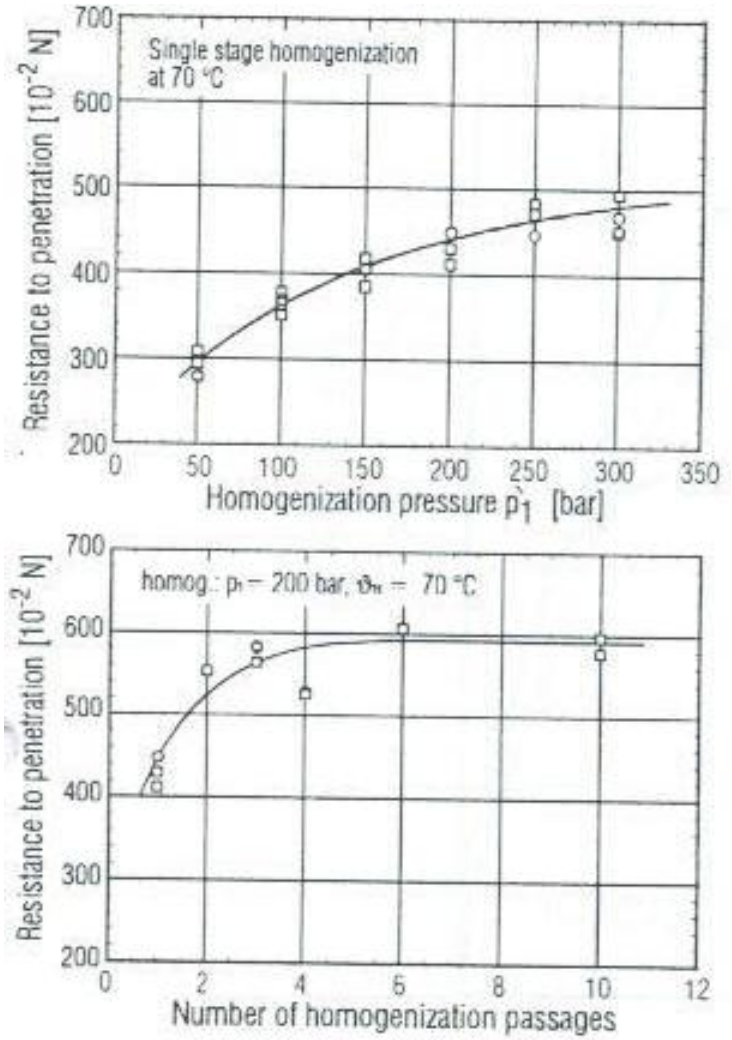
- Mainly affects the fat globule size and the make up of the fat globule surface layers
- Helps in preventing cream separation during fermentation and cooling periods
- Improves the consistency and smoothness of yogurt
- Recommended for full-fat and low-fat yogurt
- Pressure: 20-25 MPa (200-250 bar) at 60-70°C

Yogurt networks



Kessler (1998) IDF special issue 199802

Effect of homogenisation on gel strength



10% fat, 4% protein, 95°C/10 min
Degree of denaturation – 90% Lg B

Kessler (1998) IDF special issue 199802

Yoghurt starter cultures

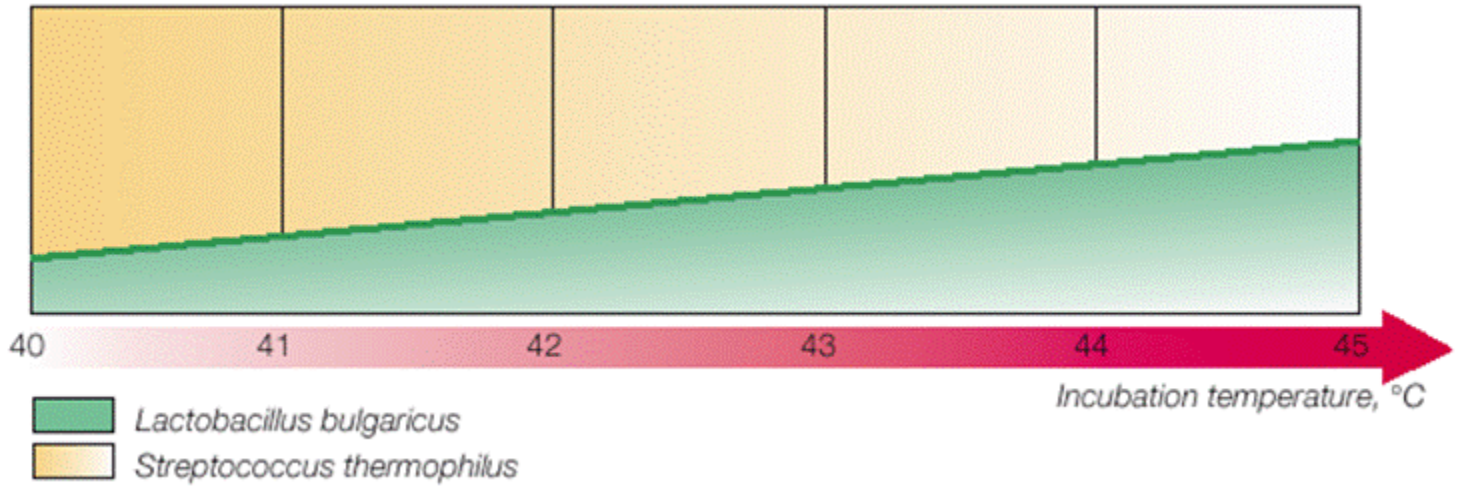
- Growth temperature
  - Mesophilic – *L.lactis, L.cremoris, L.diacetylactis, Leuconostoc* spp.
  - Thermophilic – *S. thermophilus, L. bulgaricus*
  - Mixed mesophilic/thermophilic
- State of delivery
  - Frozen
  - Freeze-dried (lyophilised)
- Probiotic
  - *L.casei, Bifidobacteria, L.acidophilus*
- Direct set
- Traditional cultures (undefined)

http://www.avistorino.it/myweb9/La_Goccia_nello_yogurt.jpg

Delivery forms of starters

- Liquid, for propagation of mother culture (fairly rare)
- Deep-frozen, concentrated for propagation of bulk starter
- Deep-frozen, super-concentrated cultures in readily soluble form, for direct inoculation
- Freeze-dried, concentrated in powder form, for propagation of bulk starter or direct inoculation

Effect of incubation temperature on yogurt starter cultures

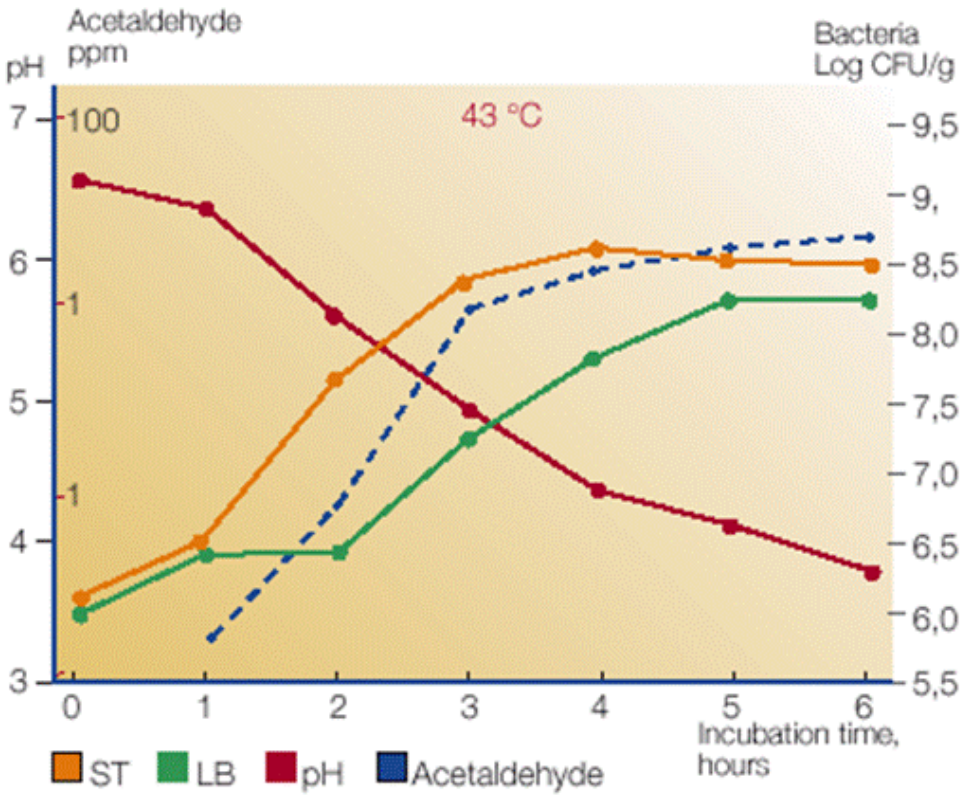


Dairy Processing Handbook, 2003

Yoghurt starter symbiosis

- *Streptococcus salivarius* subsp. *thermophilus (ST)*
  - Grows faster than LB
  - Produces acid plus carbon dioxide (help in the growth of LB)
  - Responsible for initial drop in pH (to ~5.0)
- *Lactobacillus delbrucii* subsp. *bulgaricus (LB)*
  - More proteolytic activity than ST - produce peptides and amino acids (stimulate the growth of ST)
  - Helps to drop pH below 5.0

Starter growth with pH change and flavour development (2.5% starter addition)



Dairy Processing Handbook, 2003

Role of starter in flavour development

ug/g yogurt)

Organism	Acetaldehyde	Acetone	Acetoin	Diacetyl
S. thermophilus	1.0 to 13.5	0.2 to 5.2	1.5 to 7.0	0.1 to 13.0
Lb. delbruekii subsp. *bulgaricus*	1.4 to 77.5	0.3 to 3.2	Trace to 2.0	0.5 to 13.0
Mixed cultures	2.0 to 41.0	1.3 to 4.0	2.2 to 5.7	0.4 to 0.9

Source: Tamime and Robinson 2007.

