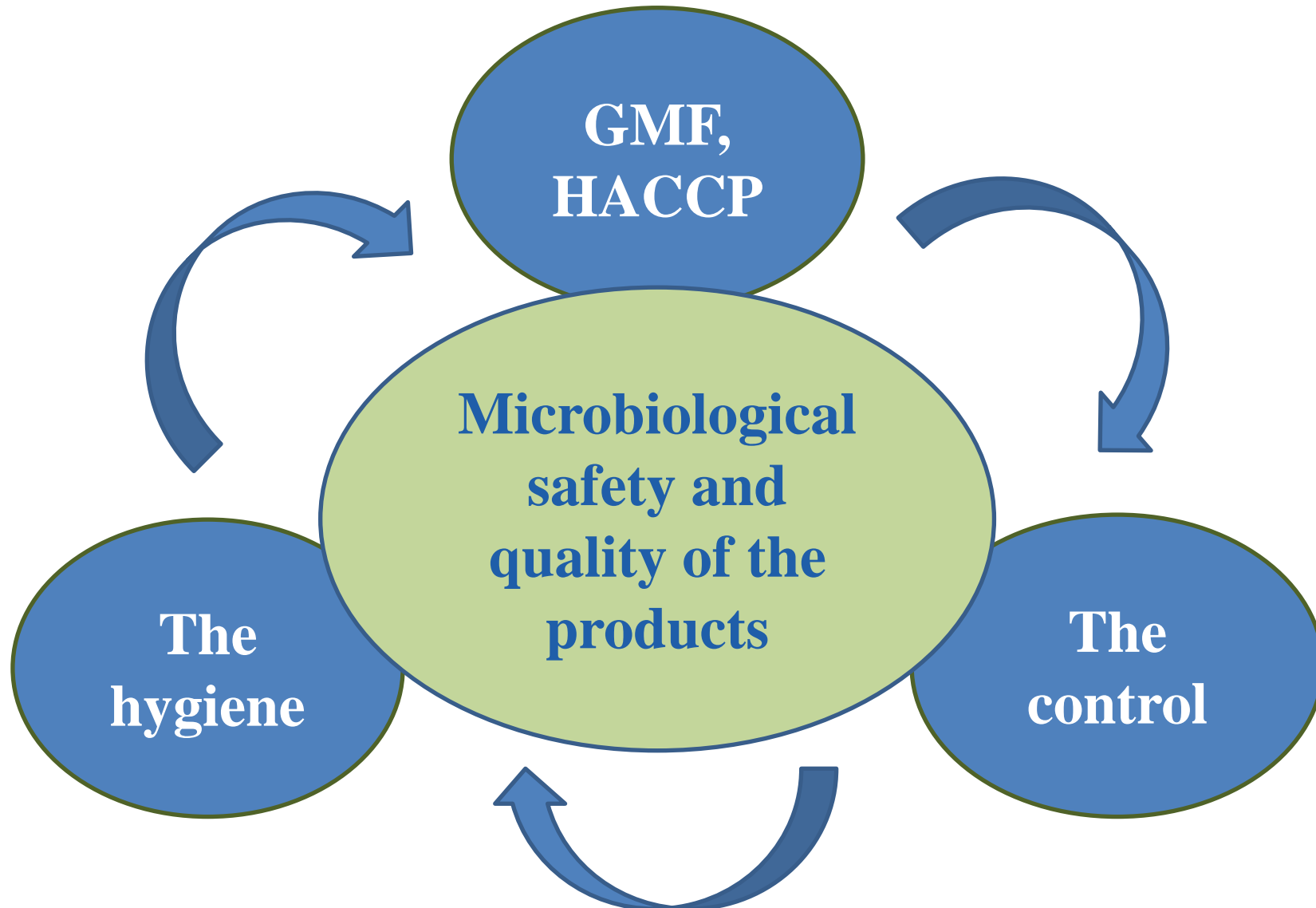LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

In-store hygiene evaluation and its relationship with microbiological indices of some foods, sold in different retail market places in Lithuania

assoc. prof. Aistė Kabašinskienė

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

GMF,
HACCP

Microbiological safety and quality of the products

The hygiene

The control

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

2

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Poor hygiene in retail market:

- leads to insufficient quality and safety of food;
- is related with foodborne outbreaks:
  - about 92% of all outbreacs occur because of insufficial staff' knowledges of food processing and personal hygiene.

Photo: http://www.naujasisturgus.lt

Data of State Food and Veterinary Service official control

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

3

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Poor hygiene:

- has been detected in 27.5 % of officially controlled food retail places in 2017 in Lithuania;
- **The main violations were:**
  - insufficient environmental hygiene (cleanness);
  - insufficient conditions of waste products' storage;
  - cross-contamination of raw and processed foods;
  - finished expiry date of food products;
  - no food documents in place.

