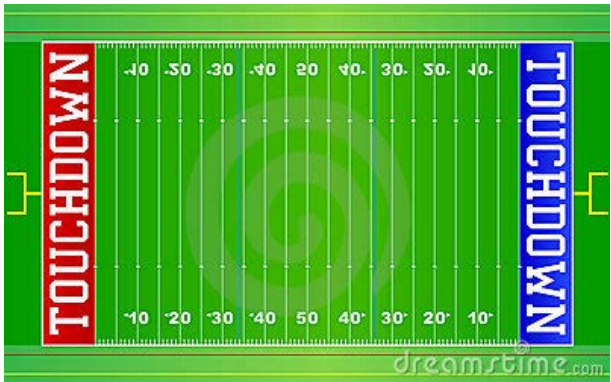

Bezbednost hrane u Srbiji pre i posle primene HACCP koncepta u prehrambenoj industriji

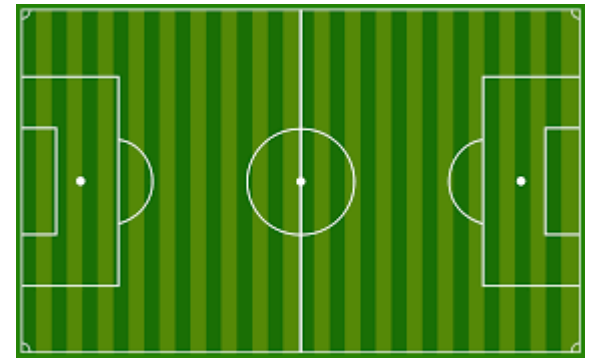
*dr Igor Tomašević, vanredni profesor,
Poljoprivredni fakultet
Univerziteta u Beogradu*



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F O O T B A L L



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HACCP

Hazard Analysis Critical Control Point



United States
Department of
Agriculture



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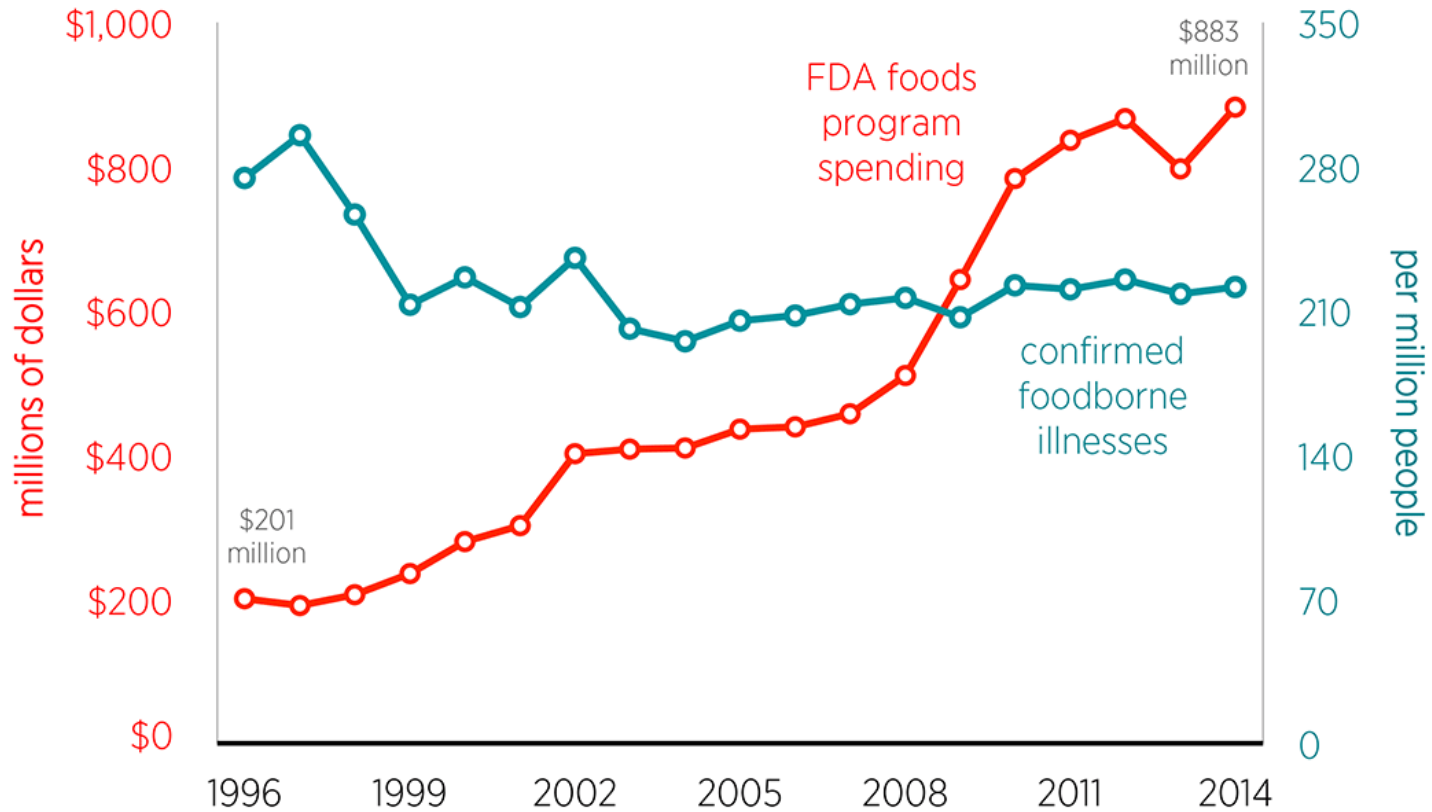