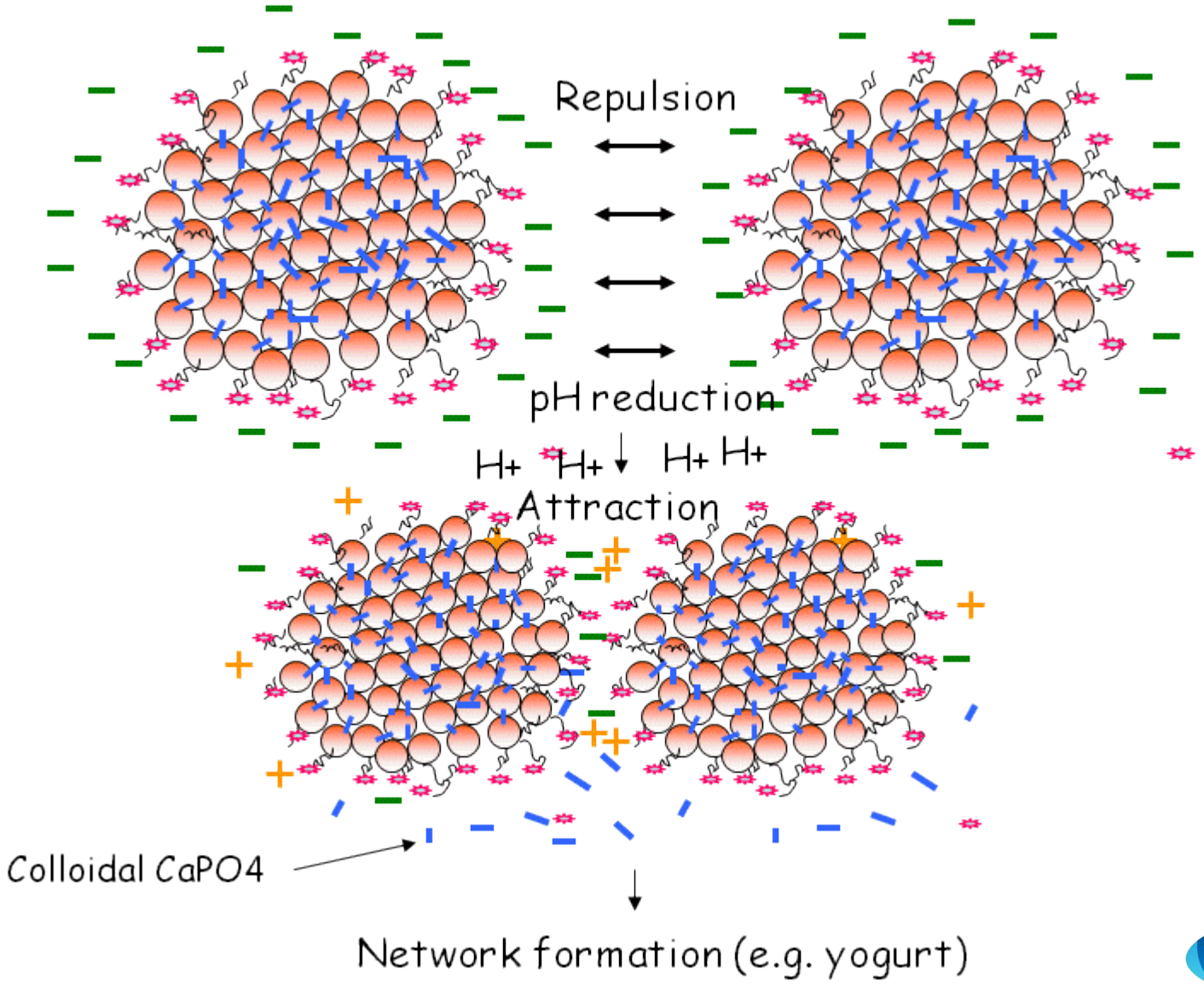
Changes during fermentation

- Partial conversion of lactose to lactic acid (lactose fermentation)
- Decrease in pH
- Release of volatiles
- Growth of starter bacteria
- Aggregation of proteins and formation of a gel network

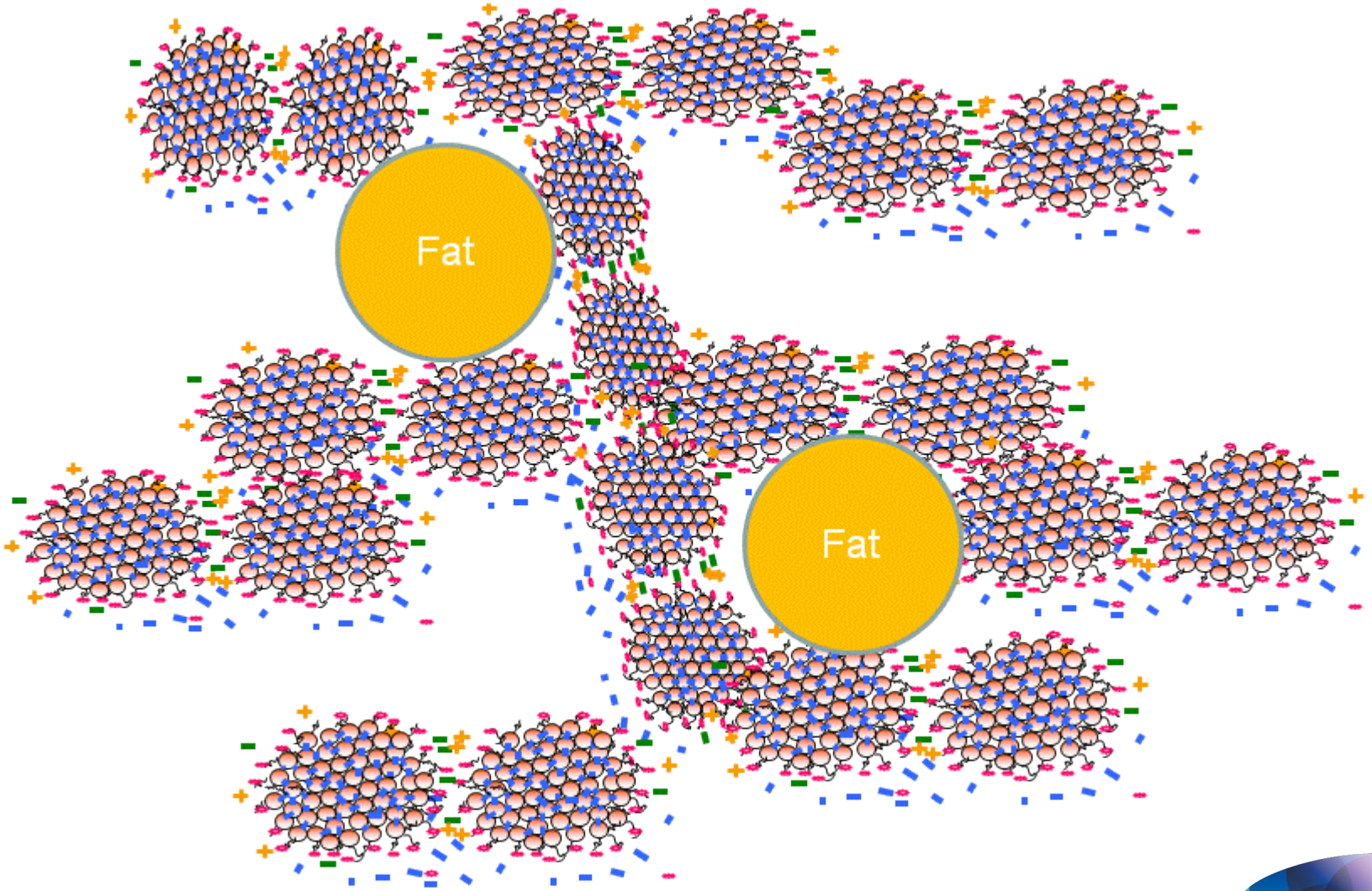
Lactose fermentation

- 20-30% lactose fermented by lactic acid bacteria using different pathways
- LAB are homofermentative, i.e. producing one major end product (95% lactic acid)
- Lactic acid
  - Conc. 0.7-1.0%
  - ST produces L(+) isomer and LB produces D(-) isomer (yougurt contains ~ 50-70% L(+))
  - D(-) isomer is metabolised slower level than L(-) isomer by humans
- Bifidobacteria produces 3:2 acetic:lactic acid

Major changes in protein during fermentation (heated milk)

