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ENHANCING THE EFFICACY OF LOCAL OFFICIAL FOOD CONTROLS IN FINLAND

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ACADEMIC DISSERTATION

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ABSTRACT

The primary legal responsibility for ensuring food safety in the European Union lies with food business operators. However, official controls shall also be implemented to ensure that food handling complies with the relevant requirements. Level of food safety is thus affected by several factors: the appropriateness of legislation in order to achieve food safety, the compliance of food businesses with legislative demands, and the efficacy of official food controls in verifying and enforcing compliance. The main objective of this work was to examine the factors behind efficacious local official food controls and the possibilities for improving the efficacy of the controls at different levels of the food control chain in Finland. The second objective was to investigate the consistency and quality of the local official food controls and ways to enhance these. To achieve these aims, studies were conducted on four different levels of the food control chain, *i.e.* level of food business operators, level of official inspecting staff, level of management for the official inspecting staff, and level of auditing of official food controls. Businesses that both prepared and served foods (in this work ‘restaurants’ or ‘restaurant business operators’) were chosen as representatives of food businesses.

Positive correlations were found between the hygiene knowledge of restaurant business operators, their attitudes towards official food control, and the hygiene level of their operations. Proper justification of control measures used by food control officials, provision of guidance, and a negotiative approach in tasks of official food controls appear to be highly important for improving hygiene in food establishments.

Several factors related to the food control official and the working unit of the official may affect the inspection processes and the efficacy of controls. The use of checklists and templates for inspection reports were noted to enhance the consistency and efficacy of controls. The templates also reduced the time used in preparing inspection reports and increased the quality of these reports. Time limits for correcting non-compliances had a significant impact on the efficacy of controls.

Food control units had created adequate working conditions by providing their staff with guidance papers, templates, and possibilities to collectively hold discussions. However, poor orientation of new staff, non-systematic utilization of tacit knowledge through converting it to explicit knowledge and sharing it, and incomplete commitment among staff to quality systems remain challenges in the units. Insufficient human resources and the inability of heads of food control units to recognize problems in the workplace setting may impair the functional capacity of units. Poor workplace atmosphere and weaknesses in organization of work may be reflected in lesser appreciation of food business operators towards official food controls.

Perceptions of the auditors (regional officials) and of the auditees (municipal officials) differed greatly regarding the adequacy of the auditing system. The regional officials had experienced the auditing visits as clearly more useful and positive than the municipal

officials and also found the current auditing system to be more suitable for the purpose. The regional officials did, however, state that the auditing results had not been adequately utilized in planning the guidance and education of professionals working in official food control.

Based on the results of this work, certain weaknesses exist in the efficacy and consistency of local official food controls in Finland. However, several means to improve the efficacy and consistency of the controls were identified on all studied levels of the food control chain. Some of the observed impact possibilities, such as using checklists during inspections and using templates for inspection reports, are relatively simple to implement. Other measures, such as fully implementing risk-based procedures during inspections and more systematic utilization of the tacit knowledge that is present among the official food control staff, would require a substantial amount of time and effort of the food control authorities.

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LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications, which are referred to in the text by their Roman numerals:

- I Läikkö-Roto, T., and Nevas, M. 2014. Restaurant business operators' knowledge of food hygiene and their attitudes toward official food control affect the hygiene in their restaurants. *Food Control* 43:65-73.
- II Läikkö-Roto, T., Mäkelä, S., Lundén, J., Heikkilä, J., and Nevas, M. 2015. Consistency in inspection processes of food control officials and efficacy of official controls in restaurants in Finland. *Food Control* 57:341-350.
- III Läikkö-Roto, T., Lundén, J., Heikkilä, J., and Nevas, M. 2016. Prerequisites for effective official food control. *Food Control* 61:172-179.
- IV Läikkö-Roto, T., and Nevas, M. 2014. Auditing local official food control: Perceptions of auditors and auditees. *Food Control* 37:135-140.

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ABBREVIATIONS

COM	Commission of the European Communities
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
FBO	Food Business Operator
FSA UK	Food Standards Agency of the United Kingdom
HACCP	Hazard Analysis and Critical Control Points
IBM	International Business Machines Corporation
INTOSAI	International Organization of Supreme Audit Institutions
MAF	Ministry of Agriculture and Forestry, Finland
PASW	Predictive Analytics Software
RBO	Restaurant Business Operator
SME	Small and Medium-sized Establishments
SPSS	Statistical Product and Service Solutions
US FDA	United States Food and Drug Administration
VFM	Value For Money

1 INTRODUCTION

Food safety is a result of several factors: legislation lays down minimum hygiene requirements, food business operators (henceforth FBOs) establish and operate food safety programs and procedures based on HACCP (Hazard Analysis and Critical Control Points) principles, and official controls ensure compliance of FBOs and foodstuffs (EC No 852/2004). Responsibility for food safety was previously more strongly placed on governments and official food control authorities (Henson & Caswell, 1999; Halkier & Holm, 2006). However, increasing numbers of recorded food-borne illnesses and high-profile outbreaks such as the BSE (bovine spongiform encephalitis, commonly known as ‘mad cow disease’) crisis in 1996 created both political and economic demands for more effective food safety controls (Halkier & Holm, 2006; Varzakas et al., 2006; Garcia Martinez et al., 2007; Bánáti, 2014). It was understood that the difference between the industry responsibility *i.e.* HACCP-based procedures, and the government responsibility, *i.e.* monitoring and assessing the proper implementation of these procedures, should be clarified (Ababouch, 2000; Motarjemi, 2000). The European Commission published the “White paper on food safety”, laying the foundation for establishment of the European Food Safety Authority EFSA and outlining a radical revision of the food safety hygiene rules in the European Union (henceforth EU) (COM, 1999; Halkier & Holm, 2006).

Regarding food production in the EU, the primary legal responsibility for ensuring food safety now lies with FBOs (EC No 178/2002). However, the member states are obliged to implement official controls in order to monitor and verify that the operators comply with the relevant requirements for ensuring the safety of their operations and protecting consumer rights at all stages of the operations (EC No 882/2004). Sufficient and appropriately trained staff shall perform the tasks, and adequate facilities and equipment shall be in place to complete controls (EC No 882/2004; EC No 677/2006). To verify whether the official food controls are effectively implemented and suitable for achieving the objectives of the relevant legislation, competent authorities shall implement audit systems (EC No 882/2004; EC No 677/2006).

This thesis concentrates mainly on the roles of FBOs and enforcers of food legislation in enhancing food safety, and on interactions between these actors. Factors affecting the efficacy of official food controls at different levels of the food control chain in Finland are discussed. Efficacious official food controls should be realized as appropriate verification and enforcement of compliance with food safety legislation. Assuming that the hygiene legislation is appropriate for achieving better food safety, and that the food businesses do not always comply with the hygiene rules, appropriate verification and enforcement should ultimately result in better food safety. However, both human factors and factors related to control systems may either strengthen or weaken this development, which is why their significance should be investigated.

‘Effectiveness’ or ‘efficacy’ in general language describes the power or capacity of something to produce a desired or intended result or effect (Cambridge Dictionary .com; Oxford Dictionaries .com; The Free Dictionary .com). However, the definitions of the terms differ somewhat between the different fields of science. In public administration, the term ‘efficacy’ can be used according to the general meaning, whereas ‘effectiveness’ also

includes an assessment of how well or to what extent the stated objectives are achieved as measured by a given set of criteria (Public Administration Dictionary, 1995; International Dictionary of Public Management and Governance, 2015). Compared with 'efficacy', the term 'effectiveness' is also more easily confused with the term 'efficiency'. Thus, in this thesis 'efficacy' is used when referring to the ability of the official food controls to make an impact on food safety.

The term 'efficiency' (operational efficiency, work efficiency, employee efficiency) is included in this work. Efficiency describes a process that uses the lowest amount of inputs to create the greatest amount of outputs. Thus, operational efficiency, work efficiency, or employee efficiency describes the ability of an employee or a working community as a whole to accomplish their desired goals with the least waste of resources such as time, effort, and money.

In accordance with Regulation EC No 852/2004, the terms 'establishment' and 'food establishment' cover any unit of a food business in this thesis. The term 'retail food establishment' is used for those establishments that prepare foods for direct use of final consumers. The term 'manufacturing establishment' is used for establishments that process foods for later handling of other food businesses.

2 REVIEW OF THE LITERATURE

2.1 Legislative framework for food production

It is necessary to establish formal policies, such as direct regulation to manage risks in food production, but the overall impact of legislation depends on the intended level of food safety (Antle, 1999). Food safety legislation reduces risks of morbidity and mortality associated with consuming foods contaminated with microbial pathogens and other hazards (Antle, 1999). However, regulation also imposes additional burdens and costs on businesses, such as the cost of compliance, the cost of more paperwork, and the costs of official controls (Antle, 1999; Kaplowitz & Eyck, 2006). Risk-based regulation responds to calls to reduce the administrative burden of regulation on food businesses and to promote more efficient approaches to regulatory enforcement (Garcia Martinez et al., 2013).

Jouve (1998) concluded already in 1998 that food safety legislation should be science-based, apply risk assessment, be proportional to real health risks, be preventive in nature, include all aspects of food safety and the food system, be flexible enough for changes, define needed authority and responsibilities, and provide means for consistent implementation and adequate enforcement. These principles were included in the European food safety legislation during 2002-2004, and the current legislation is considered more risk-based and flexible and also better matched to the needs of food establishments and enforcement than its predecessors (Garcia Martinez et al., 2013). The establishment of EFSA has strengthened risk assessment in the decision-making process, but since the risk management remains in the hands of the member states, it may include variability (Caduff & Bernauer, 2006). The requirement for implementing HACCP-based practices in food safety legislation has also been stated to have a very uneven effect on businesses because of HACCP's strong reliance on science; many small producers lack the expertise and resources to adapt to HACCP, forcing some of them out of business (Wengle, 2015).

Regarding food production in the EU, the given rules mainly consist of legislation common to all member states, provided by the European Parliament and Council or by the European Commission. According to Regulation EC No 178/2002, all FBOs shall ensure and verify that the foods under their responsibility are in compliance with the relevant requirements at all stages of production, processing, and distribution. The common principles for the hygienic handling of foods in any food business in the EU are laid down in Regulation EC No 852/2004. These hygiene principles include, among others, the structural, operational, and hygiene requirements for food establishments, the implementation of good hygiene practices and HACCP-based procedures in food production, and the obligation to provide possibilities for relevant hygiene training and HACCP training for the food operating staff (EC No 852/2004). In Finland, the requirements set in the aforementioned regulations are further specified in national legislation: all food handlers working for longer than three months in food establishments must have a Food Hygiene Proficiency Certificate to reflect their knowledge of food

hygiene, and the own-checking programs of food businesses shall describe how adequate hygiene knowledge in food handling is ensured in their operations (Finnish Food Act 23/2006; MAF No 1367/2011; MAF No 795/2014).

2.2 Critical but common hygiene deficiencies in food production

Avoidance of cross-contamination, applying good personal hygiene, keeping food at safe temperatures, and adequate cooking are among the most important factors for food safety (US FDA, 2009; Pham et al., 2012). For example, proper hand washing and proper use of gloves are efficient and convenient ways to reduce pathogens from hands and to avoid cross-contamination (Todd et al., 2010a, 2010b). However, food businesses do not always comply with the rules, and their practices may differ substantially from the legislative requirements (Henson & Heasman, 1998; Clayton et al., 2002; Walczak & Reuter, 2004; Veiros et al., 2009). Poor personal hygiene, contaminated equipment, improper holding temperatures, and inadequate cooking have been reported as food safety violations that typically cause food-borne illnesses (Collins, 1997; Buchholz et al., 2002; Roberts et al., 2008). Critical food safety violations in retail food establishments, such as commercial restaurants, catering businesses, cafés, hospital kitchens, school kitchens, and hotel kitchens, are widely reported in the literature (Table 1).

Table 1 *Critical food safety violations in retail food establishments both preparing and serving foods reported in the literature.*

Food safety violation	Reference
Inadequate temperatures and inadequate temperature control	Walker et al., 2003b; Phillips et al., 2006; Hadjichristodoulou et al., 2008; Roberts et al., 2008; Campos et al., 2009; Garayoa et al., 2011; Marzano & Balzaretto, 2011; Niode et al., 2011; Djekic et al., 2014; Garayoa et al., 2014; Martins & Rocha, 2014
Deficient hand hygiene	Phillips et al., 2006; Campos et al., 2009; Buccheri et al., 2010; Niode et al., 2011; Sheth et al., 2011; Tan et al., 2013; Boxman et al., 2015
Obvious risks for cross-contamination in operations	Walker et al., 2003b; Roberts et al., 2008; Campos et al., 2009; Buccheri et al., 2010; Sheth et al., 2011; Djekic et al., 2014; Garayoa et al., 2014; Boxman et al., 2015
Poor cleaning and disinfection practices	Legnani et al., 2004; Garayoa et al., 2011; Martins & Rocha 2014

In a study addressing Finnish food stores, temperature violations were observed in 50% (42/84) of the products on sale, and 18% (15/84) of the products exceeded the legislative temperature limits by over 3°C for more than 30 min (Lundén et al., 2014b). In 2009, hygiene level in Finnish professional kitchens was found to be generally acceptable; about 11% (22/198) of the kitchens were responsible for all unacceptable hygiene scores, the highest hygiene-related risks occurring in food storage and different operational steps of meal preparation (Tuominen & Maijala, 2009).

2.3 Determinants for hygiene level in food establishments

There are a number of factors related to food businesses that have been shown to have an effect on their hygiene level. Both the infrastructural needs and the human factor must be recognized as determinants for hygiene and food safety (Fotopoulos et al., 2009). Maintaining food safety culture successfully requires that the operators and staff know the risks associated with the foods they handle, know why managing the risks is important, and effectively manage these risks in practice (Powell et al., 2011). The right attitude together with the needed knowledge, skills, and support will lead to the required performance with a high probability (Pilling et al., 2008).