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Foods Program Spending and Foodborne Illnesses



Sources: US Department of Health and Human Services, *HHS Budgets, FY 1998-2016*; Foodborne Diseases Active Surveillance Network (FoodNet), *Number and Incidence of Infections by Year 1996-2014* (Atlanta, GA: Center for Disease Control, 2015); Michael B. Batz, Sandra Hoffmann, and J. Glenn Morris, Jr., "Ranking the Disease Burden of 14 Pathogens in Food Sources in the United States Using Attribution Data from Outbreak Investigations and Expert Elicitation," *Journal of Food Protection* 75, no. 7 (2012): 1278-91.
 Produced by Richard Williams and Tyler Richards, October 29, 2015.

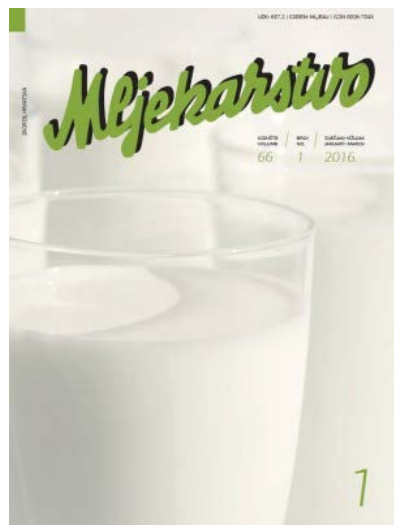


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Original scientific paper - Izvorni znanstveni rad

UDK: 637.065

Evaluation of food safety management systems in Serbian dairy industry



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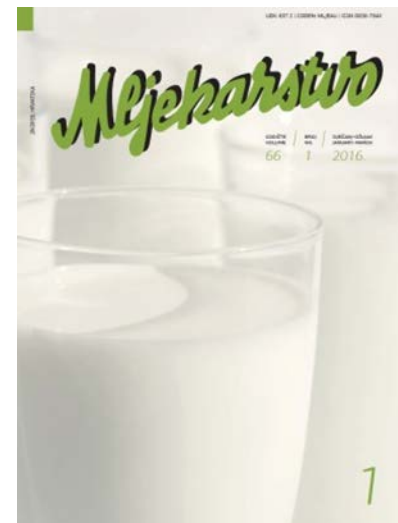
Igor Tomašević¹, Nada Šmigić², Ilija Đekić², Vlade Zarić³,
Nikola Tomić², Jelena Miocinovic^{1*}, Andreja Rajković¹