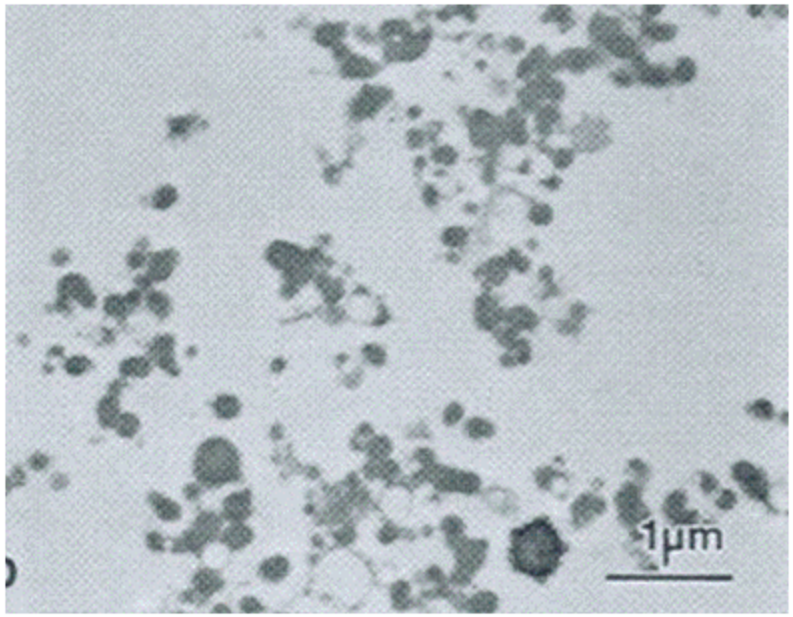


Yogurt network formation

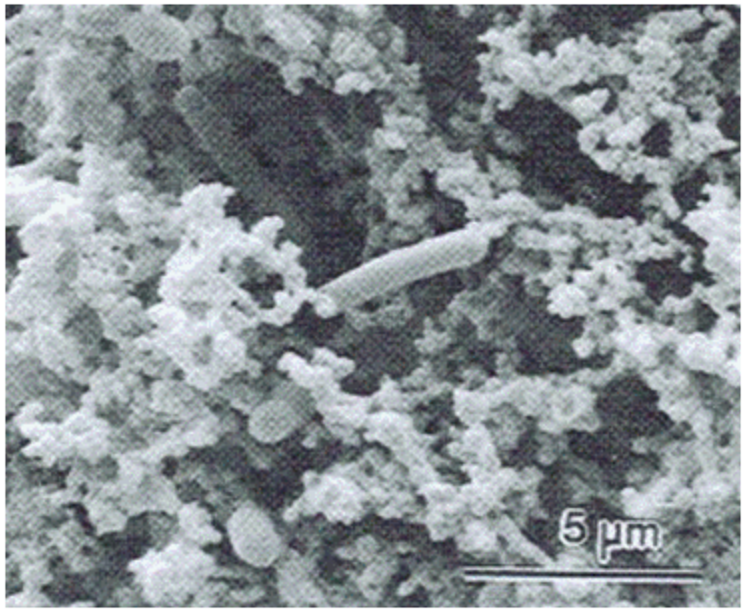


Yogurt microstructure

TEM

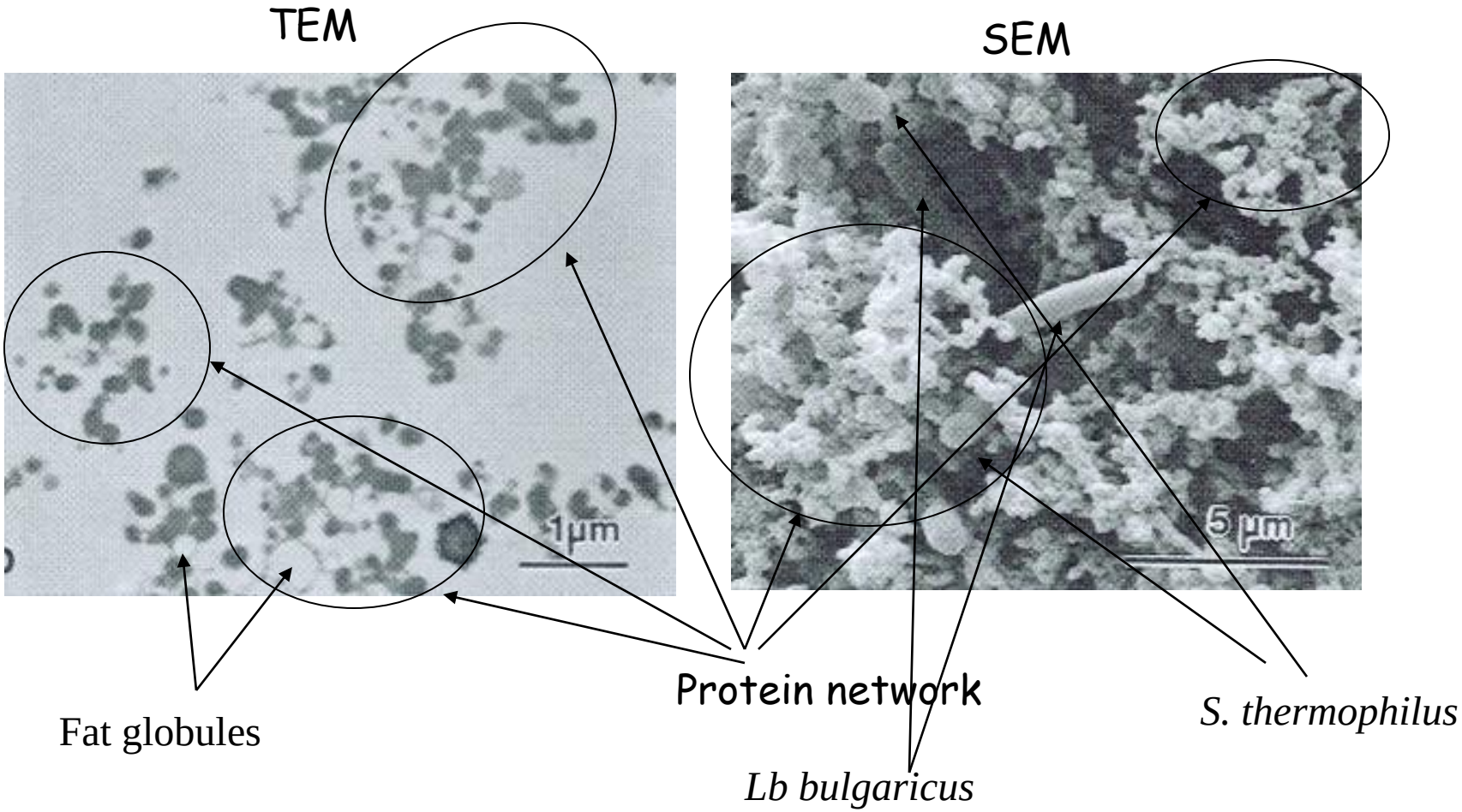


SEM



Skriver 1996 (KVL PhD Thesis)

Yogurt microstructure



Skriver 1996 (KVL PhD Thesis)

Other changes during fermentation

- Slight proteolysis (1-2%) by starter bacteria is necessary for growth of the starter
  - *L.bulgaricus* more proteolytic than *S.thermophilus*
- Casein is the principal substrate but whey proteins may also be proteolysed
  - High levels of peptides and free amino acids (e.g. valine, proline, serine, histidine) in fermented milk
- Increased protein absorption

Cooling, fruit addition and packaging

- Rate of cooling
- Cooling temperature
- Aseptic fruit dosing and fruit quality
- Method of fruit addition
  - Mixed
  - Fruit on top
  - Fruit at the bottom
- Packaging material

Effect of fruit prep on syneresis and WHC

Table 4. Syneresis (%) and WHC (%) of control and different fruit yogurt in storage time.

sample	Syneresis (%)			WHC (%)		
	First day	Sixth day	Tenth day	First day	Sixth day	Tenth day
Plane yogurt	27.32±0.12^{a}	23.63±0.39^{a}	24.91±0.12^{a}	67.21±1.40^{d}	71.71±0.01^{c}	69.33±0.01^{c}
Apple yogurt (7%)	22.61±0.36^{b}	18.96±0.02^{b}	20.65±0.14^{b}	76.01±0.21^{b}	80.01±0.36^{b}	78.39±0.09^{b}
Apple yogurt (10%)	17.93±0.63^{c}	15.74±0.26^{c}	13.65±0.12^{d}	80.31±0.89^{a}	85.64±0.18^{a}	87.4±0.06^{a}
Banana yogurt (7%)	20.31±1.6^{bc}	18.36±0.13^{b}	16.32±0.67^{c}	77.12±0.01^{b}	87.09±0.12^{a}	89.03±0.16^{a}
Banana yogurt (10%)	16.98±0.61^{c}	14.20±1.3^{c}	12.95±0.13^{d}	83.65±0.14^{a}	87.36±0.42^{a}	90.32±0.42^{a}
Strawberry yogurt (7%)	24.33±0.96^{b}	21.51±0.15^{a}	23.69±0.23^{a}	70.25±0.46^{c}	72.65±0.13^{c}	71.36±0.32^{c}
Strawberry yogurt (10%)	22.41±0.45^{b}	20.65±0.65^{b}	21.31±0.33^{b}	72.36±0.03^{c}	74.95±0.63^{c}	72.03±0.014^{c}

Effect of fruit prep on sensory properties

Table 5. Effect of fruit pulp concentrations on sensory properties of yogurt

Sample	Appearance and color			Body and texture			Flavor		
	First	Sixth	Tenth	First	Sixth	Tenth	First	Sixth	Tenth
Plane yogurt	4.31±0.14	4.40±.12	4.21±0.14	4.20±0.11	4.31±0.14	4.01±0.12	4.12±0.14	4.51±0.12	4.21±0.63
Apple yogurt (7%)	4.70±0. 21	4.81±.14	4.60±1.5	4.41±0.65	4.80±0.12	4.40±0.54	4.42±0.52	4.62±0.18	4.40±0.37
Apple yogurt (10%)	4.21±0.45	4.32±02	3.81±0.17	4.01±0.12	4.40±0.72	4.10±036	4.21±0.36	6.50±0.08	4.01±0.46
Banana yogurt (7%)	4.61±0.12	4.43±0.15	4.82±0.14	4.51±0.01	4.31±0.01	4.62±0.21	4.80±0.24	4.61±0.19	4.21±0.04
Banana yogurt (10%)	4.10±0.26	3.91±0.12	4.20±0.31	4.10±0.95	3.70±0.15	372±0.12	4.02±0.19	4.12±0.07	3.70±0.81
Strawberry yogurt (7%)	4.81±0.12	4.80±0.09	4.41 ±0.2	4.31±0.21	4.31±0.19	4.21±0.09	4.91±0.63	4.83±0.12	4.61±0.09
Strawberry yogurt (10%)	4.72±0.11	4.71±0.87	4.60±0.5	4.20±0.12	4.43±0.17	4.10±0.17	4.51±0.06	4.70±0.03	4.51±0.05

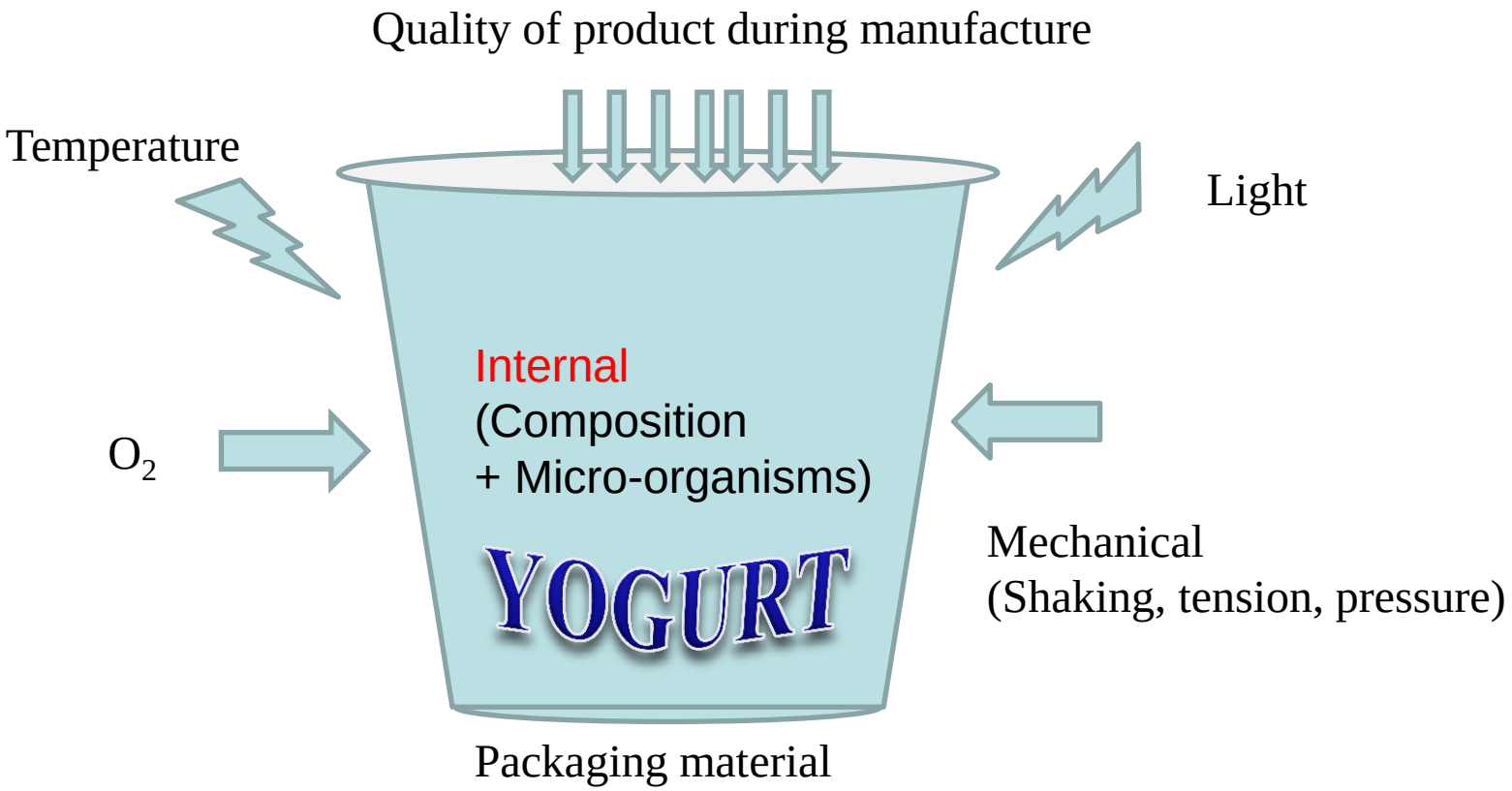
Effect of fruit prep on overall acceptability