It has been generally accepted by enforcers and other food safety experts that there will always be a sector of businesses that will not comply with food legislation, either consciously or due to a lack of knowledge (Clayton et al., 2002; Fairman & Yapp, 2004; Walczak & Reuter, 2004; Kaplowitz & Eyck, 2006; Sheth et al., 2011). Conscious decisions about whether or not to comply with safety regulations are based on different kinds of cost-benefit analysis, where the cost of the needed measures and the knowledge and attitude of the FBO all have important roles (Walczak & Reuter, 2004). Differences exist in the specific manner in which individual businesses comply with food safety regulations, but the process that leads to the decisions regarding compliance follows a common sequence of events (Henson & Heasman, 1998). These events include becoming aware of a new regulation, interpreting the effects of the new regulation on the business, and identifying the changes required to achieve compliance (Henson & Heasman, 1998). To diminish the effect of a lack of knowledge of FBOs for non-compliance, enforcement practices in the EU have moved from punishment to prevention by providing incentives and information (Rouvière & Caswell, 2012).

2.3.1 Operational aspects and size of business

Operational type of the food business is one determinant for food safety; for example, restaurants are more commonly reported to have problems in hygiene than other operation types preparing and serving foods (Tuominen & Maijala, 2009; Lee et al., 2012; Kwon et al., 2014). In Finland, the most common infection locations for food-borne outbreaks during 2000-2014 have been restaurants, cafés, and hotels, with, for example, 20/36 (56%) outbreaks in 2014, 23/43 (53%) outbreaks in 2013, 19/43 (44%) outbreaks in 2012 and

25/45 (56%) outbreaks in 2011 (Finnish Zoonosis Centre, 2016). Of the reported non-compliances in connection with the outbreak operators during 2014, 44% were associated with incorrect temperatures in storing or handling of foodstuffs, and infected food workers combined with deficient hand hygiene caused 14% of the food-borne outbreaks (Finnish Zoonosis Centre, 2016). Norovirus was the most commonly detected causative agent: of 36 food-borne outbreaks, norovirus was the causative agent in 22% (8 outbreaks) (Finnish Zoonosis Centre, 2016).

Complexity of operations appears significant within the different operation types; for example, restaurants with relatively simple menus tend to receive higher inspection scores than ones that use more complex menus with more involved preparation methods (Seiver & Hatfield, 2000). Membership to a chain may have an impact on hygiene level, but the results are conflicting: the effect of being a member of a chain has been reported both to increase hygiene (Jin & Leslie, 2009; Kassa et al., 2010; Murphy et al., 2011; Harris et al., 2014) and to weaken it (Phillips et al., 2006).

The strongest determinant for food safety and compliance with regulations according to the literature appears to be the size of the business. Small businesses generally implement regulation at a later stage and are more likely to choose partial compliance or non-compliance than large businesses (Henson & Heasman, 1998). Barriers for food safety in small and medium-sized establishments (SMEs) and microbusinesses are widely reported. These barriers include, among others, lack of adequate prerequisite programs and manager commitment, time constraints, and lack of money (Lange et al., 2000; Panisello & Quantick, 2001; Taylor, 2001; Clayton et al., 2002; Bánáti, 2003; Yapp & Fairman, 2006; Celaya et al., 2007; Kaario et al., 2007; Violaris et al., 2008; Fielding et al., 2011). Food safety violations have been reported to be positively related to the amount of work the cooks have to do and inversely related to the amount of time used for cleaning and sanitizing (Walczak & Reuter, 2002). Regression model has shown that the adequacy of buildings and facilities improves the observed practices (da Cunha et al., 2014), but small producers often lack possibilities to invest in updating plant facilities or equipment to compliance levels (Wengle, 2015). If legislation lowers the profits and productivity of a food business, the FBO may experience the rules as unfair, oppressive, ambiguous, unjustified, or unnecessary (Walczak & Reuter, 2004). Since SMEs and microbusinesses may lack expertise and resources to adapt adequate food safety systems (Fielding et al., 2011; Luning et al., 2013; Dzwolak, 2014; Fernando et al., 2014; Wengle, 2015), HACCP regulations may pose insurmountable challenges for some of them (Wengle, 2015). Additionally, since the smaller businesses more often lack the skill and knowledge necessary for them to be able to identify risks in their operations and hazards within their premises (Fairman & Yapp, 2004; Yapp & Fairman, 2006; Nevas et al., 2013), the primary motivation to improve food safety conditions will not come from within the food business, but will be provided by external drivers such as enforcement agency staff (Fairman & Yapp, 2004, 2005). This includes a risk for the enforcers to end up as permanent drivers for compliance instead of the businesses taking the responsibility themselves (Fairman & Yapp, 2004, 2005). The ability and willingness of SMEs to provide training to their staff may also be limited (Lange et al., 2000).

A large majority of FBOs belong to the group of SMEs or microbusinesses both in the EU (Eurostat, 2011) and in Finland (National register for municipal food control data, 2015). Several studies conclude that governmental agencies should provide more help for SMEs and microbusinesses to implement safe behaviors (Vela & Fernández, 2003; Kramer & Scott, 2004; Violaris et al., 2008; Luning et al., 2015). Further flexibility and simplification of the system have also been suggested (Dzwolak, 2014). However, since the small businesses may allocate the responsibility for identifying problems to the enforcers and not to themselves (Fairman & Yapp, 2004), they should primarily be supported in developing their own risk management. Food legislation of the EU includes a mechanism of national guides for good hygiene practices, designed for sharing ready-made inter-branch specific models of good practices for businesses that may lack the expertise to produce such models by themselves (EC No 852/2004). However, in Finland only seven approved guides for good hygiene practices have been taken into use for the food chain (Evira, 2015a).

2.3.2 Food safety systems

Food safety systems rely on successful determination of food safety hazards, an acceptable level of risk to the consumer, and effective measures for control of these risks (Manning, 2013). Product safety and quality improvement, increased customer confidence, and improved compliance with regulatory requirements motivate the businesses to adapt food safety systems (Mensah & Julien, 2011; Wilcock et al., 2011; Fernando et al., 2014). According to several studies, well-functioning food safety systems lead to increased food safety (Legnani et al., 2004; Eves & Dervisi, 2005; Nielsen, 2006; Hadjichristodoulou et al., 2008; Lindblad & Berking, 2013; Djekic et al., 2014). Attitudes of Finnish FBOs toward food safety systems have been shown to be positive (Hielm et al., 2006), but implementation of the systems may prove inadequate or lacking (Tuominen & Maijala, 2009; Lundén et al., 2014b).

The most widely known food safety systems include HACCP, also required for food businesses in Europe by Regulation EC No 852/2004. HACCP started as a voluntary approach by the industry, emerging as the food safety system of choice in the 1990s (Lee & Hathaway, 2000; Sperber, 2005). With HACCP, the focus in food safety has shifted from end-product to process, and the surveillance of operations has become more detailed and systematic (Nielsen, 2006). However, simply conforming to HACCP requirements does not guarantee that a food company is able to reach the highest product safety performance, and HACCP system should not be seen as an omnipotent solution (Bánáti & Lakner, 2012; Kafetzopoulos et al., 2013). The sought improvement in food safety by implementing the HACCP system is realized only if HACCP has a strong foundation in good manufacturing and hygiene practices (Sperber, 1998; Ababouch, 2000; Mortimore, 2001; Wallace & Williams, 2001; Baş et al., 2006a, 2007; Fotopoulos et al., 2009) and if the people charged with the management and implementation have the knowledge and expertise to apply the system effectively (Khandke & Mayes, 1998; Aruoma, 2006; Jevšnik et al., 2008; Mensah & Julien, 2011).

Weaknesses in implementation of prerequisites and HACCP have been reported in retail food establishments (Doménech et al., 2011; Garayoa et al., 2011), and several general barriers for implementation related to managerial, organizational, and technical issues have been identified (Taylor, 2001). Barriers identified in both retail food establishments and manufacturing establishments include complicated terminology (Mitchell, 1998; Baş et al., 2007), weak understanding of the general HACCP principles (Kvenberg et al., 2000; Vela & Fernández, 2003; Baş et al., 2007), and weak understanding of the prerequisite programs and of the relationship between prerequisite programs and HACCP (Mortimore, 2001; Wallace & Williams, 2001; Vela & Fernández, 2003; Sperber, 2005). The process of hazard analysis is weakened by poor knowledge to conduct complete hazard analysis and by difficulties in identifying hazards (Mitchell, 1998; Eves & Dervisi, 2005; Ryu et al., 2013; Wallace et al., 2014). Inadequate facilities and equipment, lack of financial resources, time-related issues, failures in motivating staff to perform according to plan, and inadequate training of managers and staff have been reported as reasons for inadequate implementation (Panisello & Quantick, 2001; Walker et al., 2003b; Strohschein et al., 2004; Eves & Dervisi, 2005; Baş et al., 2006a, 2007; Garayoa et al., 2011; Mensah & Julien, 2011).

2.3.3 Supervision and management commitment

Successful implementation of food safety systems requires commitment by both managers and food handlers (Jevšnik et al., 2008; Djekic et al., 2011; Powell et al., 2011; Wilcock et al., 2011; Wu, 2012). Appropriate food safety practices require adequate environments, skills and knowledge, and motivational support (Clayton et al., 2002; Allwood et al., 2004; Jevšnik et al., 2008; Fotopoulos et al., 2009; Djekic et al., 2011; Soon et al., 2012). Managers thus have an important responsibility in ensuring that food workers receive the needed food safety training on a regular basis, that supervision and evaluation of operations are continuous, and that proper facilities are provided (Ehiri et al., 1997; Panisello & Quantick, 2001; Clayton et al., 2002; Seaman & Eves, 2006; Egan et al., 2007; Howells et al., 2008; Pilling et al., 2008; Seaman, 2010; Seaman & Eves, 2010; Garayoa et al., 2011; Niode et al., 2011; Wilcock et al., 2011; Medeiros et al., 2012; Wu, 2012; Saccol et al., 2013; Martins & Rocha, 2014). Managers should also focus on providing a sound role model, motivating the food handlers to adopt safe food handling practices, and developing and creating an appropriate organizational climate to promote such practices (Panisello & Quantick, 2001; Seaman & Eves, 2006; Howells et al., 2008; Pilling et al., 2008; Seaman, 2010; Seaman & Eves, 2010; Lee et al., 2013). General attitudes of managers towards food hygiene and hygiene culture of establishments appear highly significant for the hygienic situation in practice (Clayton et al., 2002; Wilcock et al., 2011; Bánáti & Lakner, 2012). According to Kaplowitz & Eyck (2006), greater management commitment to food safety leads to increased food safety commitment by food workers, which in turn is associated with reduced opposition to regulation.

Certified food managers (managers who have received a certificate upon completion of a food safety training course) have been reported to have a positive effect on food safety.

In a study performed by Hedberg et al. (2006), the presence of a certified kitchen manager was reported to result in less bare hand contact with foods and noted to be the major difference between outbreak and non-outbreak restaurants. Allwood et al. (2004) found a strong positive correlation between the person in charge being a certified food manager and being able to describe the food code hand washing procedure, which in turn led to food workers being able to demonstrate code-compliant hand washing. Presence of a certified kitchen manager has also been found to decrease several types of critical violations in the operations, facility, and equipment of food establishments (Cates et al., 2009; Kassa et al., 2010). Additionally, certified kitchen managers appear to have more positive attitudes about offering food safety training to their staff and also improving the quality of informal on-the-job training (Cates et al., 2009; Roberts & Barret, 2009).

2.3.4 Knowledge and skills of food handlers

Food hygiene knowledge and skills for adequate food handling are crucial for safe food production. Hygiene situation in food establishments has been found to correlate positively with the level of knowledge of food workers (Tuominen & Maijala, 2009; da Cunha et al., 2014), and food managers have been reported to consider good food safety knowledge among food workers as the most important factor for food safety (Kramer & Scott, 2004). Despite this, critical knowledge gaps of food workers in retail food establishments in both preparing and serving foods are widely reported in the literature (Table 2). Higher age, more work experience, and higher educational level may increase food hygiene knowledge of food handlers (Çakıroğlu & Uçar, 2008; Buccheri et al., 2010; Martins et al., 2012; Soares et al., 2012; McIntyre et al., 2013; Tan et al., 2013; da Cunha et al., 2014; Martins et al., 2014; Pichler et al., 2014).

Table 2 *Reported knowledge gaps of food workers leading to inadequate hygiene conditions and hazardous operations in retail food establishments both preparing and serving foods. Some of the references include also manufacturing establishments in their study population.*

Knowledge gap	Reference
Adequate temperatures and temperature control	Walker et al., 2003a; Bař et al., 2006b; Gomes-Neves et al., 2007; Jevřnik et al., 2008; Santos et al., 2008; Tokuç et al., 2009; Jianu & Chiř, 2012; Martins et al., 2012; Soares et al., 2012; Ko, 2013; Osaili et al., 2013; Martins et al., 2014; Pichler et al., 2014; Sani & Siow 2014
Cross-contamination issues	Bař et al., 2006b; Gomes-Neves et al., 2007; Santos et al., 2008; Jianu & Chiř, 2012; Mulugeta & Bayeh, 2012
Cleaning of instruments and working surfaces	Walker et al., 2003a, 2003b; Gomes-Neves et al., 2007; Soares et al., 2012
Microbiological risks, food poisoning and pathogens	Walker et al., 2003a; Gomes-Neves et al., 2007; Bolton et al., 2008; Jevřnik et al., 2008; Santos et al., 2008; Violaris et al., 2008; Tokuç et al., 2009; Jianu & Chiř, 2012; Martins et al., 2012; Soares et al., 2012; Osaili et al., 2013; Tan et al., 2013; Verhoef et al., 2013; Martins et al., 2014; Sani & Siow 2014
HACCP system	Walker et al., 2003b; Eves & Dervisi, 2005; Bař et al., 2007; Bolton et al., 2008

Connections between training and hygiene knowledge are widely reported (Bař et al., 2006b; Roberts et al., 2008; Santos et al., 2008; Jianu & Chiř, 2012; Mulugeta & Bayeh, 2012; Soon et al., 2012; Osaili et al., 2013; Pichler et al., 2014). Training has been reported to lead to increased compliance with regulations, a reduction in critical violations, and an increased level of awareness and sense of responsibility in food handlers regarding food hygiene (Mathias et al., 1995; Legnani et al., 2004; Thompson et al., 2005; Noble et al., 2009; Choudhury et al., 2011; Garayoa et al., 2014; Martins & Rocha, 2014). Provision of training courses is also considered crucial for achieving positive behavioral changes (Acikel et al., 2008, Campos et al., 2009; Medeiros et al., 2011; Martins et al., 2012; Saccol et al., 2013). However, increasing knowledge alone may be insufficient to achieve safe behaviors (Powell et al., 1997; Bolton et al., 2008; Santos et al., 2008; Buccheri et al., 2010; Sani & Siow, 2014). Some studies have shown that training has led to improved knowledge, but not to improved hygiene practices (Buccheri et al., 2010; Park et al., 2010; da Cunha et al., 2014). Additionally, not all training provides the knowledge needed (Ehiri et al., 1997; Powell et al., 1997).