University of Belgrade, Faculty of Agriculture,
¹Animal Source Food Technology Department,
²Food Safety and Quality Management Department,
³Department of Agroeconomy,
Nemanjina 6, 11080 Belgrade, Republic of Serbia

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Domaća industrija mleka

- 27 mlekara – 65% tržišnog udela
- 70% sertifikovan HACCP
- 30% uveden bez sertifikata
- Opterećenje – konsultanti + lab analize
- Korist – povećana bezbednost proizvoda





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Food Control

journal homepage: www.elsevier.com/locate/foodcont



Serbian meat industry: A survey on food safety management systems implementation

Igor Tomašević^{a,*}, Nada Šmigić^a, Ilija Đekić^a, Vlade Zarić^b, Nikola Tomić^a, Andreja Rajković^a

^a Food Safety and Quality Management Department, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 5 Belgrade, Serbia

^b Department of Agroecology, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 5 Belgrade, Serbia



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Domaća industrija mesa

- 77 proizvođača mesa
- 93.5% sertifikovan HACCP
- 6.5% implementiran bez sertifikata
- Opterećenje – oprema i objekti
- Korist – povećana bezbednost proizvoda, povećana radna disciplina zaposlenih

The level of food safety knowledge among meat handlers

Nada Smigic

*Department of Food Safety and Quality Management,
Faculty of Agriculture, University of Belgrade, Belgrade, Serbia*

Dragan Antic

*School of Veterinary Science, Faculty of Health and Life Sciences,
University of Liverpool, Liverpool, UK*

Bojan Blagojevic

*Department of Veterinary Medicine, Faculty of Agriculture,
University of Novi Sad, Novi Sad, Serbia*

Igor Tomasevic

*Department of Animal Source Food Technology,
Faculty of Agriculture, University of Belgrade, Belgrade, Serbia, and*

Ilija Djekic

*Department of Food Safety and Quality Management,
Faculty of Agriculture, University of Belgrade, Belgrade, Serbia*

Food safety
knowledge
among meat
handlers

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The level of food safety knowledge among meat handlers

Food safety knowledge among meat handlers

- Nivo obučenosti 64% od max 100%
- Bolja obuka u proizvodnji nego u maloprodaji
- Samo 58% dovodi u vezu rast temperature sa porastom broja mikroorganizama
- Svega 5.5% zna da se kvar mesa ne može uvek detektovati vizuelno, mirisom ili ukusom





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Meat Science

journal homepage: www.elsevier.com/locate/meatsci



Short communication

The effects of mandatory HACCP implementation on microbiological indicators of process hygiene in meat processing and retail establishments in Serbia

Igor Tomasevic ^{a,*}, Jelena Kuzmanović ^b, Aleksandra Anđelković ^b, Miroslava Saračević ^b, Marija M. Stojanović ^b, Ilija Djekic ^c

^a Department of Animal Source Food Technology, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia

^b Center for Food Analysis, Zmaja od Nocaja 11, 11000 Belgrade, Serbia

^c Food Safety and Quality Management Department, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia



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Meat Science

journal homepage: www.elsevier.com/locate/meatsci



- 130 proizvođača mesa
- 220 maloprodaja mesa
- 48.246 mikrobioloških analiza
- 41 mesec pre i 43 meseca posle HACCP



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Table 2
Relative contribution of aerobic colony counts in meat establishments before and after mandatory implementation of HACCP.