Photo: The Straits Times

Data of State Food and Veterinary Service official control

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

4

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

The importance of consumers in food control

- In 2016 active consumers helped to find out about 800 cases of untrustworthy producers, hygiene and other violations.
- Almost 3000 complaints were registered and analysed by State Food and Veterinary Service.

- Alboout 90 % of retail markets are inspected annualy (422 inspections in 2016).

Data of State Food and Veterinary Service

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

5

- Ready-to-eat products usualy represent the highest risk group;

- The main saurces of Food borne infections in 2017 were caused by meat and meat products (15.6 %), fish and fish products (11.9 %), salads (8.9 %) and unknown products (38.5 %).
- The main bacteria, caused foodborne infections, by consuming contaminated salads were *Salmonella* spp. (4.7 %).

Data of Department of Public Health and Care at the Ministry of Health of The Republic of Lithuania

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

6

The aim of the work was to evaluate in-store hygiene conditions (up to 28 points) in three different retail market places (supermarkets, medium size shops and farmers' markets; n=15) and the relationship with microbiological quality (Aerobic colony count (ACC), Coliforms and *E. coli*) and safety (*Salmonella spp., L. monocytogenes*) indices of the products: minced meat (chicken, pork, beef and turkey meat; n=96), cold and hot smoked fish (*Salmo salar, Clupea harengus membras, Abramis brama, Scomber scombrus*; n=96) and fresh coleslaw (n=40).