2.3.5 Attitude and motivation of food handlers

A positive attitude of food handlers towards food safety in general is important due to its positive effect on hygiene performance (Ko, 2010; Bánáti & Lakner, 2012; Aziz & Dahan, 2013; Lee et al., 2013). Lack of motivation to perform correctly may result in, for example, poor personal hygiene (Tuominen & Maijala, 2009). A person's own belief about the safety of food is a powerful predictor for attitudes towards regulation – the food workers who are more convinced that food is safe in general are more opposed to food safety regulation (Kaplowitz & Eyck, 2006). It has not, however, been studied how the attitudes of FBOs towards the official food controls or their quality experience regarding these controls affect the corrective action performance and the hygiene status of their businesses.

The links between positive behavior, attitudes, and continuous training of food handlers regarding safe food handling are apparent (Seaman & Eves, 2006; Gomes-Neves et al., 2007; Pilling et al., 2008; Buccheri et al., 2010; Abdul-Mutalib et al., 2012; Ko, 2013; Sani & Siow, 2014). Food safety training may improve attitudes towards performing adequate hygiene practices (Soon et al., 2012; McIntyre et al., 2013). However, if the attitudes towards skills development are negative or indifferent, training opportunities will not be sought and exploited (Lange et al., 2000; Panisello & Quantick, 2001). Incorrect training also fails to improve the attitudes (Baş et al., 2006b; da Cunha et al., 2014). Furthermore, the same problem is apparent regarding attitude as with knowledge; although food workers might have positive attitudes about safe practices, the practices may not be fully implemented (Tokuç et al., 2009; Soares et al., 2012).

According to a number of authors, one of the main reasons for the lack of effectiveness of training in food hygiene is related to the knowledge-attitude-practices model adopted in most of the training programs (Ehiri et al., 1997; Coleman & Roberts, 2005; Egan et al., 2007). This model is based on the assumption that if information is provided to the food handlers they will use it to change behavior, but the model does not consider the effect of other relevant factors, such as pedagogical and motivational factors, on success (Rennie, 1995; Ehiri et al., 1997; Coleman & Roberts, 2005; Seaman & Eves, 2006; Martins et al., 2014).

2.4 Effective training programs for safe food production

The primary aim for food hygiene training is a change in behavior towards less risky food handling practices (Seaman & Eves, 2006; Egan et al., 2007; Yiannas, 2015). However, the content of training programs must be relevant and training needs should be assessed before designing the programs (Seaman & Eves, 2006; Seaman, 2010; Chapman et al., 2011; Martins et al., 2012; Garayoa et al., 2014; Martins et al., 2014). Successful communication requires investment of time and effort to uncover what people already know, what they believe, and how they best receive and understand information (Jardine, 2003). The message should also be simple; food safety messages that are difficult to receive or understand are easily disregarded (Jacob et al., 2010; Papadopoulos et al.,

2012). To be effective, training should be developed based on the concept of risk, and learning motivation of the employees should be increased by clear consequences for non-compliances and improper food handling and by stressing the importance of the actions of food workers (Clayton et al., 2002, Coleman & Roberts, 2005; Santos et al., 2008; Chapman et al., 2011; Niode et al., 2011; Sarter & Sarter, 2012; Kim et al., 2013; Martins et al., 2014).

Alternative strategies, such as online learning and interactive media, flyers and booklets, and displaying encouraging posters or signs in food establishments, should be used during the training processes (Howells et al., 2008; Pilling et al., 2008; York et al., 2009; Buccheri et al., 2010; Medeiros et al., 2011). Job-specific training with a practical approach should be included in the training processes (Lange et al., 2000; Jevšnik et al., 2008; Park et al., 2010; Soares et al., 2013; Tan et al., 2013). Training programs should also be assessed, including evaluation of the training process, of increased knowledge, and of behavioral change results (Seaman & Eves, 2006; Egan et al., 2007; Seaman, 2010; Jianu & Chiş, 2012; Soares et al., 2012; Osaili et al., 2013; da Cunha et al., 2014).

Food workers should be regularly reminded of performing the right behaviors with, for instance, post-training monitoring of the practices and feedback, and refresher training should be provided periodically (Acikel et al., 2008; Çakıroğlu & Uçar, 2008; Soon et al., 2012; McIntyre et al., 2013; da Cunha et al., 2014; Sani & Siow, 2014). To be effective in practice, food hygiene training thus needs continuous managerial support and the support of colleagues (Seaman & Eves, 2006; Egan et al., 2007; Pilling et al., 2008; Seaman, 2010; Seaman & Eves, 2010; Soon et al., 2012). A combination of training and intervention practices addressing typical barriers for food safety has been found to be more effective than relying on training alone (Howells et al., 2008; York et al., 2009; Lindblad & Berking, 2013).

The combination of incentives, technical support, and training programs is suggested as an approach also for food safety authorities to adopt (Rouvière & Caswell, 2012). Examples of well-functioning governmental methods have been reported. For instance, due to having had only a little progress with HACCP, the Food Standards Agency of the United Kingdom applied an alternative system of 'safe methods' for caterers and retailers in 2006 (Taylor, 2008; FSA UK, 2015). 'Safe methods' include more practical guiding and training and prescribed safe methods for cooking, chilling, cleaning, avoiding cross-contamination, and management control. Positive implications on food safety control and attitudes were reported, and positive effects on manager involvement, more clearly defined responsibilities, and increased staff involvement and willingness to act accordingly were noted because of giving them the reasons 'why' (Taylor, 2008).

2.5 Official food controls

2.5.1 Regulation on official food controls in Europe and Finland

According to Regulation EC No 882/2004, official food controls should be carried out regularly, on a risk basis, and with appropriate frequency. The controls shall cover all stages of production, processing, and distribution of foods. To ensure the efficacy of the controls, the competent authorities should have a sufficient number of suitably qualified and experienced staff and also possess adequate facilities and equipment to carry out their duties properly (EC No 882/2004).

In Finland, official food controls are included in the concept of environmental health, the implementation of which at the local level shall be organized in municipal co-operation areas (Finnish Act on the Environmental Health Cooperation Areas 410/2009). Municipal food control authorities and these cooperation areas are responsible for official food controls in all food establishments in municipalities, except for slaughterhouses and associated establishments (Finnish Food Act 23/2006). The Regional State Administrative Agencies have the obligation to guide and evaluate the municipal food control, and the Finnish Food Safety Authority Evira (henceforth Evira) is responsible for the national guidance of food control regulations (Finnish Food Act 23/2006). Shared responsibility between different authorities in food control activities has, however, been reported to often result in lack of coordination and efficiency, and to cause gaps and overlaps in the control system (deWaal, 2003; Varzakas et al., 2006; Al-Kandari & Jukes, 2012; Ayalew et al., 2013; Hadjigeorgiou et al., 2013; Jia & Jukes, 2013; Smigic et al., 2015).

In order to build a legislative framework for public administration in Finland, the Finnish Administrative Procedure Act 434/2003 establishes principles for good governance, and the Finnish Local Government Act 410/2015 lays down general rules regarding the organization of public administration in municipalities. However, the Finnish Constitution Law 731/1999 gives the municipalities a strong self-determination right, which may lead to differing organization of official food controls and varying provision of the needed prerequisites for the controls (such as adequate number of staff, adequate facilities and equipment, or possibilities for training) between the different co-operation areas. In fact, differences have been reported between municipal food control authorities regarding the resources available for food controls and the collected control fees from FBOs, the purpose of which is to ensure sufficient resources (Tähkää et al., 2008; Tähkää et al., 2009; Lepistö et al., 2010; Tähkää et al., 2013). According to Tähkää et al. (2008), local decisions concerning the structure of control organs can have considerable consequences on the controls; factors such as low number of food experts in the municipal council could lead to inadequate resources in local official food control. Different possibilities for organization of the system in Finland have been discussed (Niemi, 2002; Hirn, 2011; Nevas & Lepistö, 2015; Tarasti, 2016), but so far only meat inspection and control of foods of animal origin received from other member states of the EU have been centralized to the state (Amendment of the Finnish Food Act, 352/2011).

2.5.2 Role of inspections

The main objective of official controls in general is to verify compliance with given rules. Official food controls have a fundamental role in ensuring food safety through reduction of violations of regulation, and thus, presumably also the number of food-borne outbreaks (May, 2004; Doménech et al., 2011; Kwan & Lau, 2011; Murphy et al., 2011). Lundén et al. (2014a) showed that the risk management systems of the operators in Finnish retail shops are not necessarily reliable, and that official control visits in food establishments are thus crucial. Since the risk management systems proved unreliable, Lundén et al. (2014a) also concluded that inspection frequencies should not be decreased at least solely based on the own-checking results of FBOs.

The impact of inspection frequency on compliance level of food establishments has been studied, but the results are contradictory. According to Mathias et al. (1995) and Allwood et al. (1999), the compliance level of a restaurant is increased with higher inspection frequency, whereas Newbold et al. (2008) found no impact of increased inspection frequency on the number of violations. More frequent inspection visits have been suggested to have a positive effect on the understanding of FBOs about the relevance of non-compliances for food safety when the food safety risks within the processes of the inspected food establishments are openly discussed between inspectors and the FBOs (Nevas et al., 2013). Inspections may thus have an important role in preventing food-borne illness through advice and guidance given to food workers (Fairman & Yapp, 2004, 2005; Newbold et al., 2008; Nevas et al., 2013).

Education, educational communication, and enforcement all have important roles in promoting safe behaviors in food production (Fairman & Yapp, 2004; Murphy et al., 2011; Lindblad & Berking, 2013), but cooperation and an educational control approach are stated to be even more efficient in improving compliance than penalty-based enforcement (Allwood et al., 1999; May, 2004; Fairman & Yapp, 2005; Reske et al., 2007; Choi et al., 2011). No previous research has, however, been conducted on the effects of different factors related to official food controls and inspectors for the quality experience of FBOs regarding these controls.

2.5.3 Routine inspections as predictors for food-borne outbreaks

Results regarding the power of inspection results in predicting food-borne outbreaks are controversial; positive correlations between the number of non-compliances or rankings given by food control officials and food-borne outbreaks have been reported (Irwin et al., 1989; Buchholz et al., 2002; Petran et al., 2012), while others have stated that inspection results are poor predictors of food-borne outbreaks (Jones et al., 2004; Powell et al., 2013; Leisner et al., 2014). What is clear is that inspections cannot always prevent disease outbreaks (Allwood et al., 1999).

A variety of factors influences the reliability of routine inspections in preventing food-borne outbreaks (Jones et al., 2004). An inspection conducted during a busy mealtime may, for example, reveal especially those non-compliances that are related to the hectic

working pace (Petran et al., 2012). Failures in inspection practices may exist, and if food control officials therefore fail to detect the existing deficiencies and weaknesses in critical aspects for food safety, the inspection results will not be successful predictors or preventers of food-borne outbreaks (Irwin et al., 1989; Powell et al., 2013).

The most commonly cited violations in the inspection reports tend not to be the critical items for food safety (Jones et al., 2004; Hadjichristodoulou et al., 2008; Sharkey et al., 2012; Green & Kane, 2014). One explanation for enforcing more of the visually apparent and rule-based items compared with the significant risks within the processes of food businesses may be the fact that simply reporting what is seen is much easier and quicker than discussing process details such as the times and temperatures with the FBOs (Fairman & Yapp, 2005; Green & Kane, 2014). The inspectors being familiar with the production processes of the inspected establishments may have major significance through the increased possibilities for thorough discussions on process-specific hazards between them and FBOs (Reske et al., 2007; Nevas et al., 2013). However, it may be extremely difficult for an inspector who does not have hands-on experience in different areas of food technology and food production to have the needed knowledge and insight to identify potential problems (Ababouch, 2000; Nielsen, 2006; Green & Kane, 2014). Material including information about the relevant characteristics of processes and equipment, such as the stress points and failure points, should be provided to assist the inspectors (Woodcock, 2014).

2.5.4 Enforcement of food safety rules and enforcement tools in Finland

Food control officials may promote good hygiene practices through giving advice and education and through enforcement actions (Garcia Martinez et al., 2007). Based on a survey by Jokela et al. (2009), the majority of food control officials in Finland perceive food safety legislation as providing sufficient means for dealing with non-compliances in establishments. However, proper enforcement is necessary for the adequate functioning of regulations (deJonge et al., 2004; Vapnek & Spreij, 2005; Lepistö & Hänninen, 2011). Ineffectiveness of official controls may be visible in, for instance, the large numbers of repeated violations relative to the total numbers of violations (Phillips et al., 2006). Regarding enforcement of food safety rules in Finland, Lundén et al. (2014b) concluded that there is a need for improved enforcement at least in the very severe cases of food safety adulteration.

According to the Finnish Food Act (2006), food control authorities can either demand that the control objects correct the observed non-compliances by solicitation or by using administrative coercive measures. Although the attitudes towards the application of administrative coercive measures are generally positive among Finnish food control officials, sufficient improvements in operations are often considered to be achieved through giving advice and negotiating with the FBOs (Jokela et al., 2009). Correction of non-compliances in Finland is thus largely enforced by means other than coercive measures (Evira, 2015b). However, not all solicitations lead to the desired result, which is

the main reason for using administrative coercive measures in Finland (Kettunen et al., 2015).