	Class I	Class II	Class III	Class IV	Total	
Meat plants	Food contact surfaces					
	BH ^a	0 (0%)	238 (9.55%)	1190 (47.73%)	1065 (42.72%)	2493 (100%)
	AH ^b	1869 (50.9%)	1670 (45.48%)	118 (3.21%)	15 (0.41%)	3672 (100%)
	$\chi^2 = 4792.986; P < 0.001$					
	Hand swabs					
	BH ^a	0 (0%)	7 (2.53%)	124 (44.77%)	146 (52.71%)	277 (100%)
	AH ^b	13 (2.6%)	1 (0.2%)	485 (97%)	1 (0.2%)	500 (100%)
	Yates' $\chi^2 = 331.364; P < 0.001$					
	Cooling facilities					
	BH ^a	0 (0%)	20 (9.76%)	121 (59.02%)	64 (31.22%)	205 (100%)
	AH ^b	290 (89.23%)	35 (10.77%)	0 (0%)	0 (0%)	325 (100%)
	$\chi^2 = 476.34; P < 0.001$					
Meat retail	Food contact surfaces					
	BH ^a	0 (0%)	181 (1.7%)	3550 (33.41%)	6896 (64.89%)	10,627 (100%)
	AH ^b	7488 (39.42%)	8812 (46.39%)	720 (3.79%)	1975 (10.4%)	18,995 (100%)
	$\chi^2 = 19,575.262; P < 0.001$					
	Hand swabs					
	BH ^a	0 (0%)	33 (1.37%)	1144 (47.53%)	1230 (51.1%)	2407 (100%)
	AH ^b	12 (0.25%)	29 (0.59%)	4830 (98.96%)	10 (0.2%)	4881 (100%)
	$\chi^2 = 2991.798; P < 0.001$					
	Cooling facilities					
	BH ^a	0 (0%)	21 (2.89%)	427 (58.82%)	278 (38.29%)	726 (100%)
	AH ^b	2615 (83.33%)	496 (15.81%)	24 (0.76%)	3 (0.1%)	3138 (100%)
	$\chi^2 = 3563.594; P < 0.001$					

N – represents the number of samples from food establishments during the observed period; (%) – represents their share in the sample (totals may not equal to 100% because of rounding); BH – period before mandatory implementation of HACCP; AH – period after mandatory implementation of HACCP; ^{a,b} – periods denoted with different letters have significantly different results at $P < 0.001$; Class I ($n \leq 1 \log_{10} \text{CFU/cm}^2$); Class II ($1 \log_{10} \text{CFU/cm}^2 < n \leq 2 \log_{10} \text{CFU/cm}^2$); Class III ($2 \log_{10} \text{CFU/cm}^2 < n \leq 2.7 \log_{10} \text{CFU/cm}^2$); Class IV ($n > 2.7 \log_{10} \text{CFU/cm}^2$).





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Table 3
Positive samples of *Enterobacteriaceae* and *Staphylococcus* in meat establishments after mandatory implementation of HACCP.

			2011 ^b	2012	2013	2014
<i>Enterobacteriaceae</i>	FCS	MP	80 (19.0%)	137 (14.4%)	112 (9.9%)	105 (9.0%)
		MR	689 (31.4%)	1335 (26.0%)	989 (16.5%)	815 (14.4%)
	HS	MP	10 (18.5%)	10 (6.8%)	13 (9.3%)	16 (10.1%)
		MR	88 (12.2%)	150 (11.1%)	105 (8.3%)	127 (8.2%)
	CF	MP	4 (9.1%)	5 (5.2%)	4 (5.4%)	7 (6.3%)
		MR	56 (16%)	147 (14.3%)	63 (6.6%)	45 (5.6%)
<i>Staphylococcus</i>	FCS	MP	7 (1.7%)	6 (0.6%)	1 (0.1%)	3 (0.3%)
		MR	27 (1.2%)	47 (0.9%)	23 (0.4%)	18 (0.3%)
	HS	MP	7 (13%)	5 (3.4%)	10 (7.1%)	9 (5.7%)
		MR	18 (2.5%)	61 (4.5%)	66 (5.2%)	40 (2.6%)
	CF	MP	0 (0.0%)	1 (1.0%)	0 (0.0%)	0 (0.0%)
		MR	1 (0.3%)	2 (0.2%)	2 (0.2%)	0 (0.0%)