Table 6. Effect of fruit pulp concentrations on overall acceptable scores properties of yogurt

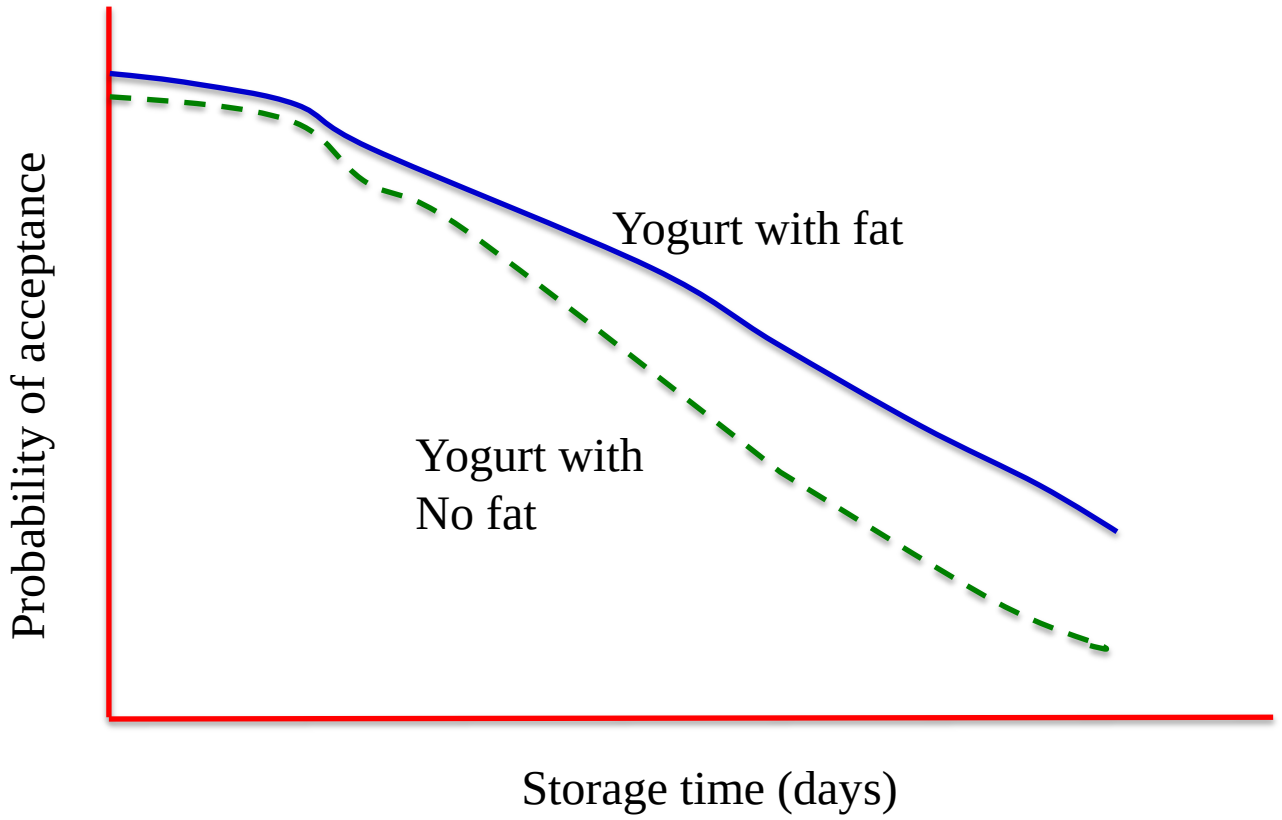
Sample	overall acceptable scores		
	First	Sixth	Tenth
Plane yogurt	4.31±0.14[a]	4.41±0.01[a]	4.31±0.04[a]
Apple yogurt (7%)	4.70±0. 02[a]	4.11±0.04[a]	4.10±0.51[a]
Apple yogurt (10%)	4.01±0.05[a]	4.32±0.02[a]	3.20±0.27[b]
Banana yogurt (7%)	4.62±0.04[a]	4.30±0.14[a]	4.01±0.09[a]
Banana yogurt (10%)	4.12±0.06[a]	3.91±0.22[a]	3.50±0.21[b]
Strawberry yogurt (7%)	4.80±0.11[a]	4.90±0.09[a]	4.71 ±0.12[a]
Strawberry yogurt (10%)	4.61±0.11[a]	4.81±0.77[a]	4.72±0.15[a]

Yousef etal 2013

Packaging, storage and distribution

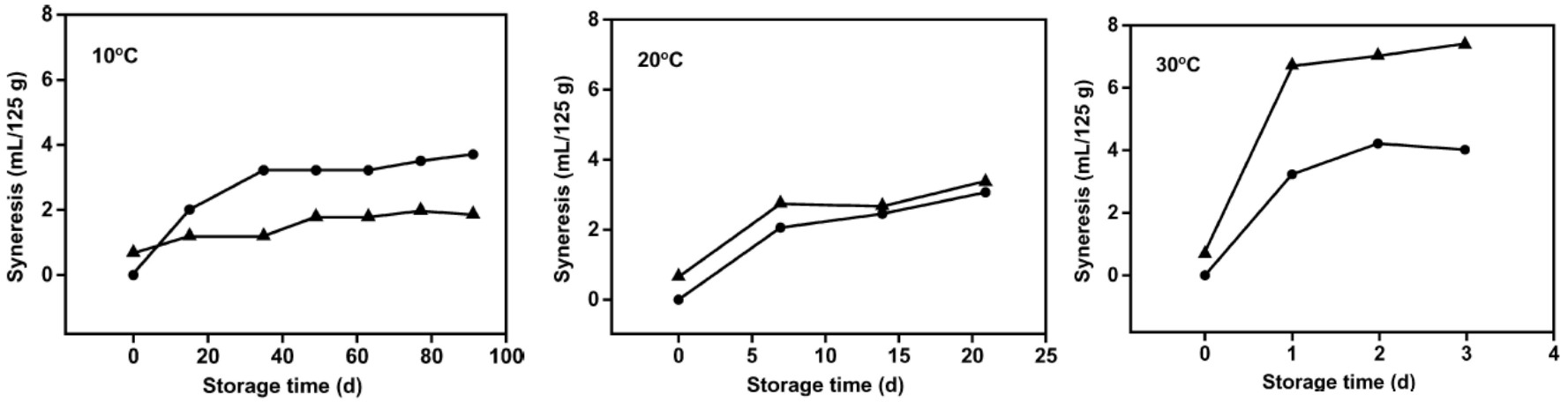


Consumer acceptability of yogurt during storage at 4°C



Based on Salvador and Fiszman, 2004

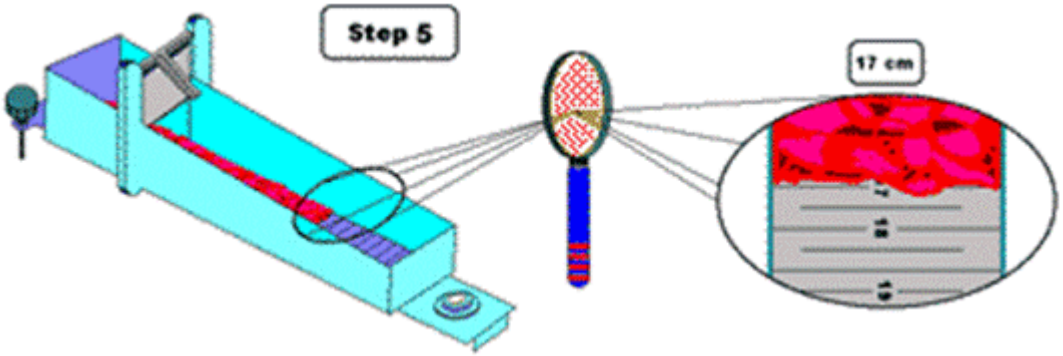
Syneresis in yogurt – effect of temperature during storage