Use of administrative coercive measures has been reduced during the last years in Finland (Evira, 2015b). The most frequent non-compliances leading to the use of administrative coercive measures in food production during 2008-2011 were of an operational nature, and the majority of the decisions involved in the process included non-compliances that have been recognized as risk factors for food-borne outbreaks, *e.g.* dirty premises, poor condition of surfaces, and temperature abuse (Lundén, 2013). Thus, when coercive measures are used in Finland, there is presumably an adequate indication (Lundén, 2013). However, the coercive measures may not be used on all occasions that would be justified or as rapidly as they should be (Kettunen et al., 2015). In general, use of administrative coercive measures in Finland is relatively infrequent, and readiness to use these measures appears to differ between control units (Jokela et al., 2009; Lepistö & Hänninen, 2011; Kettunen et al., 2015). Shortcomings have also been reported in the process itself; the legal principles of administration, especially in the hearing process, argumentations of the decisions, and instructions for appeals have been described to be insufficiently fulfilled (Lepistö & Hänninen, 2009, 2011). Reasons such as insecurity, lack of skills/expertise, and complexity of the process have been noted for the inadequate application of the coercive measures (Lepistö & Hänninen, 2009, 2011).

2.5.5 Public access to inspection results

Providing public access to inspection results is one way to force food businesses to take responsibility for food safety (Simon et al., 2005; Nielsen, 2006). Public access to inspection results is effective in increasing the transparency of official food controls and strengthens the trust between consumers and food control authorities (Papadopoulos et al., 2012). Publicly accessible inspection results also increase the willingness of FBOs to comply with food safety rules and to correct the non-compliances observed by food control officials (Fielding et al., 2001; Jin & Leslie, 2003; Thompson et al., 2005; Jin & Leslie, 2009). However, criticism regarding the implemented systems has also been expressed concerning insufficient substantial consistency in inspections and given grades not being based on the predetermined criteria (Ho, 2012).

Showing inspection results of restaurants openly to customers has an impact on their restaurant choices because the fear of food poisoning increases with increasing number of reported non-compliances (Jin & Leslie, 2003; Henson et al., 2006; Choi et al., 2011). However, awareness of consumers regarding the limitations of regulatory inspections in disease prevention should be increased since they widely lack knowledge of the fact that inspectors gather only a brief snapshot of conditions (Jones & Grimm, 2008; Leisner et al., 2014). Additionally, understanding regarding the inspection scores should be increased since consumers easily also misinterpret the given information (Nielsen, 2006; Jones & Grimm, 2008; Leisner et al., 2014). An essential requirement for publication of inspection reports is consistency of inspection criteria and enforcement (Seiver & Hatfield, 2000; Griffith, 2005; Papadopoulos et al., 2012). With a well-developed program, consistency of

official controls can be improved, leading also to FBOs perceiving official controls as fairer and more impartial (Thompson et al., 2005).

In the absence of food scandals, food safety in general is taken for granted by consumers (Angulo & Gil, 2007). However, most consumers are subjected to information about food safety hazards from a variety of sources, such as the media, government, retailers and consumer organizations (Lobb et al., 2007). Effectiveness of these messages depends on the extent to which people trust the source (Röhr et al., 2005). Consumer trust in food safety is affected by consumer trust in regulatory institutions and in participants of the food chain (de Jonge et al., 2004). A strength of the Finnish society is that the citizens have confidence in public sector organizations and societal institutions (Salminen & Ikola-Norrbacka, 2010). However, this trust can diminish if administration is experienced as too distant or ineffective (Salminen & Ikola-Norrbacka, 2010). Governments need to ensure consistency and quality of food safety programs and transparency in their communication to enhance public trust (Jensen & Sandoe, 2002; Kriflik & Yeatman, 2005; Worsfold, 2006; Papadopoulos et al., 2012).

2.5.6 Consistency of official controls

Regulation EC No 882/2004 has an important role in creating a uniform approach to official controls in all member states. However, the application of regulations is based on the judgment of the inspector, making the official inspector one of the variables that may affect inspection outcome (Seiver & Hatfield, 2000; Jones et al., 2004; Lee et al., 2012). Knowledge and experience of inspectors vary, and significant variability may also exist in the types of activities in which the inspectors engage during inspections (Selman & Green, 2008; Lee et al., 2012; Woodcock, 2014). These differences may result in differing probabilities to observe violations in general or to observe some particular violations, and may thus lead to inspector-dependent under- or over-reporting of violations (Lee et al., 2012). Regional differences have also been reported regarding inspection scores in general and the rates of documenting critical violations (Jones et al., 2004; Phillips et al., 2006). Risk of unequal treatment of FBOs depending on their geographical location has been discussed in Finland due to the varying practices regarding collected control fees, risk evaluation, and use of administrative coercive measures among municipal food control authorities (Tähkää et al., 2009; Lepistö et al., 2010; Tähkää et al., 2013). However, the consistency of the inspection processes themselves has not been studied. Additionally, the factors that may affect the inspection processes, and thus, eventually the efficacy of the official food controls have not been investigated.

The observed inconsistencies in official food controls have led to recommendations to standardize inspection systems (Jones et al., 2004, Thompson et al., 2005; Hadjichristodoulou et al., 2008). However, inspections performed by a single observer are difficult to standardize and easily influenced by subjective interpretation (Jones et al., 2004). Periodic retraining of the inspectors should be emphasized, and the observed differences in documentation of violations among them should be used in identifying the training needs (Jones et al., 2004; Lee et al., 2012).

Differences in documented violation rates also depend on actual differences among establishments (Phillips et al., 2006). It has, for example, been shown, that both inspection activities and explaining the needed corrective actions to food handlers and operators take a longer time in food establishments with inadequate hygiene standards than in establishments with better hygiene (Hadjichristodoulou et al., 2008). The diversity of food establishments and the various situations in them during the inspections also limit the possibilities to predefine the inspection task (Woodcock, 2014), rendering thorough education and provision of precise guidance highly challenging.

2.5.7 Support mechanisms of official food controls

Previous research in Finland calls for stronger guidance from central authorities to ensure good governance, adequate use of administrative coercive measures, and risk-based use in control frequencies (Lepistö & Hänninen, 2009, 2011; Tähkäpää et al., 2013). Centralization of meat inspection tasks led to improved access to guidance for food control officials, nevertheless more guidance with interpreting food safety requirements and performing food safety inspections is needed (Kotisalo et al., 2015). In a study by Pham et al. (2012), local food control officials wanted particularly a central online resource for food safety information, and ongoing food safety training. According to the study, efforts should be made to develop online resources such as online newsletters and online clearinghouses (Pham et al., 2012).

Sufficient resources, successful management and communication, and adequate education, information, and training are key challenges for the functionality of routine official controls and outbreak investigation (Selman & Green, 2008; Lepistö et al., 2010; Rostron, 2011). Official food control requires effective project management and coordination, and cooperation and communication within food control authorities and with stakeholders (Rostron, 2011).

2.5.8 Importance of work-related well-being

Work-related well-being of staff is important for the success of a work place. It is characterized by such factors as increased job satisfaction and work engagement and less occupational stress and burnout (Narainsamy & Van Der Westhuizen, 2013). Job satisfaction, organizational commitment, and work engagement are closely linked and are instrumental for general organizational success through increased job performance and decreased turnover intentions (Meyer et al., 2002; Jaramillo et al., 2005; Rose et al., 2009; Alarcon & Edwards, 2011; Brunetto et al., 2012; Mache et al., 2014). Job satisfaction is also a significant determinant in the intention to retire later, thus prolonging one's career (Kautonen et al., 2012). However, the operational functionality of food control units and the work-related well-being of their staff have not been previously studied in relation to the impact of control actions.

Good interpersonal relations, autonomy, and training opportunities at work are important for job satisfaction (García-Bernal et al., 2005; Hosie et al., 2013), and peer support and meaningful experiences through work are reflected in work engagement and job performance (Fairlie, 2011; Lim & Eo, 2014). Insufficient employee participation in decision-making leads to decreased job satisfaction and employee commitment (Appelbaum et al., 2013a, 2013b, 2013c), and perceived lack of fairness at work may lead to less satisfaction and engagement and increased turnover (Alarcon & Lyons 2011; Arshadi & Shahbazi, 2013). Pay level may affect both job satisfaction and job performance, although there are also conflicting results (Arnolds & Boshoff 2002; Judge et al., 2010; Hosie et al., 2013; Lee & Lin, 2014). Work-related stress has been shown to decrease job performance and increase turnover intentions (Khorshidifar & Abedi, 2011; Arshadi & Damiri, 2013; Hon, 2013; Yozgat et al., 2013), and non-acceptance and workplace bullying clearly decrease work-related well-being and performance (Bond & Bunce, 2003; Rodríguez-Muñoz et al., 2009; Korkmaz et al., 2014). A supportive coworker environment can minimize the negative effect of job stress on employee performance (Hon, 2013), and personal control of stressors increases job satisfaction and decreases turnover intentions (Wang et al., 2015). Job stress also causes burnout (Khalatbari et al., 2013), especially in workplaces with insufficient resources (Crawford et al., 2010) and for those who do not experience fairness in the workplace (Maslach & Leiter, 2008). Good interpersonal relations at work can protect from developing burnout (Van Droogenbroeck et al., 2014).

2.5.9 Management in public sector

Many countries experience pressure to modernize their public administration and to increase the efficiency and effectiveness of governmental functions (Saner, 2001). Leadership skills have an important role in improving the performance of public sector organizations (Orazi et al., 2013). While preserving integrity and ethics in the fulfillment of tasks is as important as before (Orazi et al., 2013), the managements of public administrations also need to acquire new knowledge and learn new skills, and focus on integration and cooperation with increasingly less bureaucratic public services (Saner, 2001). However, moving from more bureaucratic forms of management to more distributed leadership is challenging (Boyne, 2002; Currie et al., 2011).

Performance measurement systems were widely developed in large businesses in the 1990s, but they have since become increasingly popular also in the public sector; for example, in Canada and USA, performance measurement related to financial performance, operational efficiency, employee performance, and customer satisfaction are practiced in most of the municipal governments (Chan, 2004). The need to measure the outcome of organizational strategy by using indicators and target meters in the public sector has been growing also in Finland (Rantanen et al., 2007; Jääskeläinen, 2010; Linna et al., 2010; Kork et al., 2015). Until recent years, every food control authority had to develop their own performance measurement tools, but now Evira has provided indicators and target meters for national use (Evira, 2014).

According to Rantanen et al. (2007), performance measurement systems in the Finnish public sector differed significantly from those in the private sector, and the need for the public sector to improve its performance measurement skills was apparent. Later challenges and conflict situations related to and resulting from the adaption of performance measurement tools and systems from the private sector have been reported in Finland. These challenges include, for instance, risks related to conflicts between the legislative framework and the needs and expectations of multiple stakeholders of public sector organizations and difficulties in developing comprehensive measurement systems that also include aspects of quality and long-term effectiveness (Linna et al., 2010; Jääskeläinen & Sillanpää, 2013; Kallio & Kallio, 2014). Performance measurement systems can have a negative effect on work motivation among experts who perform creative, knowledge-intensive work if the systems are mainly based on quantitative rather than qualitative measures (Kallio & Kallio, 2014). The increased customer thinking may also lead to conflicting situations if old organizational structures and practices are still dominant (Kaatrakoski, 2016).

2.5.10 Performance auditing of official food controls

Competent authorities of the member states of the EU shall have procedures in place to verify the efficacy and appropriateness of the official food controls that they carry out (EC No 882/2004). To this end, the competent authorities shall arrange either internal or external audits, and take appropriate actions based on the results (EC No 882/2004). The purpose of audit systems is to verify whether the official food controls are effectively implemented and suitable for achieving the objectives of the relevant legislation (EC No 677/2006). The audit bodies or audit teams should not be involved in managing or supervising the audited control systems, and the expertise of and consistency between auditors should be ensured (EC No 677/2006). In Finland, the efficacy and appropriateness of official food controls are mainly verified through national evaluation and auditing systems planned by Evira. However, the capability of these systems to enhance the efficacy and quality of official food controls has not been studied previously.

Auditing of official food control is an example of performance auditing. Performance auditing aims to lead to improvements in performance, economy, efficiency, and effectiveness of public administrations (INTOSAI, 2004). In the literature, performance audits are often synonymous to or included in the concept of so-called Value For Money (VFM) audits (Johnsen et al., 2001; Morin, 2001, 2004, 2008; Grönlund et al., 2011). Figure 1 illustrates the value chain of audits.

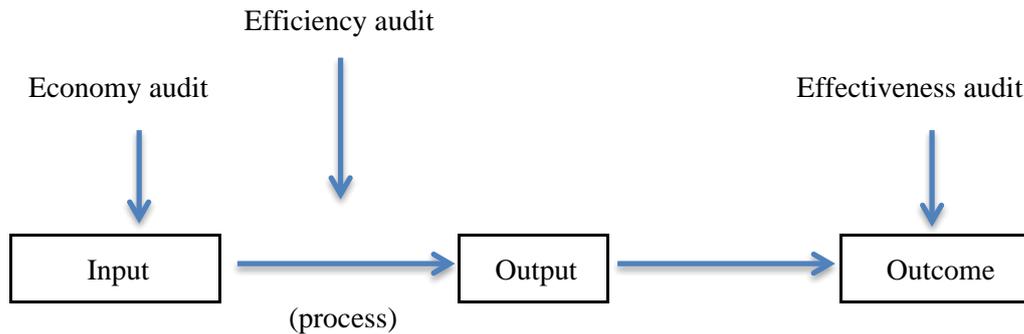


Fig. 1 *The Three “E”s (Economy, Efficiency, Effectiveness) related to the value chain of audits. This figure is a simplification of Fig. 1 presented in Grönlund et al. (2011).*

Performance auditing is considered to be one of the most effective means of improving performance and governance and is applied on different levels of governments (Daujotaite & Macerinskiene, 2008). A genuine improvement in the long term will only occur when attention is paid to the way people work and to the attitudes and beliefs they hold while performing their daily tasks (Kloot & Martin, 2000). However, the evidence of efficacy of performance auditing is limited (Leeuw, 2011). Factors such as the interests of the auditees and the relationship arising between auditors and auditees may affect the impact of the audits (Pollit et al., 1999; Morin, 2001). Problems in goal setting may lead to an overload of information in audit reports, which in turn decreases utilization of the results (Johnsen et al., 2001). To achieve the best influence, uniqueness of the government operations should be taken into account when planning the audit systems (Dittenhofer, 2001). Audit programs should be compiled based on risk, and auditing staff should possess sufficient knowledge of the audited matters (Dittenhofer, 2001; Padia & van Vuuren, 2012).