n – represents the number of positive samples; (%) – represents their share in the sample (totals may not equal to 100% because of rounding); FCS – food contact surfaces, HS – meat handlers' hands, CF – cooling facilities; 2011^b – June 01st 2011–December 31st 2011; MP – meat plants; MR – meat retail.



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Effects of HACCP on process hygiene in different types of Serbian food establishments



Ilija Djekic^{a,*}, Jelena Kuzmanović^b, Aleksandra Anđelković^b, Miroslava Saračević^b,
Marija M. Stojanović^b, Igor Tomašević^c

^a Food Safety and Quality Management Department, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia

^b Center for Food Analysis, Zmaja od Noćaja 11, 11000 Belgrade, Serbia

^c Department of Animal Origin Products Technology, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia

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ABSTRACT

This paper presents results from a research that analyzed effects of implementing HACCP on process hygiene in food establishments in Serbia. Process hygiene indicators were microbial profiles of 73,428 samples from food contact surfaces, hands of food handlers and cooling facilities collected from 1707 food establishments during a period of seven years. The study covered two periods during the observed period, 41 months before and 43 months after the implementation of the new Food Safety Law in Serbia requiring HACCP. Overall results presented in this paper confirm post-HACCP process hygiene improvement expressed as reduction of at least $0.7 \log_{10}$ CFU/cm² for food contact surfaces to over $1 \log_{10}$ CFU/cm² for cooling facilities. Our research confirms that after requiring HACCP, the main differences in process hygiene in respect to food contact surfaces were observed between takeaways (as food establishment with poorest hygiene) and other categories of food establishments. Institutional food services were the best scored establishments. Regarding food handlers' hygiene, results show similar level of hygiene improvements in all types of establishments.

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Table 2

Number of participating food establishments by businesses type.

Food businesses type	Number of businesses N ^a (%)
Take-away	999 (58.5%)
Restaurants	569 (33.3%)
Typical restaurants	437 (25.6%)
Hotel restaurants	67 (3.9%)
In house restaurant	65 (3.8%)
Institutional food service	58 (3.4%)
Cafe-bar	44 (2.6%)
Caterer	37 (2.2%)
	1707 (100.0%)

^a N represents the number of establishments; (%) represents their share in the sample.