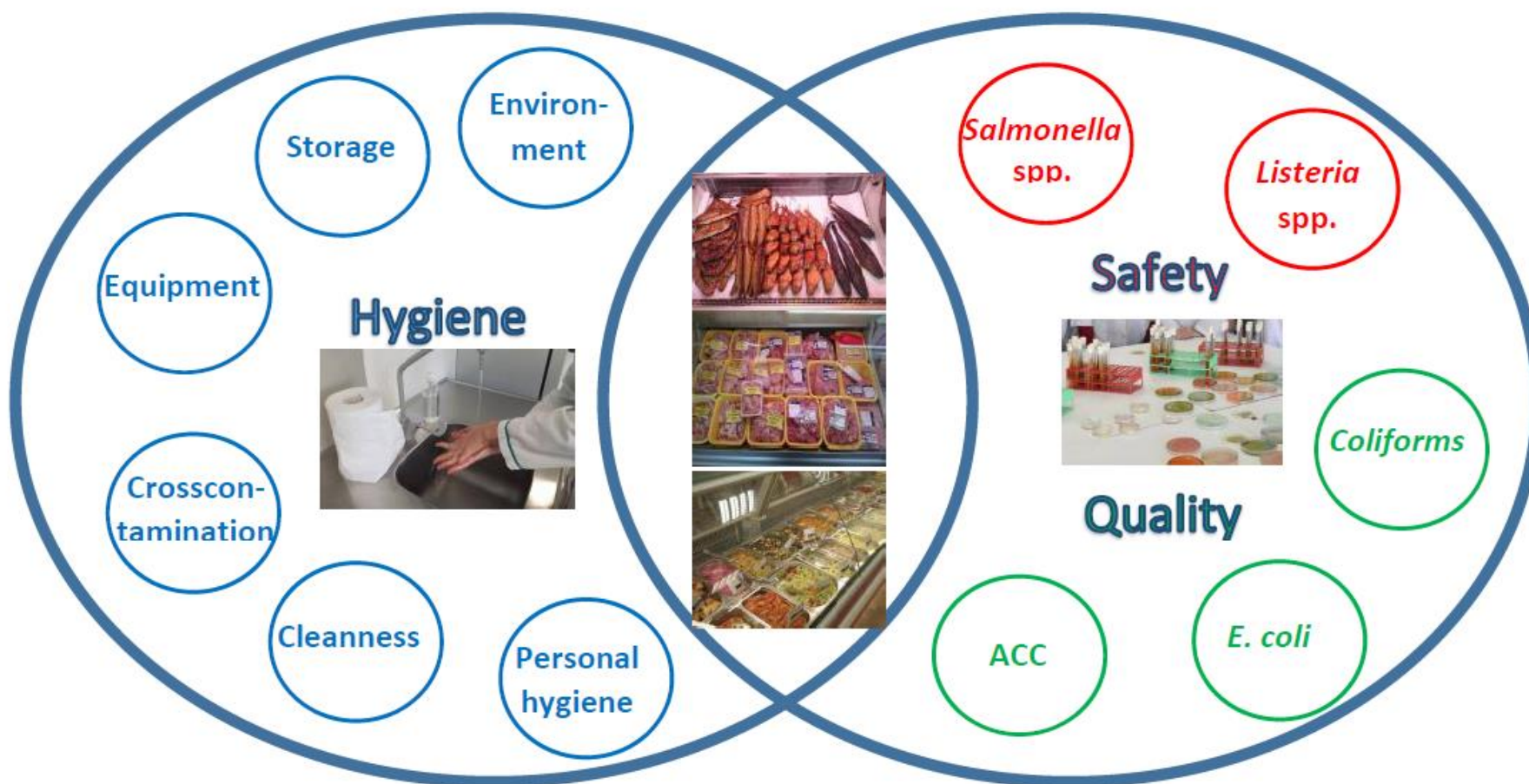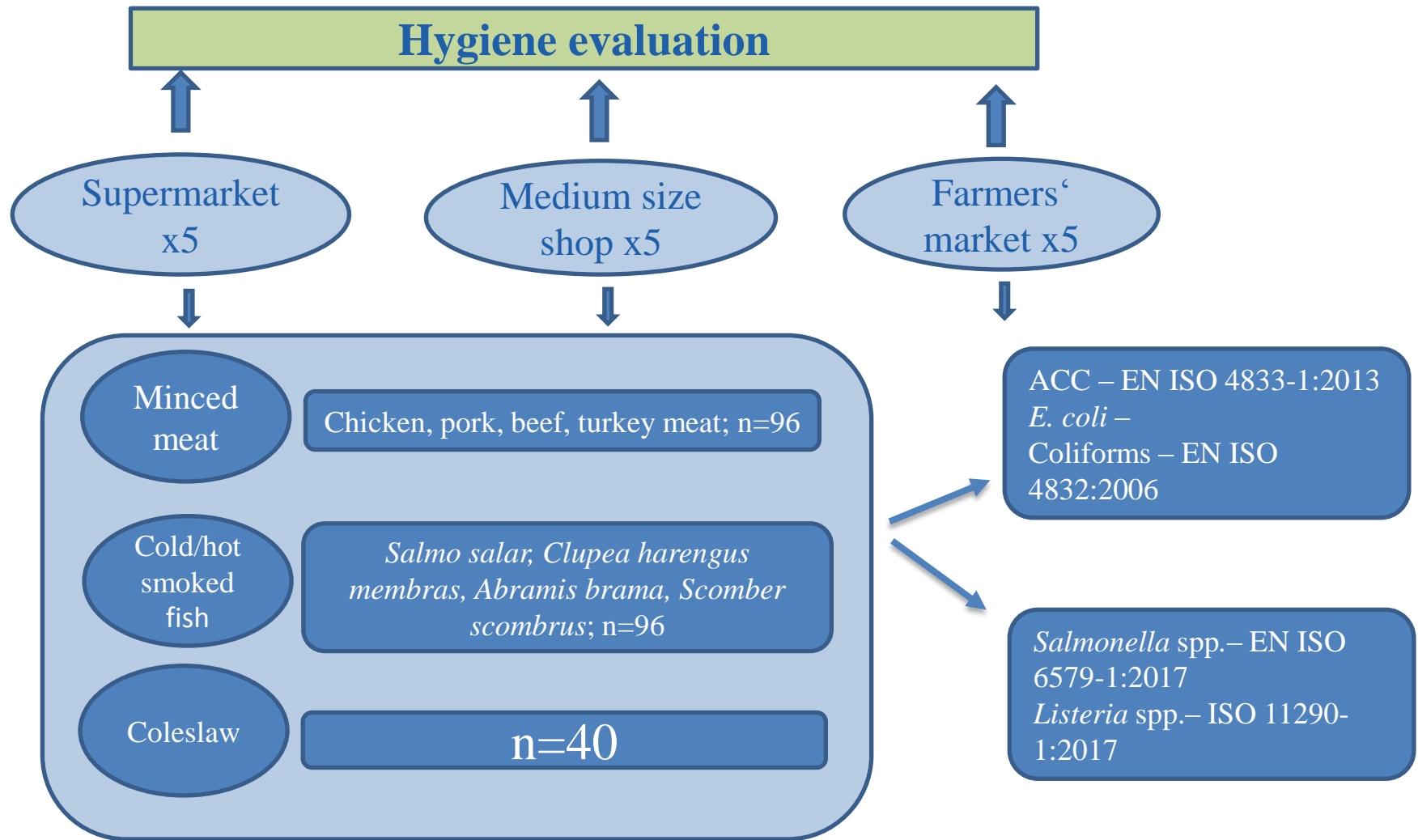8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

7

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Figure 1. Investigation plan, showing the analysed criteria and their relationship

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

8

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Hygiene evaluation

Supermarket x5

Medium size shop x5

Farmers' market x5

Minced meat — Chicken, pork, beef, turkey meat; n=96

Cold/hot smoked fish — *Salmo salar, Clupea harengus membras, Abramis brama, Scomber scombrus*; n=96