2.6 Certification systems and food safety audits by third parties

Major food crises, such as mad cow disease and dioxin in dietary products during the 1990s severely decreased consumer trust in food production and food control authorities (Vos, 2000; Poppe & Kjærnes, 2003; Berg, 2004; Halkier & Holm, 2006; Bánáti, 2014). At the turn of the millennium, food safety regulation became more process-based, placing greater pressure on food businesses to implement effective food safety controls (Henson & Caswell, 1999). Governments were increasingly concerned about existing safety requirements not being effective in reducing food-borne illnesses, and buyers started to require additional guarantees of food quality and safety from their suppliers (Garcia Martinez et al., 2007; Trienekens & Zuurbier, 2008; Luning et al., 2009; Fagotto, 2014). Companies began installing new quality assurance systems exceeding legislative demands,

and private food safety auditing became a pervasive and fast-growing industry (Henson & Caswell, 1999; Manning, 2013; Powell et al., 2013; Lytton & McAllister, 2014).

Third-party audits are considered a means of ensuring food safety with decreasing economic resources in the public sector since the auditors are free from fixed budgets and competing policy concerns (Garcia Martinez et al., 2007; Powell et al., 2013; Fagotto, 2014; Lytton & McAllister, 2014). Third-party auditing can benefit the public sector by providing extra assessment and data, but only if the data are shared with the public sector (Powell et al., 2013). Positive results have been achieved by integrating third-party-certified food safety management systems in governance of food safety (Jacxsens et al., 2015). However, audits are always conducted under a proprietary standard, which means that certification gives mainly insight into compliance to the specific standard (Luning et al., 2009; Powell et al., 2013). This may be problematic if the public and private regulatory interests do not overlap (Garcia Martinez et al., 2013). The achieved benefit also partly relies on the trust of enforcement officials in the efficacy of private mechanisms to assess and maintain compliance (Garcia Martinez et al., 2007).

As between different food control officials and units, significant differences may also exist between the auditing judgments of different certification bodies and auditors (Albersmeier et al., 2009; Djekic et al., 2011). Variance among auditing documents was noted in a recently conducted project exploring the utilization possibilities of quality certificates in official food controls in Finland (Lepistö et al., 2015). Competency of the auditor, auditing intensity, and appropriateness of audit design are relevant in whether the auditors identify the present system's weaknesses or product or process non-conformity or whether they reach incorrect audit conclusions (Albersmeier et al., 2009; Manning, 2013). The selection, training, and education of the auditors and verification of their competency are therefore critical success factors for high-quality food safety audits (Mortimore, 2000). In addition, economic dependencies and conflict of interests may occur and lead to shortcomings in the process (Albersmeier et al., 2009; Fagotto, 2014).

3 AIMS OF THE STUDY

The main objective of this work was to examine the possibilities of improving efficacy of official food controls and hygiene in food establishments by studying factors behind efficacious official food control at different levels of the control chain and the perceptions of the different actors involved. A secondary objective was to investigate the consistency and quality of controls and ways to enhance these. Specifically, the studies were conducted with the following goals:

1. to evaluate the possibilities of food control authorities and inspectors to enhance the hygiene status in retail food establishments both preparing and serving food (I).
2. to investigate the efficacy of the official food controls in municipalities in Finland and the possibilities of enhancing the efficacy (II).
3. to analyze the consistency of inspection processes in Finnish municipal food controls and the possibility of enhancing the consistency (II).
4. to examine unit-related factors affecting the efficacy and quality of municipal food controls in Finland by evaluating both the organization of the controls and the workplace atmosphere in units and their relation to the quality of controls (III).
5. to assess the auditing system of municipal food controls in Finland during 2007-2010 and the capacity of the system to increase the efficacy and consistency of official food controls, and to find key areas for development of the system (IV).

4 MATERIALS AND METHODS

4.1 Sampling

4.1.1 Sampling of the units in order to study quality and efficacy of local official food control (I-III)

Of the 79 municipal environmental health and food control units (henceforth “units”) existing in 2011 in Finland, 17 (21.5%) were chosen for the study. The units were selected based on their location so that the sample covered the whole country. The sample was weighted based on the population density. Agreement for participation was sought through telephone discussions with the heads of the units. Data on the number of food establishments operating in the control areas of the units in 2011 were gathered from the National Register for municipal food control data, maintained by Evira.

4.1.2 Sampling of the restaurants in order to study quality and efficacy of local official food control (I-III)

The participating 17 units and Evira provided lists of retail food establishments that cooked and also served food on their premises (henceforth “restaurants”) in the control area of the particular units. The data from each unit were randomly organized by using Microsoft Excel spreadsheet software, and restaurant business operators (henceforth “RBOs”) were contacted by telephone in the order dictated by this random organization. A total of 177 RBOs were contacted with the aim of making appointments with five participating restaurants from each unit, *i.e.* with 85 RBOs in total. These establishments included commercial restaurants, school, church and hospital kitchens, teaching kitchens, hotels, and service stations. Interviews and hygiene status evaluations were finally performed in 83 restaurants due to two late cancellations. In one of these restaurants, only the hygiene evaluation and in another only the interview was performed due to unexpected scheduling problems.

4.1.3 Sampling for the study concerning the auditing system of local official food control (IV)

The study population included all six regional food control authorities and all 79 municipal food control authorities in Finland. For municipal authorities, the sample was formed from the officials who had participated in auditing visits in 2007-2010, and for regional authorities from the officials who had performed these audits.

4.2 Surveys

Surveys were conducted on four different levels of the food control chain, *i.e.* level of RBOs, level of inspectors, level of heads of units, and level of regional officers. Both face-to-face interviews and electronic questionnaires were used as survey methods.

4.2.1 Face-to-face interviews of the RBOs (I - III)

The RBOs were interviewed with semi-structured questionnaires between October 2011 and May 2012. The interviews included questions about the food hygiene knowledge of the RBOs and their perceptions concerning the impact, significance, and quality of official food controls. The RBOs were also asked how they had improved their knowledge and understanding of food hygiene, how often they had contacted food control officials for advice, and how well the cooperation with the food control officials functioned. In addition, the RBOs evaluated the importance of inspection reports. Direct questions, four- and five-point Likert scales, multiple choice questions, scales from 0 to 10, and Finnish school grades (4 = fail, 5 = passable, 6 = moderate, 7 = acceptable, 8 = good, 9 = very good, 10 = excellent) were used.

4.2.2 Electronic questionnaires for inspectors concerning the study restaurants (I)

Semi-structured electronic questionnaires (E-lomake, Eduix Oy) were sent to the inspectors performing controls in the studied restaurants. These questionnaires included only questions regarding the particular restaurants. The questionnaires included questions about cooperation with the RBOs, their hygiene knowledge, and attitudes towards the official food controls, and the hygiene of the restaurants. Four- and five-point Likert scales and Finnish school grades were used as scales.

4.2.3 Electronic questionnaires for inspectors concerning the quality and efficacy of local official food control (I-III)

The heads of the 17 units participating in the study were provided with prepared semi-structured electronic questionnaires (E-lomake, Eduix Oy) regarding official food controls in November 2011. The unit heads were asked to deliver these questionnaires to the food control officials who executed restaurant inspections (henceforth “inspectors”) in their units. The inspectors were asked about their gender, age, number of food establishments for which they were responsible, and working experience in tasks related to official food control. Regarding the needed prerequisites for controls, the inspectors were asked about sufficiency of facilities and equipment, possibilities for vocational training and updating of knowledge, guidance papers and templates provided by the unit, planning of controls,

realization rate of planned controls, actions taken in case of poor realization, perceptions regarding the regularity and frequency of restaurant controls, staff meetings and discussions, and working atmosphere in the units. Regarding their own control procedures, the inspectors were asked about the distribution of their time during inspections and the effects of inspection history. Uniformity of actions was also studied through questions concerning hypothetical control situations or descriptions of imaginary establishments. In addition, the inspectors were asked about restaurant controls, uniformity of official food controls, and the most important training areas for improving the quality and efficacy of their controls. Direct questions, four- and five-point Likert scales, multiple choice questions, scales from 0 to 10, and Finnish school grades were used.

4.2.4 Face-to-face interviews of heads of units (II, III)

Heads of the units were interviewed between October 2011 and March 2012 with semi-structured questionnaires. They were asked about the number of officials performing tasks related to official food controls in their units. The interviews included questions about sufficiency of facilities and equipment, possibilities for vocational training and updating of knowledge, guidance papers and templates provided by the unit, planning of controls, realization rate of planned controls, actions taken in case of poor realization, perceptions regarding the regularity and frequency of restaurant controls, staff meetings and discussions, and working atmosphere in the units. Direct questions, four- and five-point Likert scales, multiple choice questions, and scales from 0 to 10 were used.

4.2.5 Electronic questionnaires concerning auditing system of local official food control (IV)

The study was carried out in March 2011 by two semi-structured electronic questionnaires (E-lomake, Eduix Oy). One of the questionnaires was directed to officials working in municipal food control and the other to officials working in regional food control in Finland. The links to the questionnaires were sent by e-mail. The respondents were asked about how they had benefited from auditing visits, how they had experienced the visits, whether the auditing system was suitable for evaluating the municipal food controls, and how the auditing system should be developed. Questions about utilization of the results, expertise of the auditors, and objectives (and purpose) of the visits were also included. Direct questions and four- and five-point Likert scales were used as scales.

4.3 On-site evaluation of hygiene status and own-checking systems of restaurants (I)

In connection with the interviews of the RBOs, the hygiene status and the own-checking systems of the restaurants participating in the study were evaluated by using a pre-

prepared evaluation form during on-site visits. One person performed all of these evaluations. The hygiene status evaluation consisted of the cleanliness status of customer areas, storages, kitchens, dressing rooms, staff toilets, surface materials in kitchens, and suitability of the premises for the operations. Also the risk for cross-contamination, hygiene and temperature control of foods during serving, adequacy of hand-washing possibilities, work clothing, equipment of staff washing rooms, and waste handling were evaluated. A four-point scale was used for grading of the situation. The evaluations of the own-checking programs consisted of the programs for initial checking of received foods, hygiene and temperatures in food storage, preparing/cooking dishes, serving temperatures, cleaning operations, and cleanliness control. To evaluate documentation of own-checks, temperature control of received foods, refrigerators, and foods during serving and cleanliness control were included. Three-point scales were used for grading.

4.4 Analysis of inspection reports (II)

Inspection reports of the 83 restaurants participating in the study were collected for a five-year period (2007-2011). Inspected items were divided into 26 categories, and these categories were also used for classifying observed non-compliances and demands for corrections. Five items (prevention of cross-contamination, temperature control, hand-washing facilities, cleanability and cleanliness of food contact surfaces, and personal hygiene of staff) were determined as being critical because of their significant impact on food safety (US FDA, 2009; Sharkey et al., 2012). The numbers of different categories of inspected items, observed non-compliances, and demands for corrections were calculated for each inspection report. The numbers of set time limits for correcting non-compliances, the length of time allowed for corrections to be made, and the numbers of repeated demands due to inadequate correction of non-compliances were calculated. Verification of corrective actions was analyzed by calculating the number of verification activities and the time from the observation of non-compliances until the verification activities. Variables were formed to describe the extent to which corrections of non-compliances in the restaurants were carried out based on documented verification.

4.5 Statistical analysis

4.5.1 Statistical analysis of data concerning quality and efficacy of local official food control (I-III)

All data gathered from the 17 units participating in the study were processed using SPSS statistical software (SPSS Statistics 21.0, SPSS IBM, NY, USA). Comparisons were made between the responses of the different answer groups: unit heads, inspectors, and RBOs. In addition, the study population in each answer group was stratified into certain groups,

and comparisons were performed between these groups. The data obtained through interviews of unit heads and through electronic questionnaires for inspectors were stratified based on the number of control objects and food control personnel in the units. The data obtained through electronic questionnaires for the inspectors were stratified according to gender and working experience. The interviewed restaurant population was stratified based on the following factors: membership in restaurant chain and Finnish Hospitality Association MaRa, seating capacity of the restaurant, and the age, sex, working experience, and education of the persons responsible for hygiene issues in the restaurant. The data obtained for the analysis of the inspection reports were stratified according to the following: the number of inspections performed in the restaurants during the study period, the use of templates for writing inspection reports on the respective inspections, and the number of food control personnel in the units. Normality of the distributions was tested by the Kolmogorov-Smirnov test. The equality of means in the groups was analyzed by t-test when the compared distributions were found to be normal. Kruskal-Wallis test and Mann-Whitney U-test were used for comparison of the groups when non-parametric variables were included in the analysis, and the two-tailed Pearson Chi-square test was used to analyze binomial scales. Sum variables were created for certain answer complexes. Cronbach's alpha was used to examine the reliability of the created sum variables. Pearson's correlation coefficient with two-tailed significance was used to examine correlations between sum variables and Spearman's rank order correlation when discrete variables were included in the analysis. Linear regression analysis was used to test a model of the evaluations of the inspectors in predicting the result of restaurant hygiene evaluations, performed by an independent party. All "Don't know" answers were excluded from the analysis, and statistical significance was set at a confidence level of 95%.

4.5.2 Statistical analysis of data regarding the auditing system (IV)

The data were processed using SPSS statistical software (PASW Statistics 18.0, SPSS IBM, Chicago, USA). Comparisons were made between the responses of the auditors and the auditees. A two-tailed Fisher's exact test was used to analyze the differences between the two answer groups when the questions were asked on binomial scales and four-point Likert scales. Sum variables were created for certain answer complexes. Mann-Whitney U-test was used to analyze the differences between the two answer groups in the cases of five-point Likert scales and the created sum variables. All "Don't know" answers were excluded from the analysis, and statistical significance was set at a confidence level of 95%.