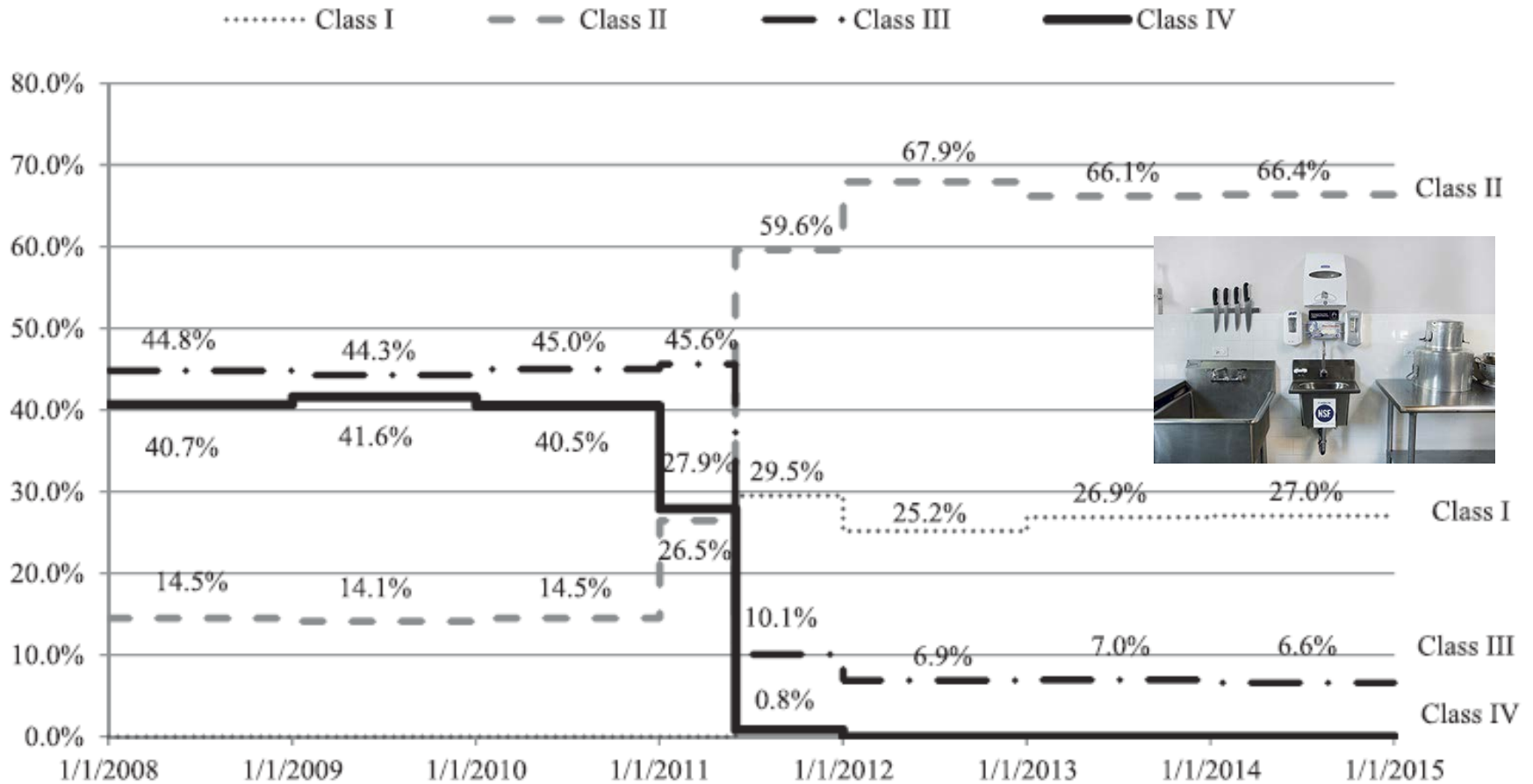


Fig. 1. Relative contributions of TPC/ACC on food contacts surfaces (in %). TPC – total plate count; ACC – Aerobic Colony Count