Coleslaw — n=40

ACC – EN ISO 4833-1:2013
E. coli –
Coliforms – EN ISO 4832:2006

Salmonella spp.– EN ISO 6579-1:2017
Listeria spp.– ISO 11290-1:2017

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

9

**LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES**

General requirements	Food processing requirements	Personal hygiene requirements
1. Premises (layout, cleanness)	6. Temperature of refrigeration equipment	11. Personal protective measures (head covers)
2. Technical installations	7. Arrangement of products in fridges	12. Personal protective measures (clothes)
3. Hand washing equipment	8. Tools and inventory	13. Hand hygiene
4. Refrigerating equipment	9. Touching/placing of products	14. Personal hygiene skills (hand washing)
5. Food contacting surfaces	10. Packages	
Evaluation in points: 0 – unsatisfactory, 1- partly satisfactory , 2 satisfactory condition		

Final hygiene evaluation:
25-28 points – sufficient; 16-24 points – partly sufficient; 0-15 points – insufficient

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES

Hygiene evaluation in different retail market places

Average hygiene	points
Supermarkets	27.9±0.20
Medium size shops	23.3±2.05
Farmers markets	12.5±4.5

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

11

Detailed Hygiene evaluation in Farmers markets (1)

Description			Farmers markets (nx3) and evaluation of hygiene in points																Average hygiene evaluation, max 5 points
			1			2			3			4			5			n=5
1. General requirements (max 10 points)																			
1.1.	Premises (layout, cleanness)	Rebuilding is needed, visualy unclean, premises of stock and final product intercross.																0	1.2
		Rebuilding is needed, visualy unclean, premises of stock and final product do not cross.	1	1	1				1	1	1				1	1	1		
		Correct layout, clean, no risk of intercrossing.				2	2	2				2	2						
1.2.	Technical installations	No additional lighting, no ventilation, no water-supply.																	1.4
		Additional lighting is not working, no ventilation, only cold water							1	1	1	1	1	1	1	1	1		
		Adequate lighting, ventilation, thermometers in place, hot and cold water	2	2	2	2	2	2											
1.3.	Hand washing equipment	There are washbasins, but there are no soap, disinfectants, paper towels				0													1.1
		There are washbasins, there are soap and disinfectants, but no paper towels	1			1	1	1		1	1	1	1	1	1	1	1		
		There are washbasins, soap, disinfectants, paper towels		2	2					2									
1.4.	Refrigerating equipment	Surfaces visually unclean, old food residues are visible, no control thermometer in fridges				0						0	0		0		0		0.8
		Surfaces visually unclean, old food residues are visible, control thermometers are in fridges		1	1		1	1	1	1				1		1			
		Surfaces visually clean, no food residues, control thermometers are in fridges	2	2															
1.5.	Food contacting surfaces	Unclean, abrasions and old food residues are visible				0	0		0	0	0								0.9
		Abrasions are visible, but surfaces are clean	1	1	1			1				1	1	1	1	1	1		
		Clean, smooth								2	2								
	Average total evaluation		7.3			5.6			4.7			5.0			4.0				

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

12

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

Detailed Hygiene evaluation in Farmers markets (2)

	Description		Farmers markets (nx3) and evaluation of hygiene in points															Average hygiene evaluation, max 5 points
			1			2			3			4			5			n=5
2. Food processing requirements (max 10 points)																		
2.1.	Temperature of the fridge	Above +6ºC												0				1.9
		Below 0ºC																
		0-6ºC	2	2	2	2	2	2	2	2	2	2	2		2	2	2	
2.2.	Arrangement of products in fridges	Arrangement of products is disoredered				0	0		0	0	0	0	0	0	0	0		0.7
		Products are arranged according their sort	2	2	2			2									2	
2.3.	Tools and inventory	Tools are not signed, visually unclean				0			0	0	0							0.7
		Tools are signed, visually insuficiently clean	1	1	1		1	1				1	1	1	1	1	1	
		Tools are signed, clean																
2.4.	Touching/ Placing of products	Products touch other surfaces during placing (shelf, package, etc.)	0		0	0	0	0	0	0	0	0			0	0	0	0.4
		Products do not touch other surfaces during placing (shelf, package, etc.)		2									2	2				
2.5.	Packages	Packages are visually unclean and leaky												0				1.3
		Packages are visually unclean or leaky				1	1		1	1	1	1		1	1	1		
		Packages are visually clean, not leaky and whole	2	2	2			2	2									
		Average total evaluation		**7.7**			**4.7**			**3.3**			**4.3**			**4.7**		