Whole milk yogurt ●
Skim milk yogurt ▲

Salvador and Fiszman, 2004

Measuring yogurt quality - consistency



Consistometer

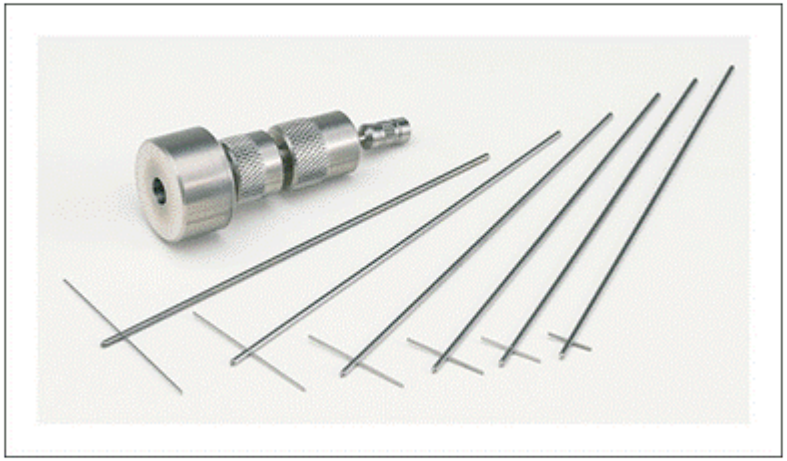
http://www.cscscientific.com/html/consist.html

http://foodqalab.byu.edu/testing_techniques/manual/bostwick.html

Measuring yogurt quality - viscosity

Brookfield viscometer

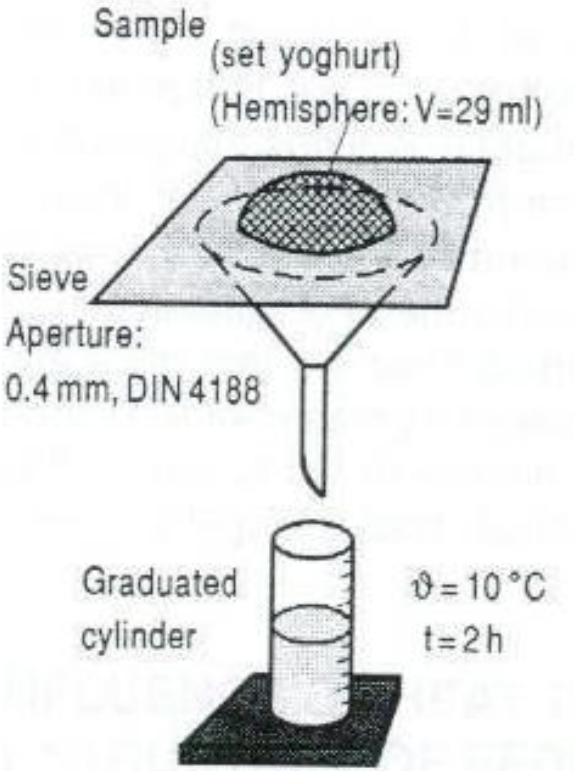
Helipath drive and “T” spindles



Measuring yogurt quality - rheology

- Tests are performed applying a small sinusoidal strain (or stress)
- Able to detect small changes in yogurt structure (useful for quality and consistency)

Measuring yogurt quality - syneresis



- Syneresis
  - Leave yogurt on a strainer at refrigeration temperature for a fixed time
  - Measure amount of free whey

Kessler (1998) IDF special issue 199802

Measuring yogurt quality – gel strength

- Penetrometer
  - Use fixed weight to penetrate into the gel network
  - Measure the resistance/depth

Flavour compounds and sensory aspects of yogurt

Flavour compounds in yogurt

- The flavour compounds of yogurt are determined by the
  - Relative balance of flavor compounds derived from fat, protein, or carbohydrate
  - The distinct flavor contributed by lactic acid and a complex mixture of aroma compounds, which include the volatiles already present in the milk and specific compounds produced from milk fermentation

Flavour compounds in yogurt

- Four main categories:
  - Volatile carbonyl compounds (e.g., acetaldehyde, acetone, acetoin, and diacetyl)
  - Volatile acids (e.g., acetic, propionic, and butyric)
  - Non-volatile acids (e.g., lactic, pyruvic, oxalic, and succinic)
  - Miscellaneous compounds (e.g., certain amino acids and/or constituents formed by thermal degradation of protein, fat, and lactose

Volatile compounds in yogurt

- More than 90 volatiles identified
- Carbonyl compounds (30+) – e.g. acetaldehyde, diacetyl, propanal etc
- Alcohols (15+) – ethanol, propanol, butanol etc
- Acids (10+) – acetic acid, propionic acid butyric acid, etc
- Esters (5+) – methyl, ethyl, butyl acetates, etc
- Sulphur compounds (5+) – sulphides and disulphides, etc
- Hydrocarbons (4+) – heptane, nonane etc
- Aromatic compounds (10+) – benzene, toluene etc
- Heterocyclic compounds (10+) – furan, fufural, etc

Cheng, H (2010): Volatile Flavor Compounds in Yogurt: A Review, Critical Reviews in Food Science and Nutrition, 50:10, 938-950

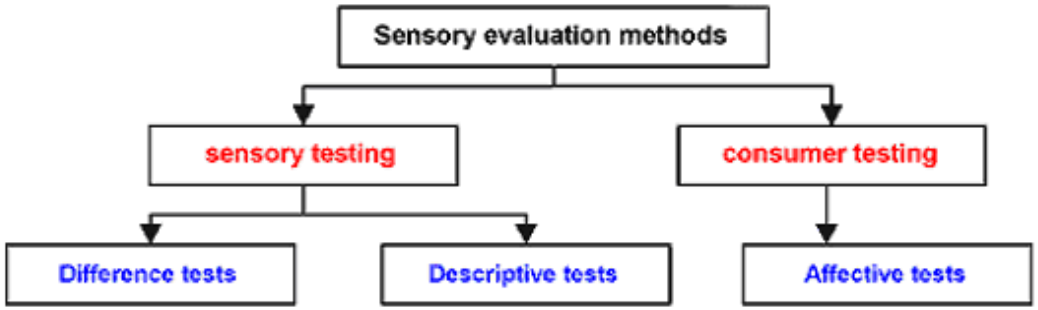
Measuring volatiles in yogurt

- Complicated due to heterogeneous nature of matrix of fat, carbohydrate, proteins
  - Tendency to degrade or to form artifacts in the presence of heat and/or oxygen;
  - Potential formation of secondary volatiles via enzymatic reactions; and
  - Incomplete recovery of the polar/semi-volatile flavor constituents
- Involves pre-concentration before GC-MS
- May use electronic nose for qualitative mapping

Deterioration of flavour during storage

- Yogurt is prone to deterioration, especially at an ambient temperature, within a matter of days
- Microbial, enzymatic, or chemical reactions occurring within yogurt during storage may alter its physical, chemical, and microbiological structure, causing deterioration or spoilage
- Generation of volatile by-products leads to off-flavors and makes the product unsatisfactory for the tastes of consumers
- The evolution of volatile compounds can often determine the storage and shelf life of yogurt

Measuring sensory quality of yogurt



Aims:

- objective measurement of differences of tastes of similar product types
- verbal description of characteristics of products
- measurement of subjective impressions / hedonics / preference for products

Areas:

- Quality control
- Quality assurance
- Product development (R&D)
- Production
- Marketing
- Market research

Panels:

- trained food experts, trained tasters
- inhouse groups or external
- few people can set up reproducable results
- consumer groups
- representative random samples

http://sst-web.tees.ac.uk/external/U0000504/Notes/Sensory/SensoryIntro.html

Factors affecting sensory results

Factors that affect the results:

- Subjects - humans
- Type of test - appropriateness
- The way the test is carried out
- Testing facilities – lighting, odours, noise etc

Sensory analysis of yogurt – University of Queensland/Dairy innovation Australia

- Uses Quantitative Descriptive Analysis (QDA ®) as one of main descriptive analysis techniques developed by Tragon Corporation and Department of Food Science at the University of California, Davis
  - Recruitment of panelist
  - Selecting questionnaire
  - Screening sessions
  - Language development
  - Line scale training
- Compusense – data collection and analysis software

Sensory analysis of yogurt – language development

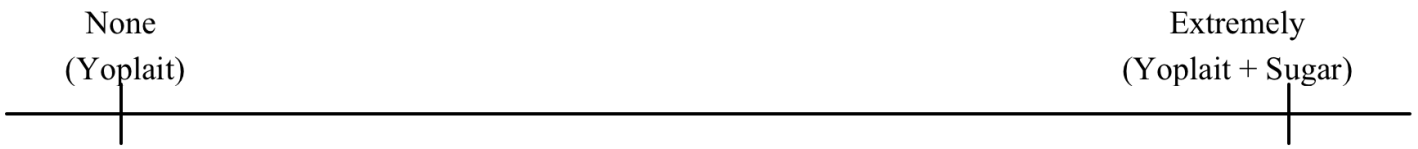
Aroma		
Rancid aroma	Oxidized fat (Spoilt yoghurt)	Feta cheese
Cheesy aroma	Aroma of cheese	Cheddar cheese
Acidic aroma	Aroma associated with Yoghurt	Yoplait and Select Greek style yoghurt
Basic Taste		
Sweetness	Taste of sugars	Yoplait + Sugar
Sourness	Taste associated with acid like lactic acid	Yoplait + Citric acid
Bitterness	Taste associated with caffeine	Yoplait + Caffeine
Flavour		
Acidic	Typical acidic flavor associated with yoghurt	Select Greek style yoghurt
Cheese	Aromatics/ flavour associated with cheese	Cheddar cheese
Rancid	Aromatics/flavor associated with oxidation of fat	Feta cheese

Sensory analysis of yogurt – language development

Texture		
Viscosity	Resistance to flow in the mouth before saliva modifies the sample	Yoghurt with 2% fat and 11% fat
Fattiness	Estimation of fat content in the mouth / Perceived amount of fat/grease in the mouth	Same as above
Firmness	Solid compact sensation, holds its shape in the mouth	Same as above
Lumpiness	Amount of lumps or graininess present in the sample (soft lumps)	Yoplait and pot set yoghurt
Stickiness	Degree to which the sample sticks to the teeth and palate	Yoghurt with 2% fat and 11% fat
Astringency	The shrinking or drying effect on the tongue surface, followed by increased saliva forming	Cranberry juice
Mouthfeel		
Mouth coating	Thin film or layer that lines the surface of the mouth	
Oiliness in the mouth	Perception of oiliness in the mouth	

Sensory analysis of yogurt – line scale development

- A line scale is 15 cm in length with sensory intensities word anchors located 1.25 cm from each end. The evaluation length is thus 12.5cm. The scale direction goes from left to right with increasing intensities, e.g., weak to strong