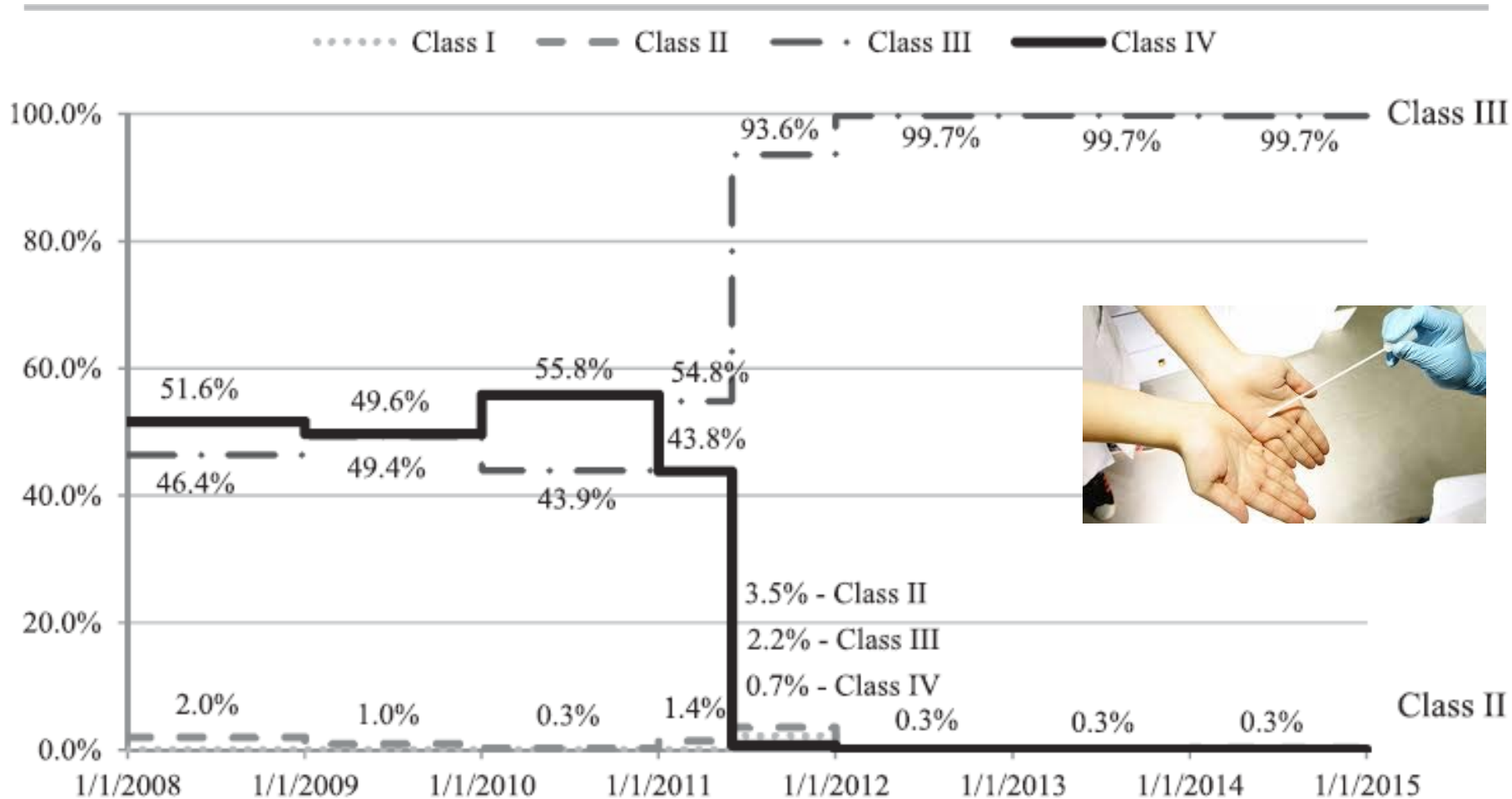


Fig. 2. Relative contributions of TPC/ACC on hand swabs (in %). TPC – total plate count; ACC – Aerobic Colony Count.