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain
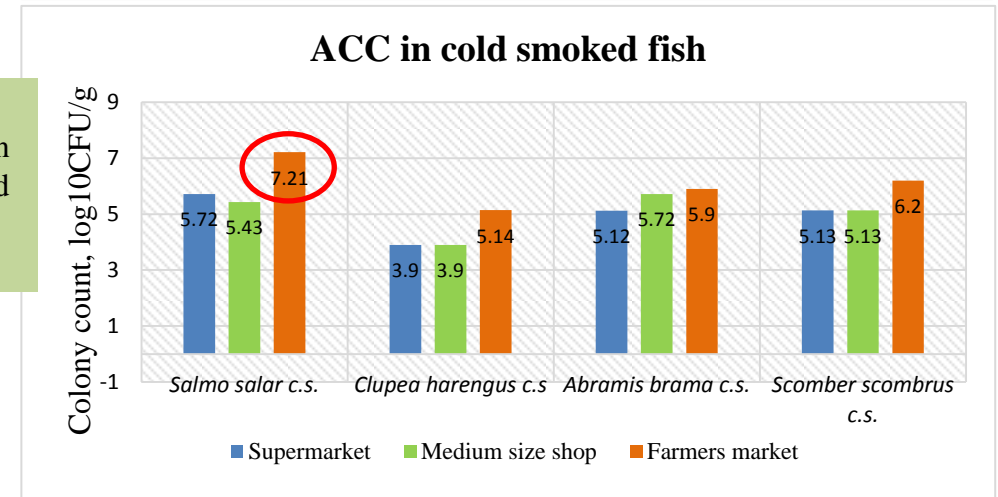
13

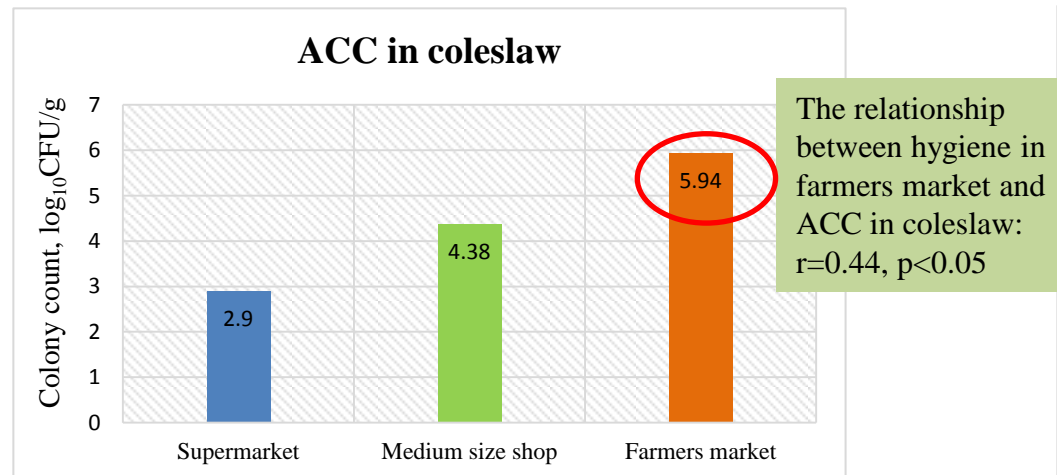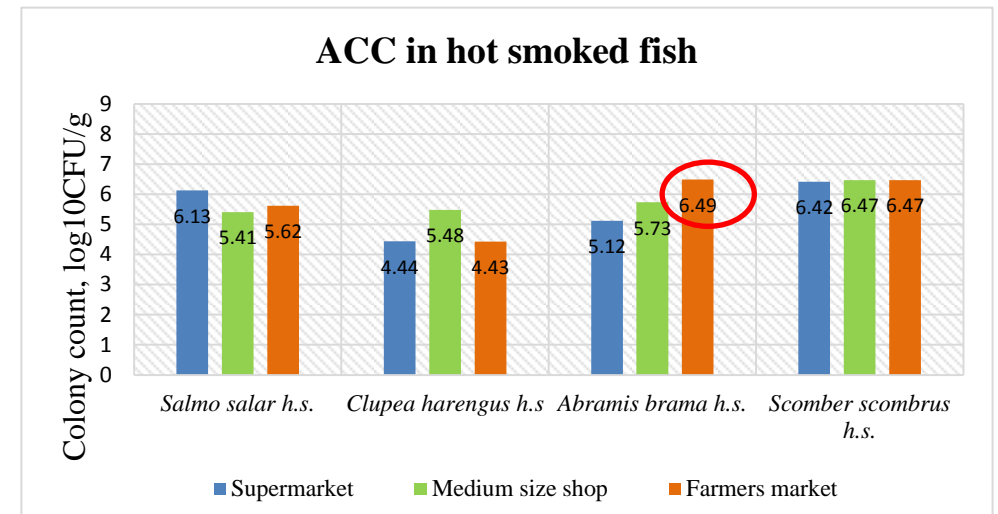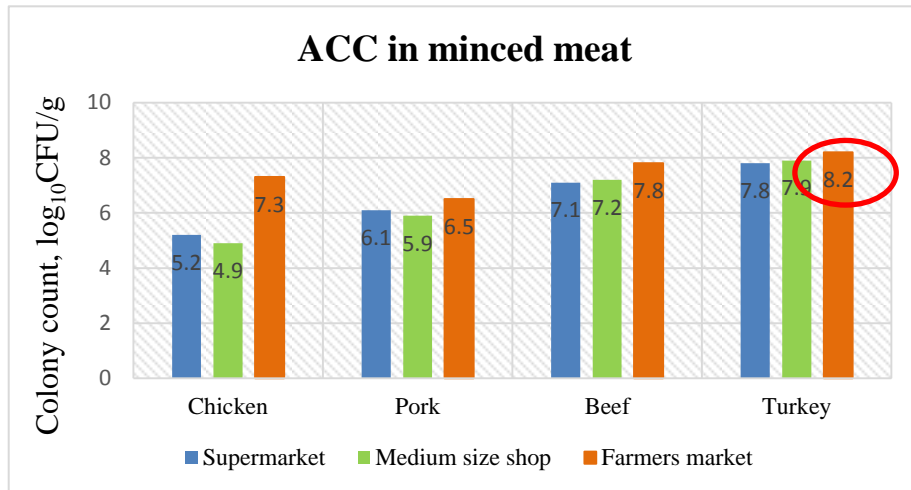# LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