Sensory analysis of yogurt - results

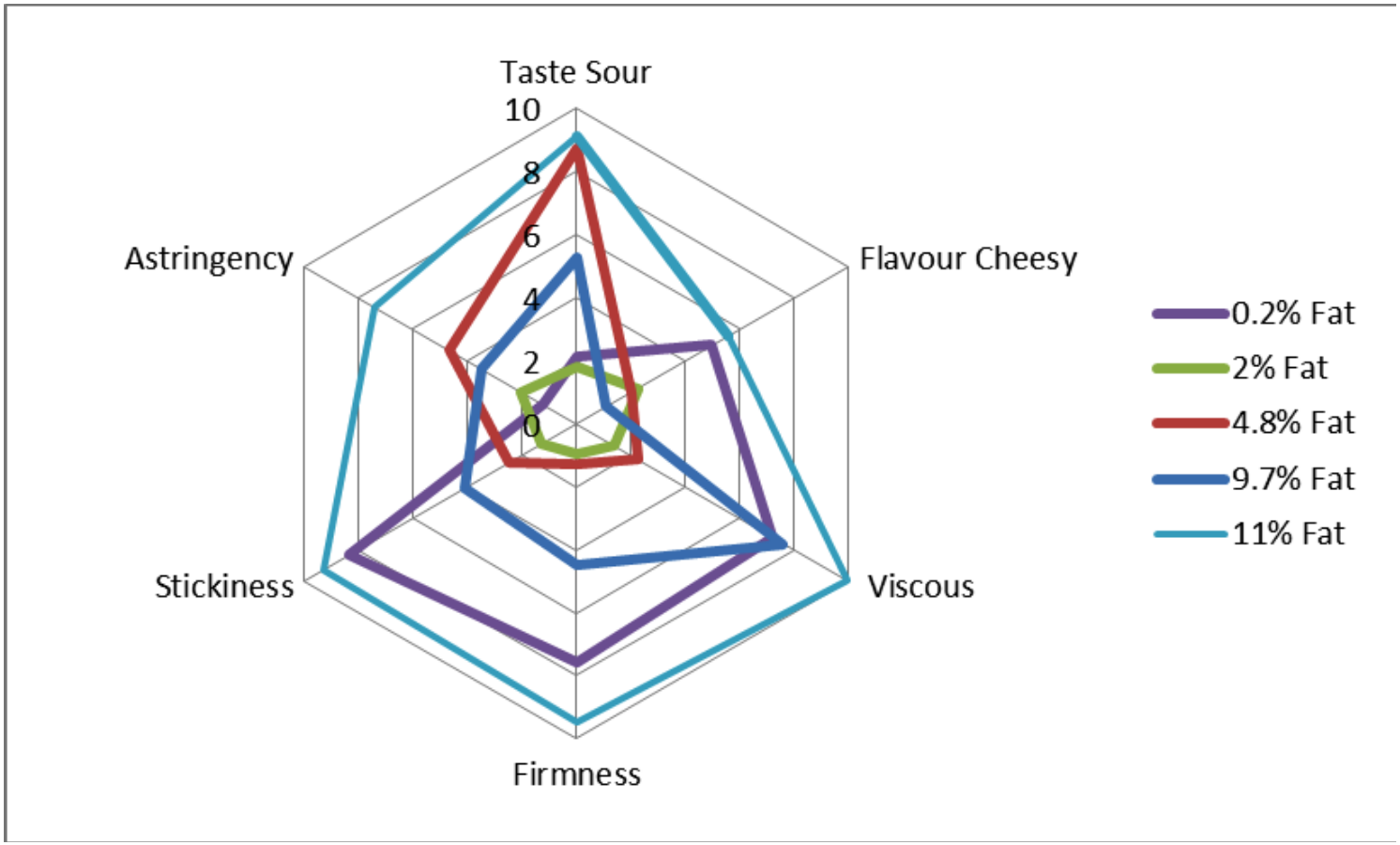
Yogurt with different fat levels

Yoghurt Brand	Energy (kJ/100mL)	Protein (g/100mL)	Sugars (g/100mL)	Sodium (mg/100mL)	Calcium (mg/100mL)
0.2% Fat (Brand A)	300	5.7	9.0	60	200
2.0% Fat (Brand B)	306	5.4	8.3	78	198
4.8% Fat (Brand C)	360	5.8	6.6	83	196
9.7% Fat (Brand D)	520	5.7	8.6	69	175
11% Fat (Brand E)	614	4.9	5.8	51	173

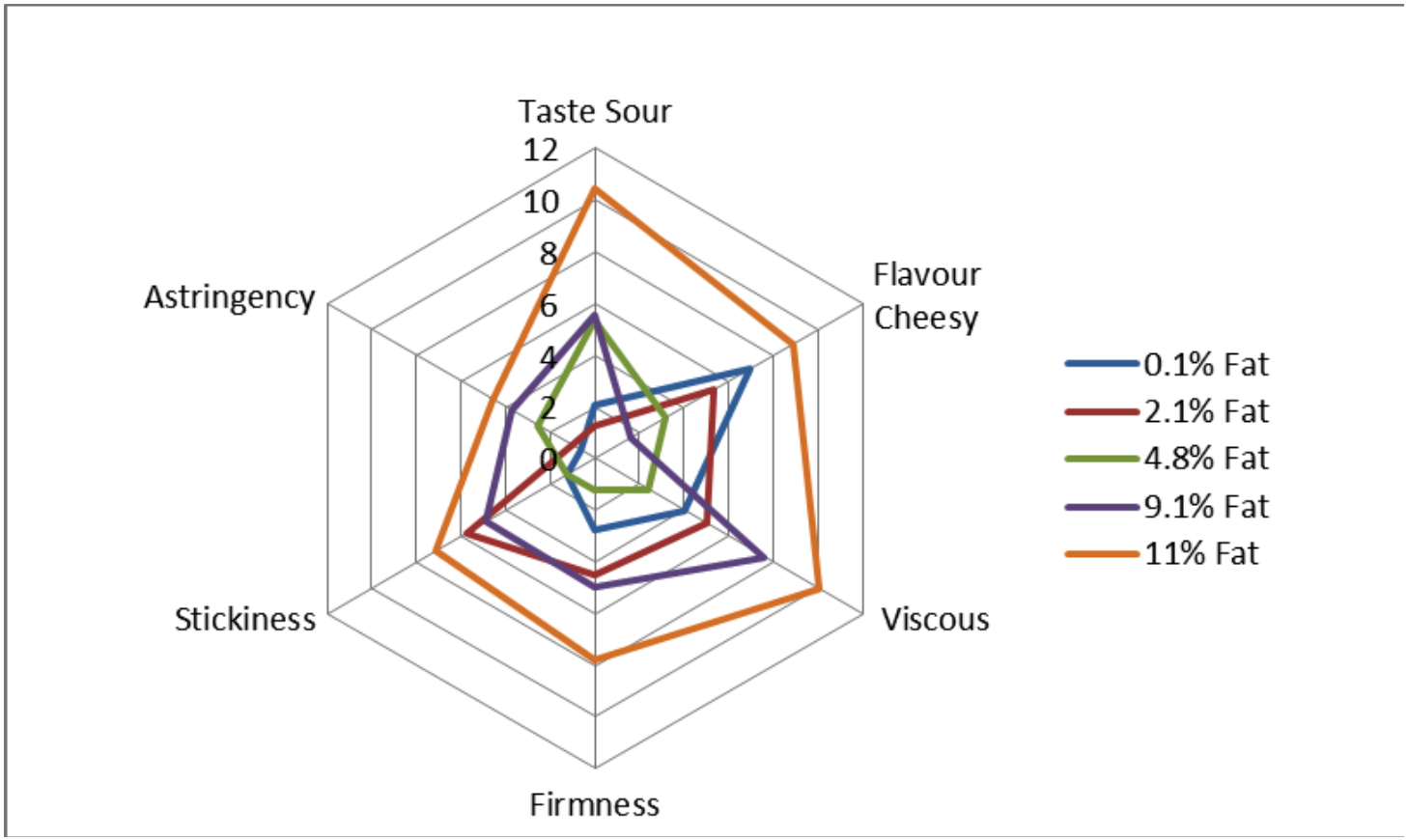
Greek yogurt with different fat levels

Yoghurt Brand	Energy (kJ/100mL)	Protein (g/100mL)	Sugar (g/100mL)	Sodium (mg/100mL)	Calcium (mg/100mL)
0.1% Fat	282	3.2	5.9	99	130
2.1% Fat	412	7.5	8.3	110	160
4.8% Fat	425	5.6	9.0	80	206
9.1% Fat	561	4.7	7.2	65	168
10.7% Fat	601	5.7	7.9	77	202