5 RESULTS

5.1 Background information on units, inspectors, and restaurants (I-III)

In total, 82 RBOs and 17 heads of control units were interviewed. Responses from inspectors were received from all 17 units, between 1 and 6 respondents per unit, yielding a total response rate of 49% (56/115). The inspectors were responsible for controls in 8533 food establishments, 2306 of which were commercial restaurants. Background characteristics of the respondents, used for grouping of the three original answer groups, are presented in Table 3.

Table 3 *Background characteristics of RBOs (n = 82), inspectors (n = 56), and units (n = 17).*

Factors related to restaurants, units, and inspectors	Number, n/N (%)	
	Yes	No
Person responsible for hygiene issues in restaurant has education for restaurant field (henceforth "relevant education")	60/80 (75%)	20/80 (25%)
Person responsible for hygiene issues in restaurant has more than 20 years' work experience in restaurant field	37/81 (46%)	44/81 (54%)
Restaurant is a member of a restaurant chain	23/81 (28%)	58/81 (72%)
Restaurant is a member of Finnish Hospitality Association MaRa	29/79 (37%)	50/79 (63%)
Inspector has more than 10 years' work experience in official food control tasks (henceforth "more experienced inspectors")	28/56 (50%)	28/56 (50%)
Unit has at least 1900 control objects (henceforth "units with more control objects")	9/17 (53%)	8/17 (47%)
Unit has at least 10 officials performing tasks related to official food control (henceforth "larger units")	8/17 (47%)	9/17 (53%)

5.2 Food hygiene knowledge and attitudes of RBOs towards official food controls (I-III)

Hygiene of different areas in restaurant facilities was evaluated on-site on a scale from 1 to 4 (1 = good hygiene status, 4 = bad hygiene status). Customer areas were discovered to have the best hygiene status; mean value of the created sum variables describing the hygiene on customer areas was 1.13 (range 1.00-2.10, variables included in sum variable = 5). Kitchens had the second most adequate hygiene status, with a mean of 1.35 (range 1.00-2.00, variables included in sum variable = 14), and storages for cleaning equipment had the least adequate hygiene status with a mean of 1.62 (range 1.00-3.67, variables included in sum variable = 7). Inspectors assessed the hygiene of the restaurants

with Finnish school grades from 4 to 10 (4 = fail, 10 = excellent). The mean value of the grades given to the hygiene of the restaurants by inspectors (74/82) was 8.14 (range 4.00-10.00, variables included in sum variable = 4).

Of the RBOs, 72% (51/71) opined that the official controls implemented during 2009-2011 had had a “fairly positive” (48%) or “greatly positive” (24%) effect on the hygiene in their restaurants. Most RBOs (94%; 74/79) also considered inspection reports as “very important” (56%) or “quite important” (38%) for developing the operations of their restaurants. On a scale from 0 to 10, RBOs estimated the Finnish Food Hygiene Proficiency Certificates as more significant (mean of evaluations 8.9, n = 82) for restaurant food safety than did the inspectors (mean of evaluations 6.4, n = 54) (Mann-Whitney U-test $p = 0.001$).

RBOs chose food trade journals (66%; 54/82), guidance papers (56%; 46/82), and internet material (55%; 45/82) as their most frequently used channels for increasing knowledge and understanding of food hygiene. According to the RBOs, 53% (43/82) contacted the inspector “most often” or “always” when needing advice regarding food hygiene issues. Non-members of restaurant chains and non-members of Finnish Hospitality Association Mara were more likely to contact an inspector when in need of food hygiene advice than were their organized counterparts (Pearson Chi-square, $p < 0.001$ and $p = 0.012$, respectively).

Significant positive correlations existed between the hygiene knowledge of the RBOs, their attitudes towards official food control, and the overall hygiene level of the restaurants (Fig. 2). In addition, heat-treated foods were more poorly separated from raw ingredients if the person responsible for hygiene issues lacked the relevant education (Pearson Chi-square, $p = 0.003$). If the person responsible for hygiene issues had more than 20 years of working experience in the restaurant field, cleanability and cleanliness of food contact surfaces were also better (Pearson Chi-square, $p = 0.008$ and $p = 0.042$, respectively), and temperature control of warm and cold foods during serving was more often documented (Pearson Chi-square, $p < 0.001$ and $p = 0.049$, respectively).

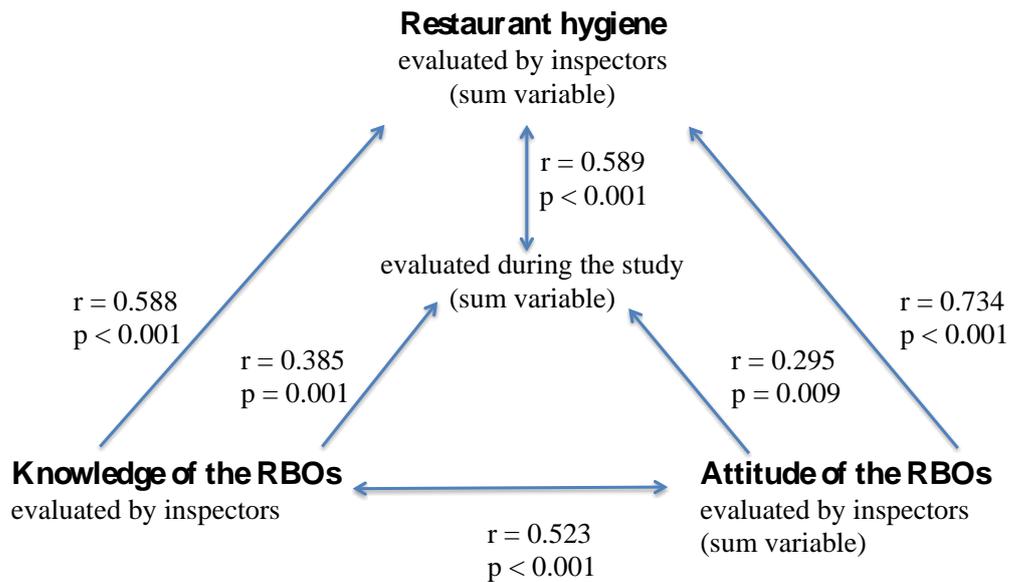


Fig. 2 *Relations between good hygiene knowledge of the RBOs, positive attitudes of the RBOs towards official food controls, and good hygiene status in the restaurants. Correlations between sum variables were examined by using Pearson's correlation coefficient. Spearman's rank order correlation was used when discrete variables were included in the analysis. This figure is amended from Fig. 1 in Study I. The original scale used for on-site hygiene evaluation was inverted for this figure.*

Statistically significant positive correlations were also discovered between the perceptions of the RBOs regarding the quality of official food controls and their appreciation of the controls (Fig. 3). RBOs operating in control areas of larger units and units with more control objects evaluated the quality (sum variable created from 13 original variables) of official controls in their restaurants as lower than did RBOs in smaller units (t-test, $p = 0.004$ and $p = 0.029$, respectively). They also gave lower school grades (sum variable created from 6 original variables) for inspectors (Mann-Whitney U-test, $p = 0.002$ and $p = 0.024$, respectively) and evaluated the significance of official food controls in their restaurants as lower (Mann-Whitney U-test, $p = 0.004$ and $p = 0.002$, respectively) than did the RBOs in smaller units.

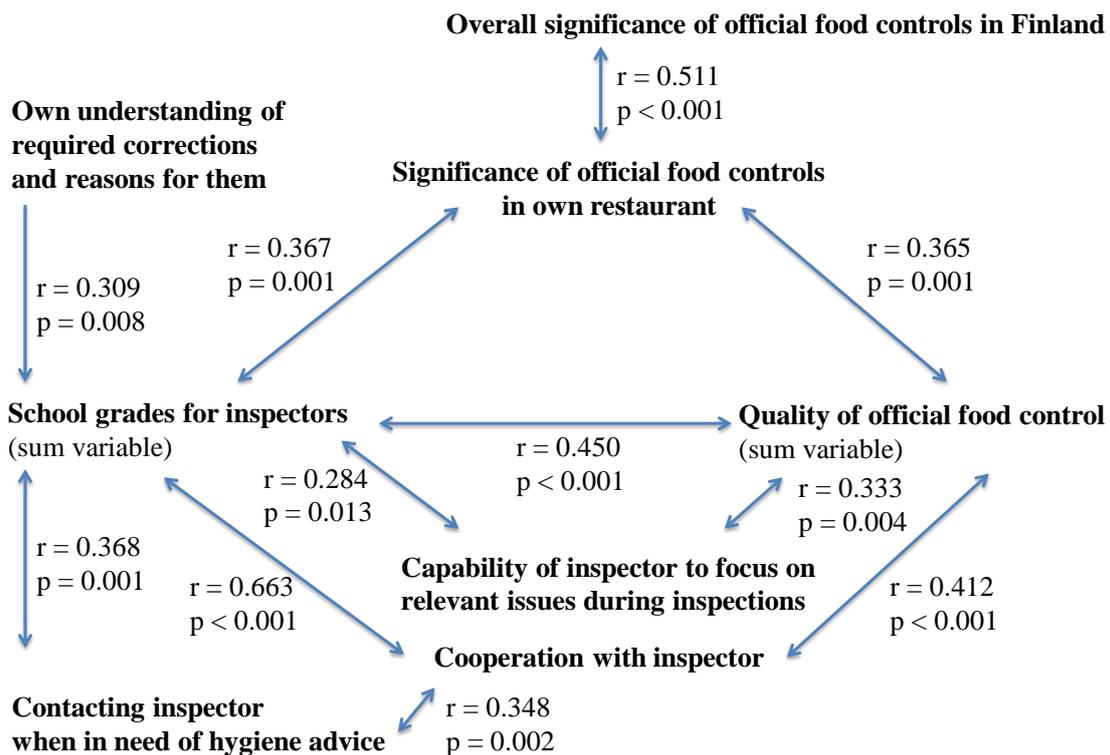


Fig. 3 Relations between positive perceptions of the RBOs about quality of official food controls and their appreciation of the controls. Correlations between sum variables were examined by using Pearson's correlation coefficient. Spearman's rank order correlation was used when discrete variables were included in the analysis.

Of the 16 given factors describing characteristics of inspectors, RBOs perceived the following five as the most effective for correction of observed violations in their restaurants: proper justification of issued demands and control actions, professionalism, negotiative approach, willingness to give instructions, and encouraging attitude.

5.3 Consistency of inspection processes and actions taken by inspectors and efficacy of official food controls (II)

5.3.1 Responses to questionnaires

Of the total working time used for inspections and related activities, a mean of 37% (SD = 12.9, range 20-70) was used for inspecting the establishments and 27% (SD = 12.4, range 5-50) for writing inspection reports. During inspection visits the more experienced inspectors used more time for evaluating operational hygiene and temperature control (Mann-Whitney U-test, $p = 0.005$ and $p = 0.024$, respectively) than did the less

experienced inspectors. The evaluations of the inspectors regarding the average time they had used for writing inspection reports for restaurant inspections ranged from 15 minutes to 4 hours, 51% (26/51) spending one hour or less and 49% more than one hour to write these reports.

The inspectors were given nine examples of imaginary food establishments and asked whether the described conditions, facilities, or equipment in these were “adequate”. In two of the nine examples, the perceptions of the inspectors were very uniform, with only one inspector disagreeing with the rest. The description that caused the most disagreement concerned the adequacy of hand-washing facilities and divided the responses in half, with 50% (28/56) of inspectors agreeing and 50% disagreeing with the adequacy of the described situation. The inspectors were also presented with four imaginary inspection situations and asked what measures they would take by choosing from a list of options. Some differences occurred in responses, and control history influenced the chosen action (Fig. 4).

Given hypothetical examples of non-compliances in restaurants

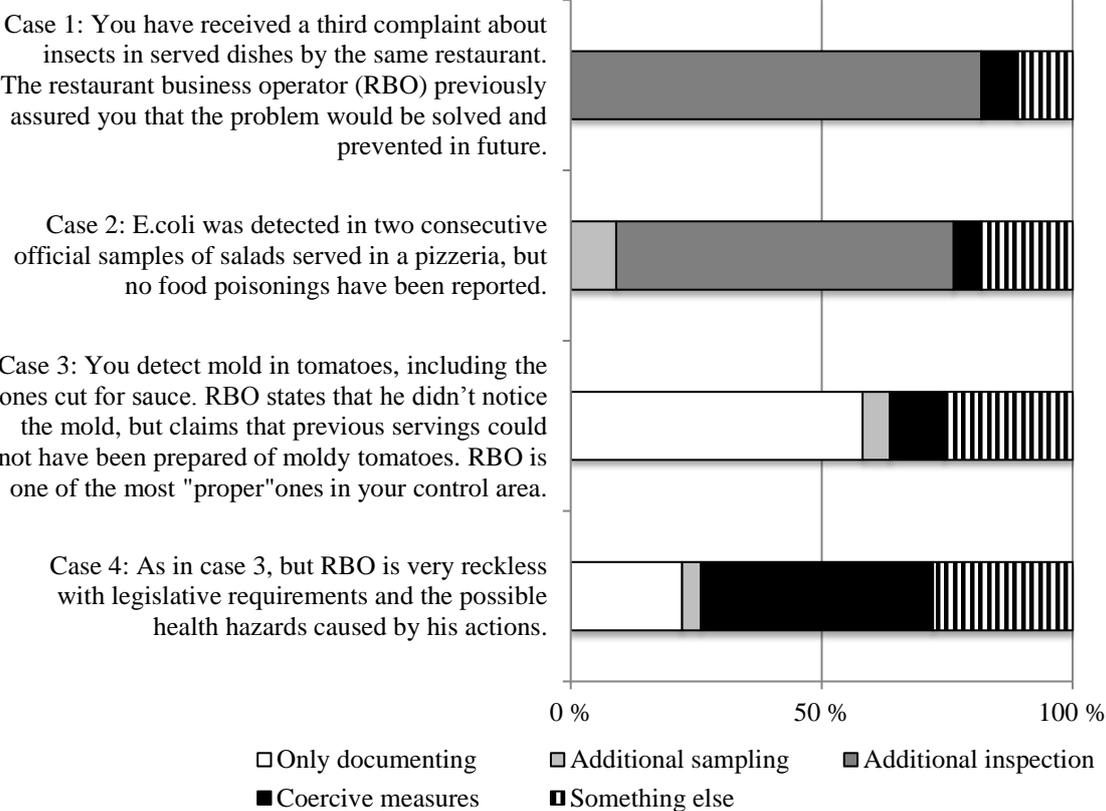


Fig. 4 *Actions that would be taken by food control officials (n = 56) in given hypothetical examples of non-compliance in restaurants. The bars show the percentage (%) of respondents choosing the given option. Under the answer option "something else", the officials chose to give special guidance, advice for disposal of the foods, and a combination of the different answer options. This figure is amended from Fig. 2 in Study II.*

All inspectors (51/51) agreed that the nature of the non-compliance affected the strictness of their control actions, and almost all inspectors responded that previous inspection findings had either “fairly much” (60%; 31/52) or “very much” (37%; 19/52) influence on future controls in an establishment.