Detailed Hygiene evaluation in Farmers markets (3)

Description			Farmers markets (nx3) and evaluation of hygiene in points					Average hygiene evaluation, max 5 points
			1	2	3	4	5	n=5
3. Personal hygiene requirements (max 8 points)								
3.1.	Personal head protective measures	No head cover, hair is not tied	0 0	0	0 1 0	0	0	0.5
		No head cover, hair is tied well	1	1 1		1	1 1 1	
		Adequate head cover, hair is tied						
3.2.	Personal protective measures (clothes)	No working clothes, no apron	0			0	0 0	0.7
		Working clothes are visually unclean, disordered, no apron	1 1	1 1 1	1 1 1	1	1 1	
		Clean and suitable working clothes						
3.3.	Hand hygiene	No gloves	0		0	0 0	0 0 0	0.5
		Gloves are used, but unclean or tattered	1	1 1 1 1	1	1	1	
		Clean gloves are used						
3.4.	Personal hygiene skills (hand washing)	Hands are not washed and disinfected before begining to work		0	0 0		0 0 0	0.6
		Hands are washed, but insufficiently, disinfected if necessary	1 1 1	1 1		1 1 1	1	
		Hands are washed correctly and disinfected if necessary						
		Average total evaluation	2.7	3.3	2.3	2.3	1.3	

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

14

Aerobic colony count (ACC) in analyzed foods

ACC in minced meat

Colony count, log₁₀CFU/g

Chicken: Supermarket 5.2, Medium size shop 4.9, Farmers market 7.3
Pork: Supermarket 6.1, Medium size shop 5.9, Farmers market 6.5
Beef: Supermarket 7.1, Medium size shop 7.2, Farmers market 7.8
Turkey: Supermarket 7.8, Medium size shop 7.9, Farmers market 8.2

ACC in hot smoked fish

Colony count, log10CFU/g

Salmo salar h.s.: Supermarket 6.13, Medium size shop 5.41, Farmers market 5.62
Clupea harengus h.s: Supermarket 4.44, Medium size shop 5.48, Farmers market 4.43
Abramis brama h.s.: Supermarket 5.12, Medium size shop 5.73, Farmers market 6.49
Scomber scombrus h.s.: Supermarket 6.42, Medium size shop 6.47, Farmers market 6.47

ACC in coleslaw

Colony count, log₁₀CFU/g

Supermarket 2.9, Medium size shop 4.38, Farmers market 5.94

The relationship between hygiene in farmers market and ACC in coleslaw: r=0.44, p<0.05

ACC in cold smoked fish

Colony count, log10CFU/g

Salmo salar c.s.: Supermarket 5.72, Medium size shop 5.43, Farmers market 7.21
Clupea harengus c.s: Supermarket 3.9, Medium size shop 3.9, Farmers market 5.14
Abramis brama c.s.: Supermarket 5.12, Medium size shop 5.72, Farmers market 5.9
Scomber scombrus c.s.: Supermarket 5.13, Medium size shop 5.13, Farmers market 6.2