Sensory properties of yogurt – effect of fat levels

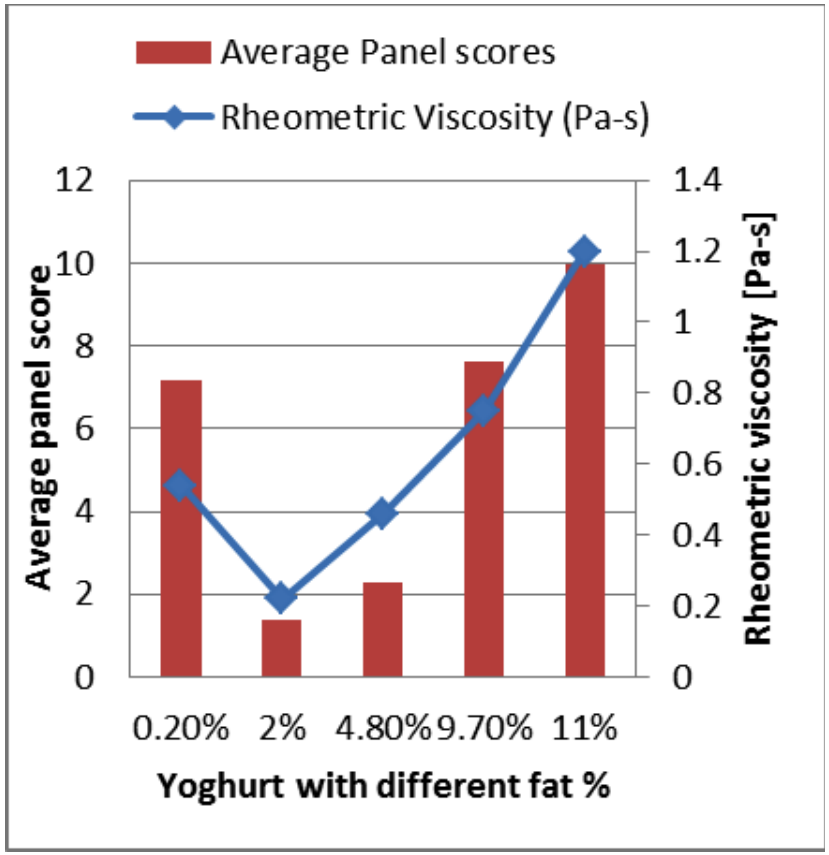


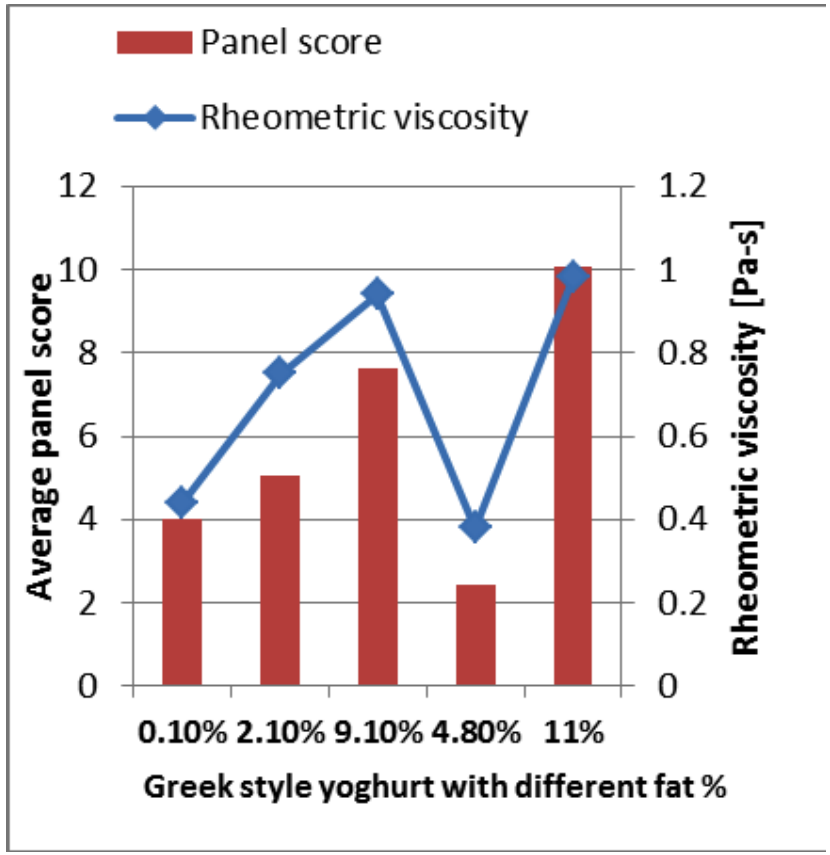
Sensory properties of Greek yogurt – effect of fat content