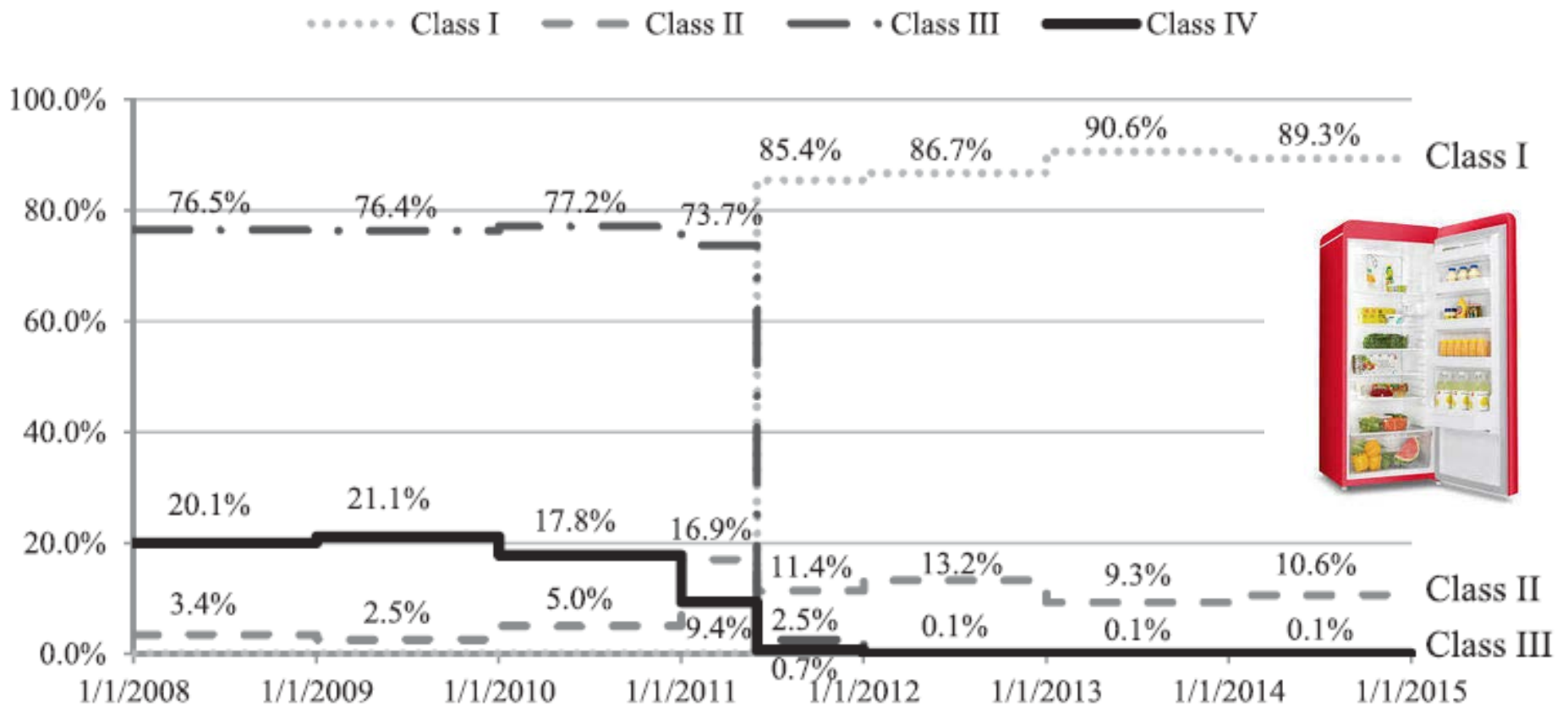
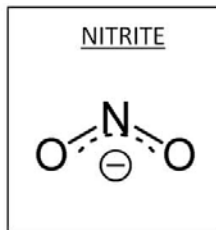
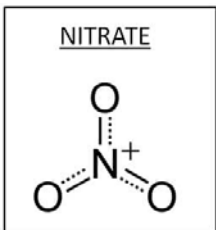


Fig. 3. Relative contributions of TPC/ACC on surfaces from cooling facilities (in %). TPC – total plate count;



Industrija mesa

- **Koncentracija rezidualnog nitrita** u proizvodima
- 268 proizvođača tokom 13 godina
- 20.106 uzoraka
- Rezidualna konc opala 30.65% nakon HACCP
- Udeo proizvoda sa konc iznad 80 mg/kg opao za 52%
- Broj uzoraka iznad zakonskog max isti 0.19%

Industrija mesa

- Koncentracija rezidualnih sulfita u proizvodima
- 555 proizvođača tokom 10 godina
- 7.351 uzorak
- Koncentracija smanjena 43% nakon HACCP
- Broj neusaglašenih uzoraka pao sa 18.6% na 8.3% nakon HACCP
- Najveći problem su ćevapi

SULFITES