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

15
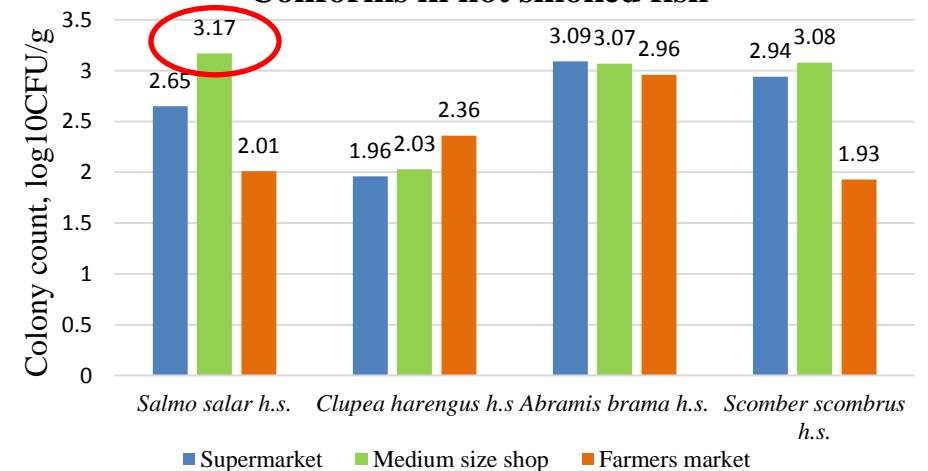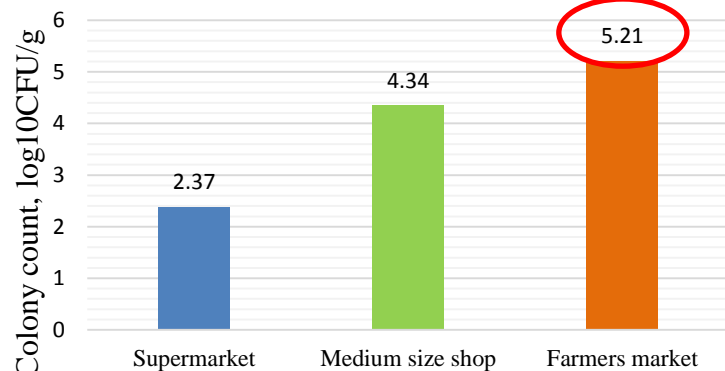
Coliforms in analyzed foods

Coliforms in minced meat
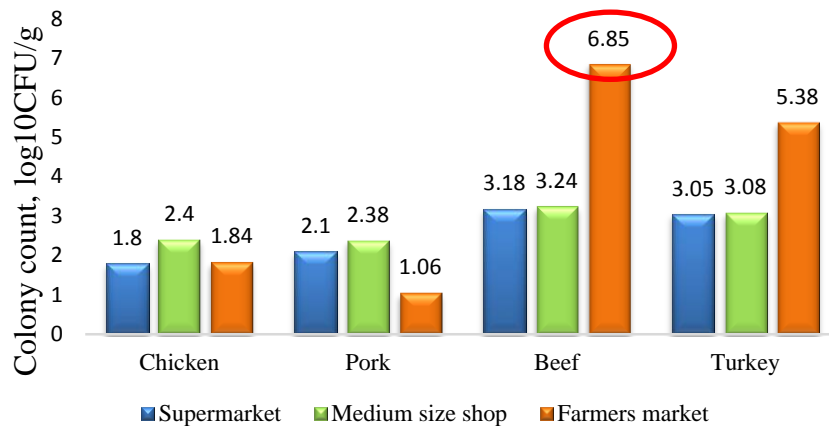
Coliforms in hot smoked fish
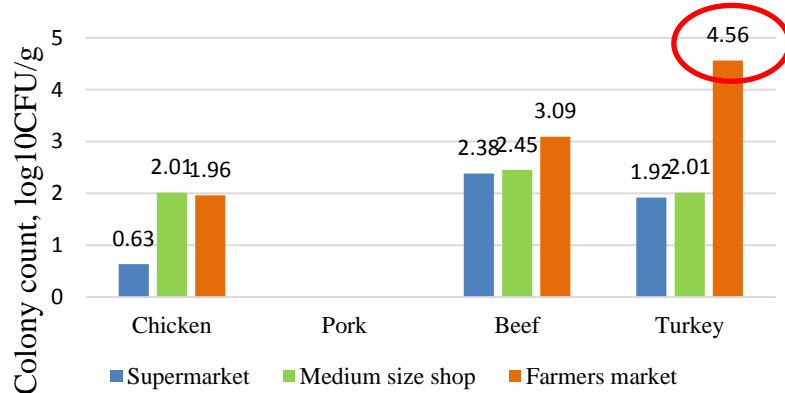