Sensory and viscosity relationship

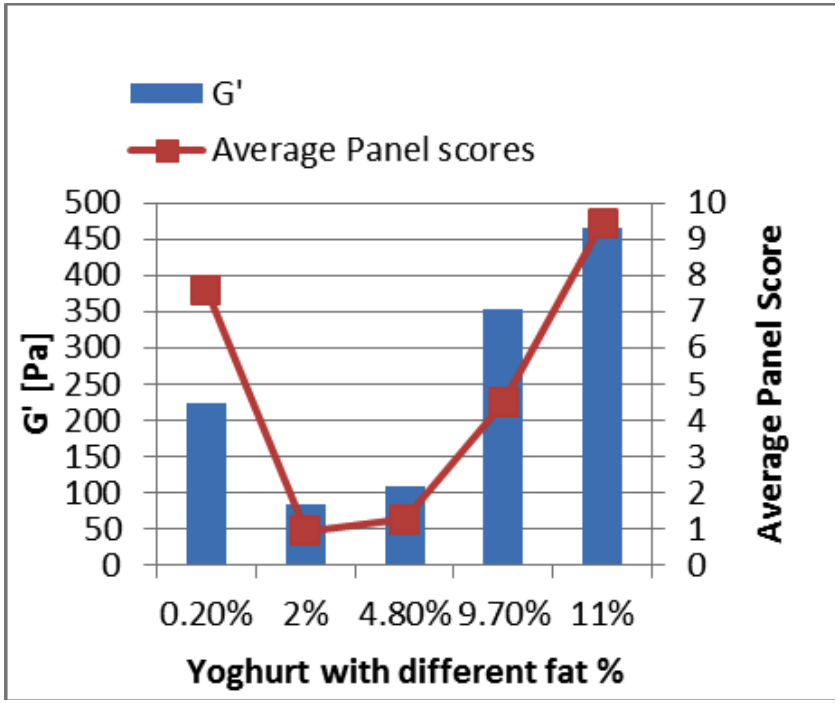
Panel viscosity vs rheometer viscosity

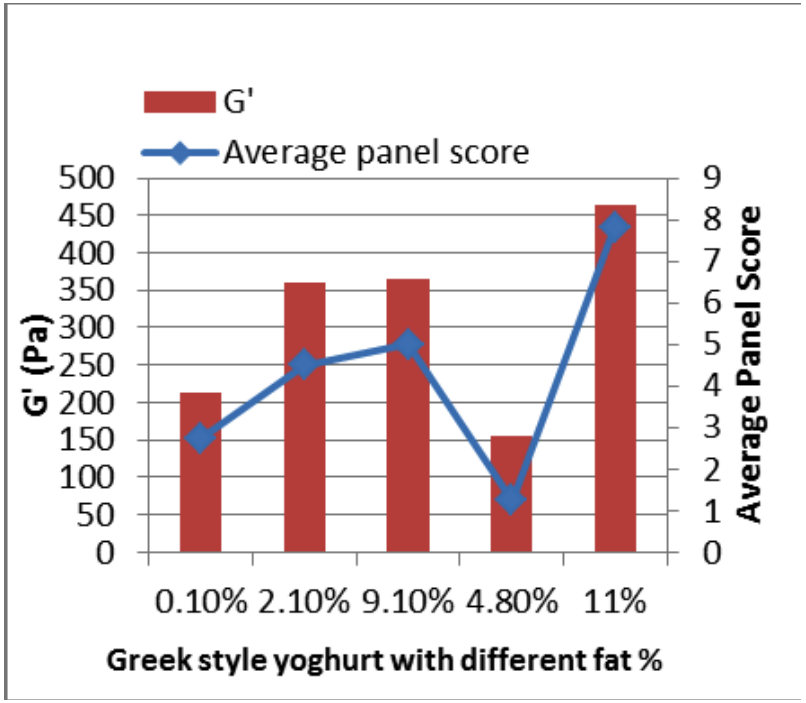




Sensory-rheology relationship

Firmness vs elastic modulus

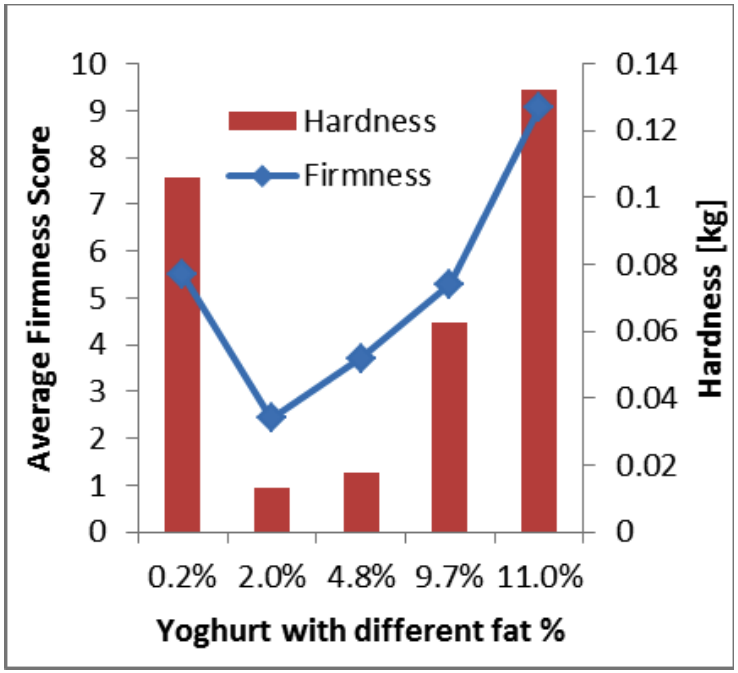




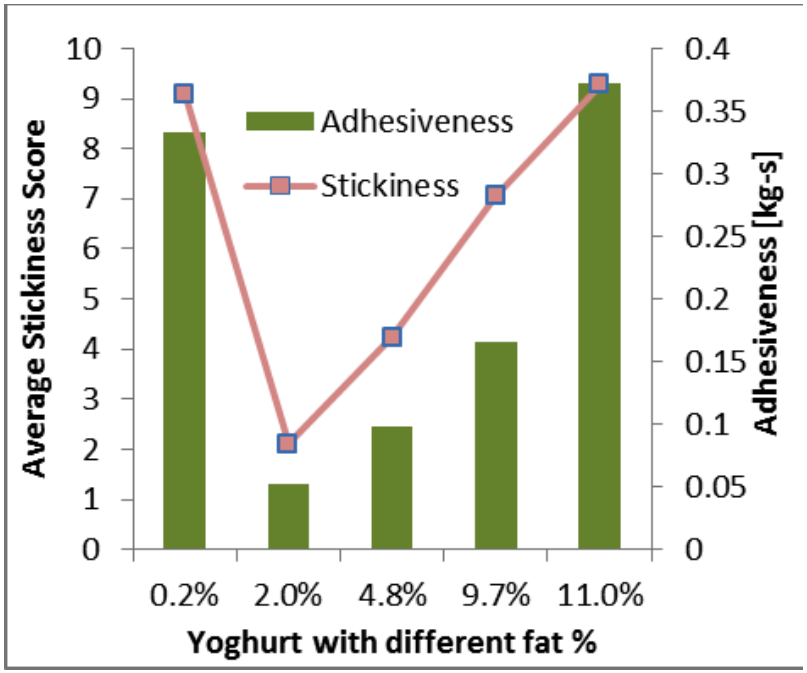
UQ/DIAL 2013

Sensory-texture relationship – effect of fat

Firmness vs Sensory Hardness

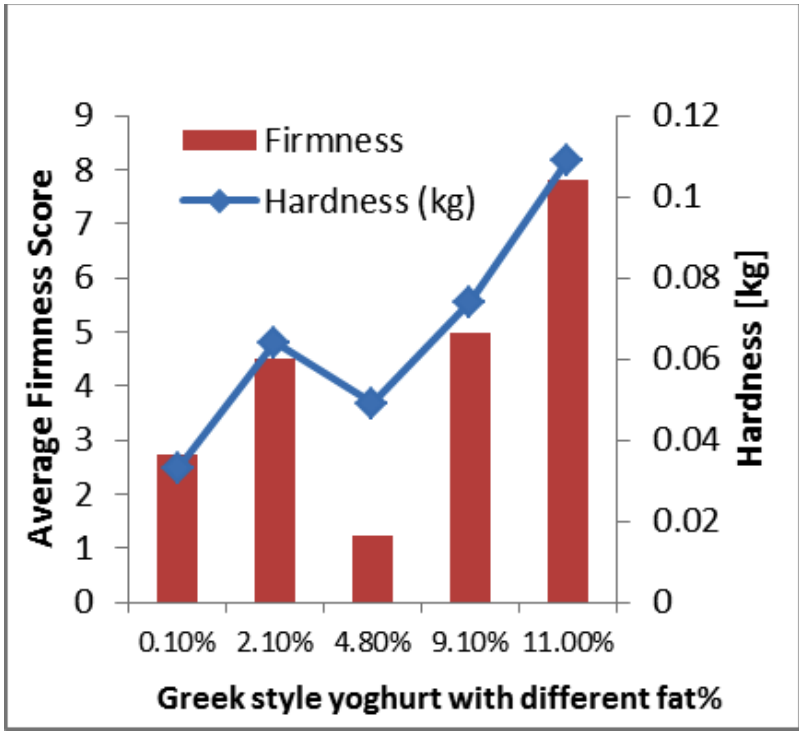


Adhesiveness vs Sensory stickiness

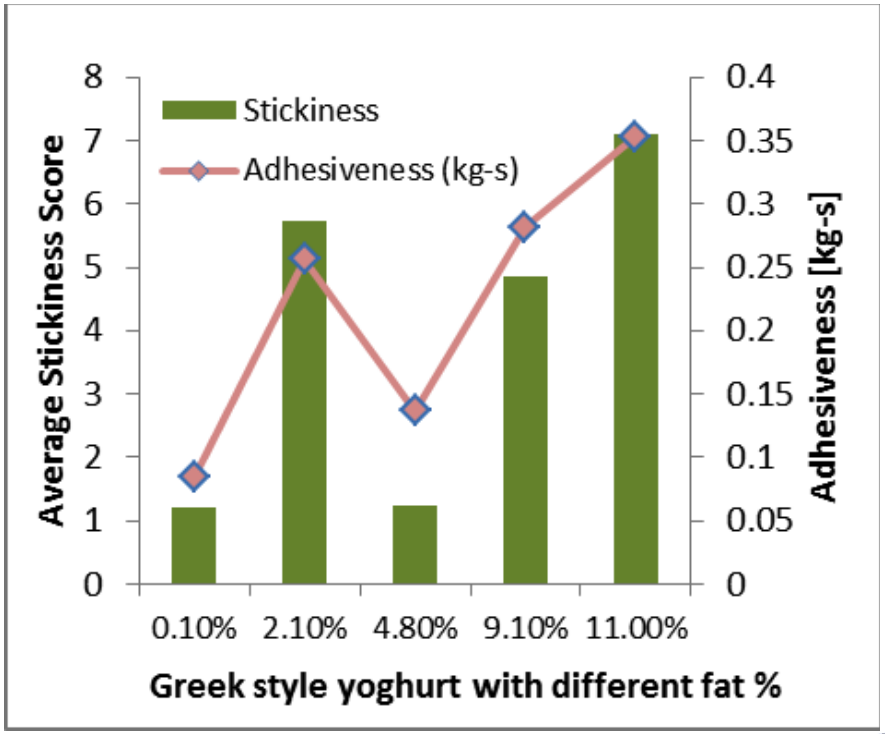


Sensory- texture relationship – Greek yogurt

Firmness vs Sensory Hardness

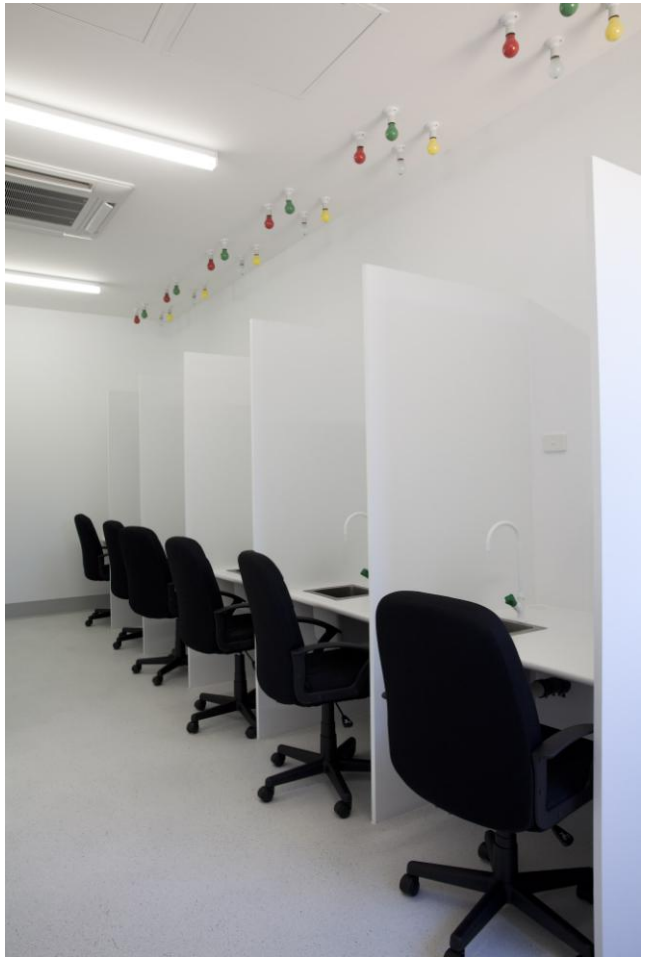


Adhesiveness vs Sensory stickiness

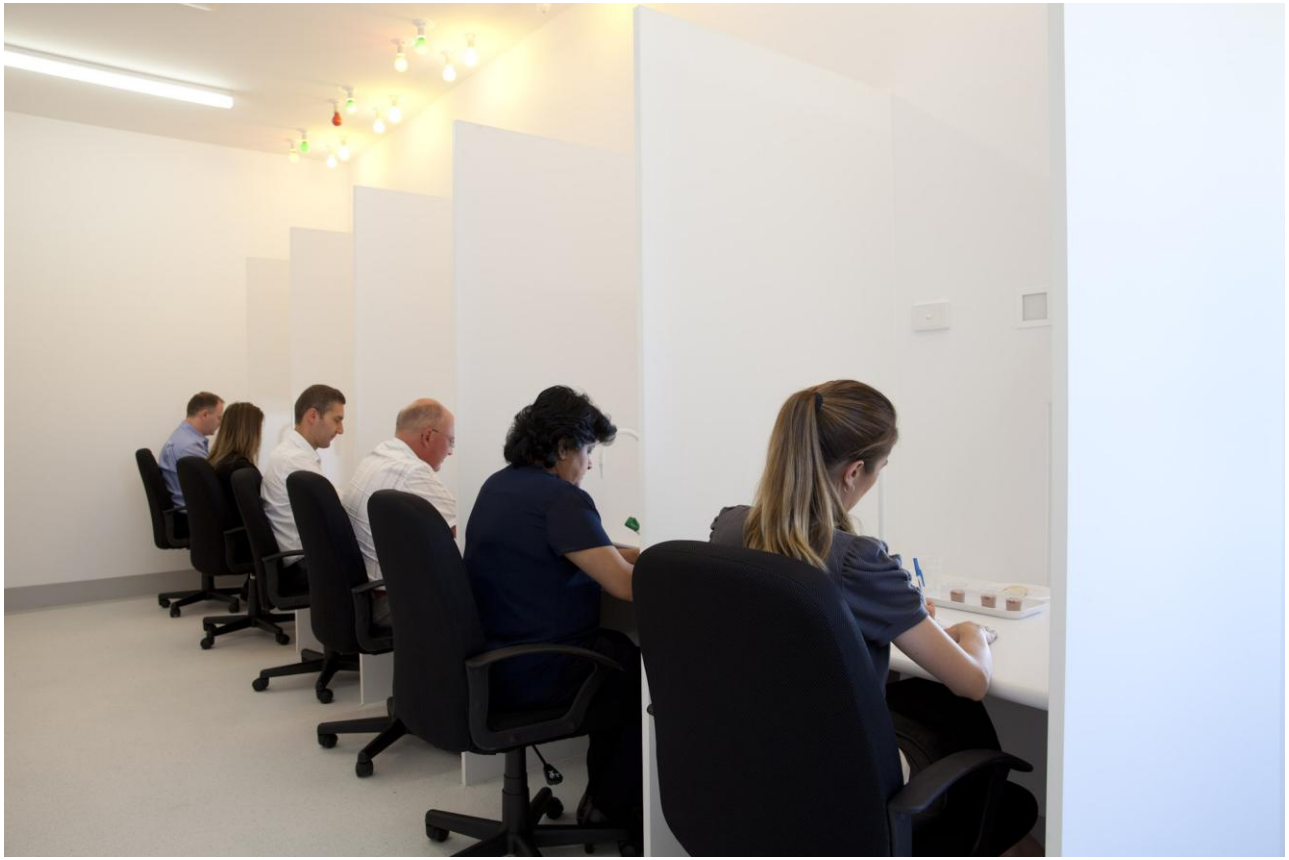


Dairy Innovation Australia Sensory Analysis Lab

- Specially designed
- 6 booths
- Controlled environment
- Controlled lighting
- Noise-free area
- Discussion room
- Dedicated kitchen



Dairy Innovation Australia Sensory Analysis Lab



Dairy Innovation Australia Sensory Analysis Lab

Dairy Innovation Australia Sensory Analysis Lab

Summary
Quality defects – appearance/texture

Defect	Cause of defect
Syneresis/whey separation	Low total solids, Over acidification, mechanical shaking of gel network, insufficient denaturation of whey proteins, incompatibility of dairy and non-dairy ingredients (inappropriate amount and/or type of stabiliser), too high incubation temperature, too low acidification (pH>4.6)
Low viscosity/runny	Low total solids, insufficient heat treatment/homogenisation of milk, poor selection of stabiliser, too low incubation temperature, too low inoculation rate
Film or colony growth on surface of consumer packs	Growth of yeasts and moulds (poor pasteurisation and/or post processing contamination), unhygienic processing conditions in the factory
Long/roapy texture	Slime producing contaminants, too low temperature of incubation

Summary
Quality defects – appearance/texture

Defect	Cause of defect
Grainy texture	Improper mixing or homogenisation of dry milk ingredients; too high incubation temperature, too low inoculation rate
Mealy gluey texture	Excessive addition of milk powder
Gas or air bubbles in coagulum	Contamination with yeasts or coli forms; aeration during pumping, air leaks in pipelines
Nodulation/curdy flecks	Improper mixing of starter culture, localised fermentation, too rapid acidification

Summary
Quality defects – flavour/taste

Defect	Cause of defect
Unclean/low-acidic	Poor activity of starter culture
Fermented	Contamination by yeasts and coli forms
High acid flavour	Too rapid fermentation by starter culture due to high temperature or too high starter conc level
Grassy/feed flavour	Grassy/feed flavour from raw milk
Bitter taste	High proteolytic activity, too high starter inoculation
Rancid flavour	Fat degradation due to lipolytic enzymes (insufficient heat treatment)
Oxidised	Light, metal catalyst