According to inspectors, the three most important training areas to improve the quality and efficacy of their controls would be “evaluation of food hygiene and operational hygiene” (chosen by 59%; 33/56 inspectors), “evaluation of the severity of neglecting legislative requirements, and the needed actions” (54%; 30/56) and “legislation” (43%; 24/56). The more experienced inspectors evaluated training regarding “production, processing, and distribution steps in different types of food production” as less needed than did the less experienced inspectors (Mann-Whitney U-test, $p = 0.022$).

Almost all inspectors (95%; 52/55) agreed that the official food controls should be uniform, but only 7% (4/55) believed that the controls were uniform throughout Finland. The majority (67%; 35/52) of the inspectors considered that the reason for non-uniform controls was insufficient guidance.

5.3.2 Analysis of inspection reports

According to the control data from 2007 to 2011, the inspectors had performed a total of 325 inspections in the 83 restaurants participating in the study. Documentation from 312 inspections was available for analysis, ranging from 7 to 39 inspection reports per control unit (median 18 reports) and from 0 to 12 per restaurant (median 3 reports). Templates for inspection reports existed in 15 units and had been used for inspections of 43% (34/80) of the restaurants.

Of the 26 different categories used for evaluating the inspected items, a mean of 7.4 were documented as inspected ($SD = 4.42$, range = 0.5-21.0) and a mean of 2.9 as observed non-compliances ($SD = 2.26$, range = 0.0-11.0) per inspection report for each restaurant. Of the five categories classified as critical for food safety, a mean of 1.5 were documented as inspected ($SD = 1.18$, range = 0.0-5.0) and a mean of 0.5 as observed non-compliances ($SD = 0.60$, range = 0.0-2.0) per inspection report. A total of 1137 demands for implementing corrective actions had been issued to the restaurants during the study period, 21% (238/1137) of which were for correcting critical violations. The mean for demands for correcting non-critical violations per inspection report was 2.6 ($SD = 2.49$, range = 0-14.0) and for correcting critical violations 0.6 ($SD = 0.79$, range = 0.0-3.0). Demands for correcting non-critical violations had been given for 80% (250/312) of the inspections in total and for 93% (74/80) of the restaurants. Demands for correcting critical violations had been issued for 36% (112/312) of all inspections and for 59% (47/80) of the restaurants. Repeated demands for correcting non-compliances had been issued for 65% (48/74) of the restaurants and for correcting critical violations for 36% (17/47) of the restaurants.

Time limits had been set for correction of 39% (349/899) of the non-critical violations and 29% (70/238) of the critical violations. The higher the total number of demands was for corrective actions given without time limits, the higher the total number of repeated

demands for the restaurant (Pearson $r = 0.731$, $p < 0.001$). The RBOs neglected the corrective actions for critical violations more often when these demands were issued without time limits, both when calculated by using total numbers of demands and by using the proportion of demands issued without time limits (Spearman $r = 0.480$, $p = 0.004$ and $r = 0.410$, $p = 0.016$, respectively) (Fig. 5). A similar effect was discovered regarding the correction of non-critical violations (Fig. 5).

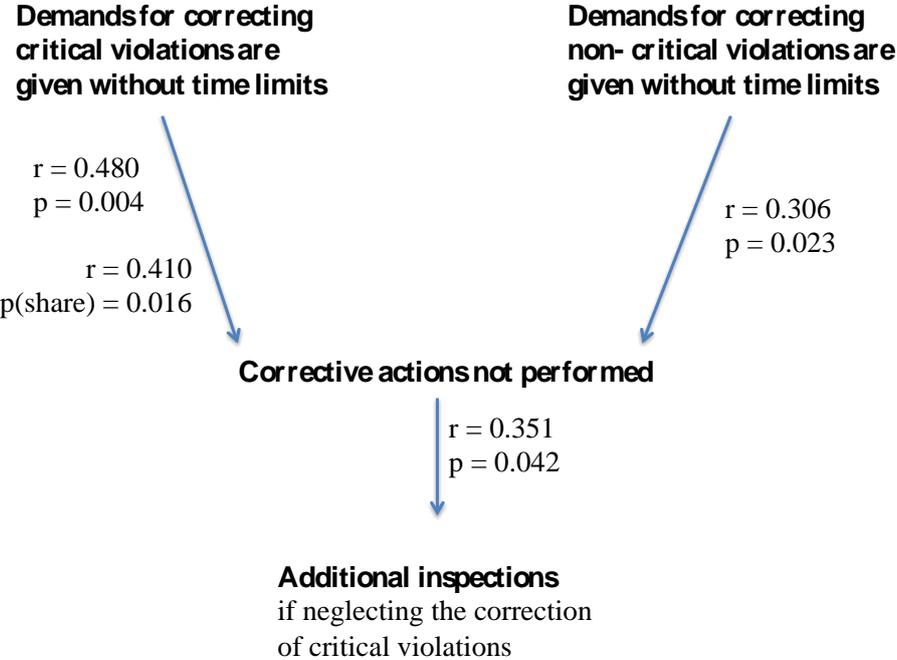


Fig. 5 Relations between use of time limits for corrective actions, performance of these actions, and additional inspections. Correlations were examined by using Pearson’s correlation coefficient.

The higher the total numbers of demands were for correcting non-critical and critical violations in the restaurants, the shorter the time frames until verification of the corrections (Pearson $r = 0.416$, $p = 0.001$ and $r = 0.361$, $p = 0.006$, respectively). The better the critical violations were corrected in the restaurants, the higher the school grades (sum variables) given by the RBOs for the inspectors (Spearman $r = 0.480$, $p = 0.006$).

Working unit and use of templates for inspection reports were shown to have significant effects on inspection processes and documentation of the inspections (Table 4). The total number of demands for correcting critical violations per inspection report was higher in larger units (Mann-Whitney U-test, $p < 0.001$), and inspectors in larger units had set demands for correcting critical violations regarding temperature control and hand-washing facilities more likely during the study period (Pearson Chi-square, $p = 0.010$ and $p = 0.001$, respectively). Verification documentation of corrective actions regarding critical violations was more common in larger units (Pearson Chi-square, $p = 0.008$), but the share of demands for corrections set without time limits was higher relative to smaller units (Mann-Whitney U-test, $p = 0.020$).

Table 4 *Effect of food control unit and use of templates for inspection reports on inspection processes and documentation of the inspections.*

Influencing factor	Observed differences caused by influencing factor (statistical significance of difference)
Unit	<p>Proportions of time used for inspecting activities ($p = 0.007$)¹ and inspection reports ($p = 0.015$)¹ of all activities connected to inspections</p> <p>Proportions of time spent on evaluating temperature control during inspections ($p = 0.017$)¹</p> <p>Total numbers of demands for correcting non-critical ($p < 0.001$)¹ and critical violations ($p = 0.002$)¹ per inspection</p> <p>Time limits for correcting non-compliances ($p = 0.011$)¹</p> <p>Length of time limits for correcting non-critical ($p < 0.001$)¹ and critical violations ($p < 0.001$)¹</p> <p>Time spent for writing inspection reports for restaurant inspections; 1 hour or less / more than 1 hour ($p = 0.007$)²</p> <p>Observed violations in cross-contamination prevention ($p = 0.039$)², temperature control ($p = 0.006$)², and personal hygiene of staff ($p = 0.029$)² present in material or not (henceforth 'documented')</p> <p>Demands for correcting violations in temperature control ($p = 0.001$)² and hand-washing facilities ($p = 0.018$)² documented</p> <p>Verification activities for non-critical ($p = 0.001$)² and critical violations ($p = 0.001$)² documented</p> <p>Choosing less strict actions in case of violation in establishment with generally well-functioning own-checking system ($p = 0.032$)²</p>
Use of templates for inspection reports (often also used as checklists during inspections)	<p>Decreased proportions of time used for inspecting documentation of the own-checks during inspections ($p = 0.021$)³</p> <p>Less time used for writing inspection reports ($p = 0.005$)³</p> <p>Increased number of inspected categories in total ($p = 0.003$)³ and ones critical for food safety ($p < 0.001$)³</p> <p>Increased number observed non-compliances in total ($p = 0.021$)³ and ones critical for food safety ($p = 0.005$)³</p> <p>Increased number of demands for correction of non-critical ($p = 0.011$)³ and critical violations ($p = 0.024$)³ per inspection</p> <p>Increased total numbers of set time limits per restaurant ($p = 0.043$)³</p> <p>Observed violations in temperature control ($p = 0.002$)² and hand-washing facilities ($p = 0.019$)² documented</p> <p>Demands for correcting critical violations regarding hand-washing facilities ($p = 0.037$)² documented</p> <p>Time limits for correcting non-compliances ($p < 0.001$)² documented</p> <p>Increased verification of corrections of non-critical ($p = 0.004$)² and critical violations ($p = 0.002$)²</p>

The statistical tests used are indicated next to each p-value as ¹Kruskal-Wallis test, ²Pearson Chi-square test, and ³Mann-Whitney U-test.

5.4 Unit-related factors affecting municipal food controls (III)

5.4.1 Operational functionality and prerequisites for official food controls in the units

Of the 17 units, 15 held meetings where staff could discuss control situations and problems related to controls. Inspectors also discussed control situations with each other frequently; 30% (17/56) consulted other inspectors “daily”, 41% (23/56) “weekly”, and 29% (16/56) monthly or less often. Orientation of new staff to control practices was considered to be functioning well by 9/17 heads (53%) and by 17/51 officials (33%). However, much “tacit knowledge” (knowledge not included in quality systems) existed in the units according to 11/16 heads.

Regarding support tools for inspections, 14/17 units provided officials with checklists or other detailed guiding instruments, and 12/17 units possessed operating instructions for inspections, 9/17 for writing inspection reports, and 8/17 for the use of protective clothing during inspections. However, only 56% (31/55) of the inspectors thought that the unit had sufficient guidance papers concerning controls in practice. Nearly all units (16/17) provided their staff with templates for sample documentation, 15/17 for inspection reports, 14/17 units for hearing letters, and 13/17 units for coercive measures. More templates and forms existed in the units according to the heads than according to the inspectors, and the responses from heads and inspectors fully corresponded with each other in only one unit. Of the inspectors working in the 14 units that provided checklists or other detailed tools for inspecting activities, 63% (27/43) used these tools. According to inspectors, 68% (38/56) of them followed the guidance provided by the unit, and 69% (37/54) used the templates provided, “always” or “nearly always”. Of the inspectors who used the templates at least “nearly always”, 97% (36/37) felt they saved a “very high” (46%) or a “relatively high” (51%) amount of time by doing so.

A considerable proportion of inspectors felt that their working time was insufficient for developing their professional competence; 29% (16/56) considered their working hours insufficient for adequate development of knowledge and professionalism, 29% (16/56) for reading legislation and guidance papers set by the needs of normal control situations, 29% (16/55) for familiarizing themselves with new legislation, and 20% (11/55) for familiarizing themselves with new guidelines. Inspectors in larger units and in units with more control objects considered their working time as significantly less sufficient for developing their professional competence in relation to other inspectors (t-test of sum variables created from the four original variables, $p = 0.007$ and $p < 0.001$, respectively). The larger the number of control objects inspectors were personally responsible for controlling, the less sufficient they felt their working hours were for becoming familiar with new legislation (Spearman $r = 0.304$, $p = 0.025$). More experienced inspectors considered their working hours less sufficient for reading legislation and guidance papers

to the extent needed for normal control situations than did less experienced inspectors (Mann-Whitney U-test, $p = 0.020$).

Of the heads of the units, 8/17 disagreed and only 5/17 agreed that the restaurant controls were performed regularly and frequently enough in their unit. When the inspection numbers in the units were low relative to the control plan, targeting of controls was discussed among staff in 12 units. According to inspectors, only 20% (11/56) of them would follow the written guidance from the unit or instructions from their heads if problems arose in the realization of their inspection plans, and the rest (80%) would target their controls to the most relevant issues or establishments in their opinion or perform only the inspections for which they had time.

Facilities and equipment of the units were considered sufficient for effective controls by 88% (15/17) of heads and 73% (38/53) of inspectors.

5.4.2 Importance of work-related well-being for work efficiency in units

Inspectors and heads assessed the negative effect of 11 factors related to work efficiency in their unit on a scale from 0 to 10. The assessments of heads and inspectors differed significantly in relation to the effect of all factors (Table 5).

Table 5 *Assessments by inspectors and heads of food control units regarding the experienced negative effect of given factors for work efficiency in the units on a scale from 0 (no significant effect) to 10 (highly significant effect). This table is amended from Table 4 in Study III.*

Factors	Means of responses of the inspectors	Means of responses of the heads	Significance of difference between groups (Mann-Whitney U-test)
Insufficient salaries	7.4	3.8	$p < 0.001$
Negative stress	6.8	4.8	$p = 0.005$
Work not experienced as meaningful	5.6	2.2	$p < 0.001$
Unclear operating procedures	5.4	3.8	$p = 0.046$
Unfair treatment by head of unit	5.4	2.6	$p = 0.011$
Unclear work objectives	5.2	2.9	$p = 0.005$
No possibility to influence subjects concerning oneself	5.2	2.6	$p = 0.002$
Unclear division of tasks	4.9	2.5	$p = 0.029$
Unclear responsibilities	4.8	2.2	$p = 0.006$
Generally poor work atmosphere	4.7	2.2	$p = 0.024$
Bullying	3.9	1.2	$p = 0.009$

A significant difference regarding the negative effect of the 11 factors emerged between the assessments of the inspectors in different units (Kruskal-Wallis test of sum

variables, $p = 0.007$), and inspectors from units with more control objects deemed the negative effect of the factors to be greater than did the other inspectors (t-test of sum variables, $p = 0.034$). The combined negative effect of the 11 factors was also assessed as higher by more experienced inspectors in relation to their less experienced colleagues (t-test, $p = 0.035$). The more limited the inspectors considered their ability to develop their professional competence (sum variable) during working hours, the higher they assessed the negative effect of the listed 11 factors (Pearson $r = 0.278$, $p = 0.040$). In addition, the less sufficient the inspectors considered the guidance papers of their unit concerning controls in practice and the less adequate they considered the follow-up of their vocational training needs and provision of sufficient training, the higher they assessed the negative effect of the 11 factors (Spearman $r = 0.302$, $p = 0.027$ and $r = 0.416$, $p = 0.002$, respectively).