Coliforms in coleslaw

Coliforms in cold smoked fish

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
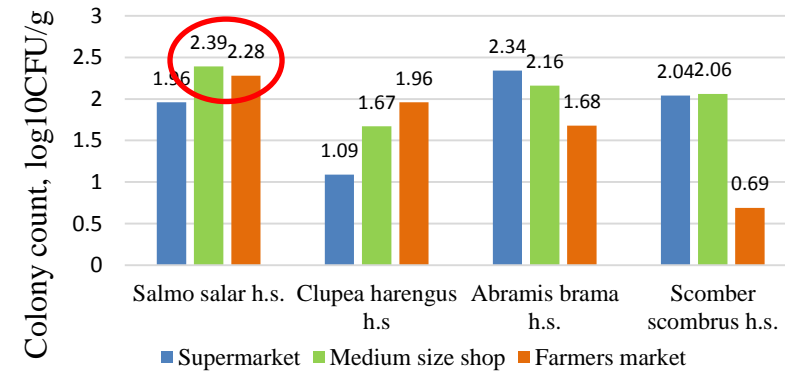11-12 June 2018 Barcelona, Spain

16

LITHUANIAN UNIVERSITY
OF HEALTH SCIENCES
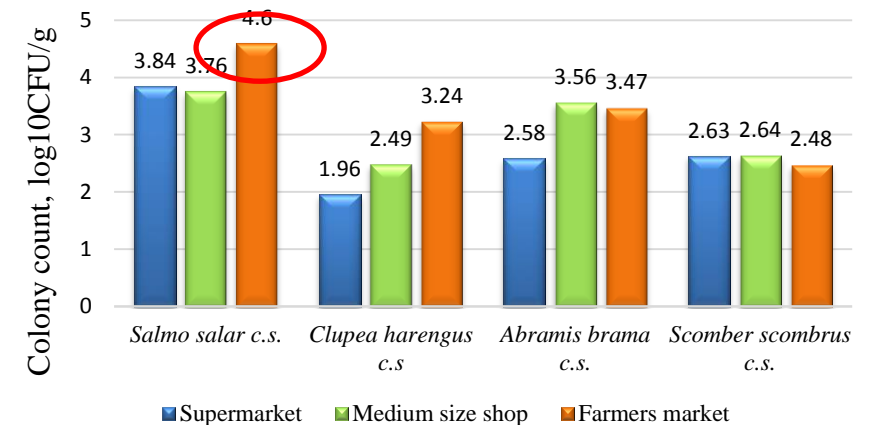
E. coli in analyzed foods

E. coli in minced meat

E. coli in hot smoked fish

E. coli in coleslaw – not found

E. coli in cold smoked fish

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World; 11-12 June 2018 Barcelona, Spain

17
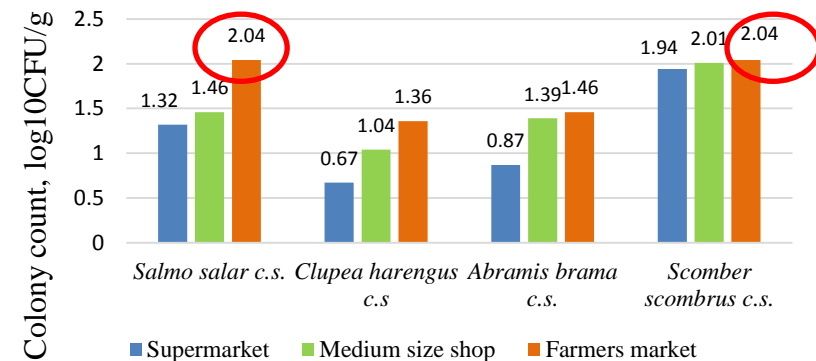
1. The most often found hygiene violations were improper storage conditions of the food, cross contamination and poor personal hygiene.
2. Hygiene of the farmers' markets was evaluated as insufficient (12 points out of 28), whereas the highest hygiene level (28 points out of 28) was assured in supermarkets:
    *   the hygiene conditions of farmers had a positive correlation ($r=0.44$, $p<0.05$) on the ACC of the products.
3. The highest counts of aerobic bacterias, coliforms and *E. coli* were found in foods, sold in farmers markets: in turkey meat (ACC- 8.18 log CFU g^{-1}), in coleslaw (coliforms - 5.21 log CFU g^{-1}), beef (coliforms - 6.85 log CFU g^{-1}) and turkey meat (*E. coli* - 4.56 log CFU g^{-1}).
4. *Salmonella* spp. and *Listeria* spp. were absent in all samples.

8th International Conference on Food Safety & Regulatory Measures – Healthier the Food, Merrier the World;
11-12 June 2018 Barcelona, Spain

18

THANK YOU
FOR ATTENTION