5.5 Auditing of municipal food control during 2007-2010 (IV)

The proportion of respondents from regional authorities was 59% (13/22 officials) and from municipal authorities 24% (19/79 control units). Mean values of answers of regional officials concerning perceived benefits of the auditing visits ranged between 3.9 and 4.9 (scale from 1 = totally disagree to 5 = totally agree), while answers of municipal officials ranged between 2.8 and 3.5. Mean values of created sum variables describing the perceived benefits of the answers of regional officials was 4.58 (variables included in sum variable = 8) and of the answers of municipal officials 3.24 (variables included in sum variable = 10). Significant differences in perceived benefits between the two answer groups occurred regarding all five questions that were similarly posed to both groups (Mann-Whitney U-test, $p < 0.001$).

All regional officials (13/13) considered that the current form of the official food control auditing system was suitable “at least for the most part” for evaluating the different municipal food control units, while 68% (26/38) of the municipal officials considered the system suitable for evaluating their control unit “at least for the most part”; the perceptions between the groups differed significantly (Fisher’s exact test, $p = 0.023$). Compared with the municipal officials, the regional officials also considered the auditing system significantly more suitable for evaluating the risk basis of the controls (Fisher’s exact test, $p = 0.038$) and sufficiency of control actions ($p = 0.046$).

Respondents were asked to describe the experience of the auditing visits with the help of a list of given adjectives. Both answer groups had experienced the visits in particular as “developing the operations of the control unit”, “providing guidance”, and “needed”, but responses of the municipal officials were more scattered between positive and negative adjectives than of the regional officials. Compared with municipal officials, the regional officials had also experienced the auditing visits significantly more often as “useful” (Fisher’s exact test, $p < 0.001$), “developing the operations of the control unit” ($p < 0.001$), and “well-structured” ($p = 0.025$). The prevailing negative option in both groups concerning the auditing system overall as well as on-site visits to the establishment being “inconsistent”, and the least favored positive option was “well-structured”.

Of the regional officials, 85% (11/13) considered that they had sufficient expertise and 60% (6/10) that they get adequate training for auditing of official food controls. Of the municipal officials, only 24% (9/38) considered the expertise of the auditors to be sufficient, 47% (18/38) that it was sufficient for the most part, and 29% (11/38) that it was only somewhat sufficient. In response to the open question “How should the auditing system of Finnish official food control be developed?”, 30% (7/23) of the municipal officials noted that the expertise of auditors in food control in practice should be enhanced.

None of the regional officials considered that the results obtained from the auditing visits had been utilized appropriately in guiding and developing the official food control.

6 DISCUSSION

6.1 Enhancing hygiene in food establishments through official food controls at restaurant level

Significant positive correlations exist between the knowledge of the RBOs, their attitudes towards official food control, and hygiene in their restaurants. In addition, significant positive correlations were discovered between the perceptions of the RBOs regarding the quality of official food controls and their appreciation of the controls. These results are an important complement to previous results revealing positive connections between hygiene knowledge of FBOs, their attitudes towards food safety, and the hygiene in their food businesses (Seaman & Eves, 2006; Gomes-Neves et al., 2007; Pilling et al., 2008; Buccheri et al., 2010; Abdul-Mutalib et al., 2012; Ko, 2013; Sani & Siow, 2014). It is thus important to ensure high quality in official food controls and to search for ways to increase the positive attitudes of the FBOs towards official food controls when aiming to maximally improve the hygiene in food production. Sharing knowledge of the most relevant issues for safe food handling as simply as possible and sharing information of the most severe and most typical deficiencies in national food production and the possible consequences of these deficiencies should have as low a threshold as possible for food control authorities.

6.1.1 Increasing food safety knowledge

According to our results, the inspectors did not consider the Finnish Food Hygiene Proficiency Certificates as a sufficient guarantee of adequate food safety knowledge and safe behaviors in food handling in restaurants. The role of inspectors as informants concerning food hygiene issues and food safety was apparent, especially regarding those RBOs who were not members of a restaurant chain or Mara. Food control authorities could, however, take a more central responsibility in providing food safety knowledge to FBOs. By doing so, the authorities could decrease the workload of inspectors and ensure more equal opportunities for all FBOs to access the most relevant knowledge.

Since the RBOs preferred easy channels, such as food trade journals, guidance papers, and internet material, for increasing their knowledge and understanding of food hygiene, the provided material should be readily accessible and understandable for its users. Pedagogical and motivational factors, such as evaluation of training needs ahead of time, clear consequences for non-compliances and improper food handling, and limiting the training content to relevant factors for the trainees, should be emphasized when designing the material (Rennie, 1995; Ehiri et al., 1997; Clayton et al., 2002; Coleman & Roberts, 2005; Seaman & Eves, 2006; Santos et al., 2008; Martins et al., 2014). Food control authorities could also take more responsibility in organizing training events for FBOs, preferably including both theoretical and practical components (Soares et al., 2013). Examples of well-functioning governmentally driven methods with positive implications

on food safety control and attitudes of FBOs have been reported (Taylor, 2008). Control results should be utilized more efficiently when designing the training events in order to meet the actual training needs of FBOs and to focus on the most severe non-compliances in their operations (Jardine, 2003; Coleman & Roberts, 2005; Seaman & Eves, 2006; Seaman, 2010; Niode et al., 2011; Martins et al., 2012; Garayoa et al., 2014; Martins et al., 2014). Food control authorities should also seek to promote the development of national guides for good hygiene practices.

6.1.2 Increasing positive attitudes towards official food controls

Good cooperation, negotiative approach when possible, provision of instruction and guidance, and solid reasoning behind issued demands and control actions taken should be emphasized in inspection processes, as they may both increase the appreciation of official food control and improve the correction of non-compliances. The significance of the attitudes of the RBOs towards official food controls was seen, for example, through the significant positive correlations between the school grades that the RBOs gave inspectors and the correction level of the critical violations in their restaurants. This finding provides important new information about the relevance of the interactions between different actors of the food chain for food safety. However, it should be kept in mind that while cooperation, a negotiative approach, and provision of advice are important, the food control authorities must require compliance with relevant regulations and also apply administrative coercive measures when needed. Positive attitudes about safe food handling practices will not automatically lead to full implementation of these practices (Tokuç et al., 2009; Soares et al., 2012).

6.2 Enhancing consistency and efficacy in inspection processes

6.2.1 Consistency of controls

The control history of the food establishment, the perceptions and work experience of the food control official, and the specific unit for which the official works were shown to have an effect on the performed official controls and the chosen control actions. These results provide valuable information about variation that exists in inspection processes and about the factors contributing to this variation. Recognition of these factors is important for further development of the local official food controls.

According to Regulation EC No 882/2004, control history of the food establishment shall have an effect on performed controls, and the nature of the non-compliance shall have an effect on the actions chosen. However, the noted differences in time usage during the inspections may, for example, result in varying efficacy of controls, and differing perceptions of adequate conditions may lead to uneven remedial costs for FBOs. The unit-

and inspector-related differences in controls should thus be addressed, although achieving complete unity in the processes is both unnecessary and impossible. Differences in control practices may set the FBOs in an unequal position (Jones et al., 2004; Phillips et al., 2006; Tähkää et al., 2009; Lepistö et al., 2010; Lepistö & Hänninen, 2011; Lee et al., 2012; Tähkää et al., 2013; Kettunen et al., 2015).

One factor that appeared to steer the inspection process was the amount of work experience of the inspector; more experience resulted in a stronger focus on the critical food safety aspects during the inspections. More work experience also decreased the perceived need for training in production, processing, and distribution steps in different types of food production, indicating that the inspectors have traditionally achieved such knowledge during their working years rather than during their basic vocational education. More emphasis should be placed on providing the inspectors with the skills and tools to adapt risk-based thinking in their controls in practice from the very beginning of their working years.

Based on the assessments of inspectors regarding the uniformity of official food controls in Finland, they were well aware of the existing variability. According to inspectors, detailed guidance should be provided when aiming for consistency. Training was considered especially needed relating to: evaluation of food hygiene and operational hygiene in food establishments, evaluation of severity of non-compliances and related control actions, and legislation. Since these views were collected, a publication system for inspection results, “Oiva”, was launched in Finland. In connection with the Oiva system, Evira has provided the inspection staff in Finland both general guidance regarding risk-based approaches in official food controls and more detailed guidance regarding the inspection of different subjects. In the same process, Evira has also nationally standardized the templates used for inspection reports. Based on the results of this work, the applied measures appear adequate and justified. Their importance is further emphasized by the criticism expressed about certain publication systems of inspection results, in particular regarding insufficient consistency in inspections and inappropriate grading (Ho, 2012). The new guidance and the nationally standardized templates provided subsequently to the study are likely to have increased the consistency of inspection processes. The results of this study may thus not reflect the current situation accurately. However, it remains important to verify the consistency of the application of the guidance and the Oiva system.

6.2.2 Efficacy of controls

Based on the analysis of inspection reports, inspection frequencies were increased when the RBOs failed to implement the corrective actions for noted critical violations, and verification activities were performed more urgently in restaurants issued a higher number of demands for corrective actions. Control results of food establishments appeared thus to have an adequate effect on the actions of inspectors. The high rates of demands for corrective actions issued during the inspections emphasize the importance of official food controls in detection of non-compliances and in assurance of compliance with the relevant legislation. However, the numbers of repeated demands were high, suggesting low

efficacy of controls. One factor decreasing the efficacy appeared to be the infrequent use of time limits: time limits were used only for one-third of demands, although their importance for adequate corrective actions was apparent. Additionally, on average only one or two critical items were inspected per inspection, suggesting that the inspectors did not focus on the most relevant issues during the inspections. This result corresponds with findings in other countries (Jones et al., 2004; Hadjichristodoulou et al., 2008; Sharkey et al., 2012; Green & Kane, 2014). The risk-based approach appeared to be more strongly implemented in larger units; for example, issuing demands for correcting critical violations and verification documentation of corrective actions regarding these violations were more common in larger units. However, the share of demands for corrections set without time limits was higher than in smaller units, possibly decreasing the efficacy of the demands in relation to the smaller units.

The vast majority of the RBOs considered that the official controls had a positive effect on the hygiene in their restaurants and that the inspection reports were highly important for developing the operations of their restaurants. Of different areas in restaurant facilities, the customer areas were discovered to have the most adequate hygiene status, indicating that the RBOs especially invest in giving a good impression of hygiene status to customers. This result highlights the importance of publicly accessible inspection results since the customers usually only have access to customer areas in a restaurant. According to the literature, publication of inspection results also leads to increased efficacy, emphasizing its importance for food safety (Fielding et al., 2001; Thompson et al., 2005).

Evira has provided the Finnish inspection staff with a considerable number of further guidance papers, checklists, and templates for inspection reports since this analysis of the reports was performed and has also emphasized the importance of setting time limits for corrective actions in these tools. However, further efforts for increasing the risk-based approach and efficacy of official food controls are needed. True nationwide deployment of risk-based approaches in practice and adequate use of the Oiva system are not going to happen overnight, and continuous support for inspection staff and monitoring of additional guidance and training needs will be required in the years to follow. Based on the literature, the efficacy of the Finnish official food controls may also be decreased by insufficient use of administrative coercive measures (Kettunen et al., 2015).

6.3 Enhancing quality of official food controls in units

6.3.1 Prerequisites for high-quality effective controls

Food control units have commonly invested in ensuring the quality of official food controls through providing their operative staff with guidance papers, templates, and possibilities for collective discussions regarding control situations. However, the units have not completely succeeded in committing their staff to these tools, suggesting that

more than one organizational culture may be present in the units (Schein, 1999). Incomplete commitment of staff to quality tools decreases the functionality of the quality systems and may thus result in inconsistency of practices between staff members in food control units. Additionally, non-systematic utilization of the tacit knowledge available in the units and poor orientation of new staff may further decrease the functionality of the quality systems and jeopardize the consistency in operations. Tacit knowledge is highly personal and difficult to formalize, making it challenging to share with others (Nonaka & Takeuchi, 1995). However, converting tacit knowledge to explicit knowledge and sharing it systematically is critically important for organizational knowledge creation (Nonaka & Takeuchi, 1995). One-third of the inspectors considered the practical guidance regarding inspections to be insufficient, leading to a lower quality and less efficacy in controls. Additionally, inspectors were largely unaware of the templates that their control units had provided, reflecting deficiencies in information flow and a failure to familiarize staff with the available guidance tools.

The vast majority of heads and inspectors were satisfied with the facilities and equipment provided, indicating that the authorities are capable of ensuring these resources in official food controls. However, less than one-third of the heads thought that the restaurant controls in their units occurred regularly and sufficiently, and, in fact, in 2011 only 49% of municipal food control units in Finland “fully” or “mostly” implemented their control plans (Evira, 2012). The situation seems to have improved recently: in 2014, the planned control activities were realized “fully” or “mostly” in 51% of the control units and in 2015 in 68% of the units (Evira, 2015b; Evira, 2016). The non-realization of control plans may result from lack of resources or inadequate management within units.

Less than 60% of inspectors considered their working time sufficient for reading legislation and guidance papers to the extent needed for normal control situations, and about 30% considered their working time insufficient for familiarization with new legislation. These figures may reflect the economic situation and limited resources in official food controls. The result is alarming since the quality of the inspections will likely deteriorate if inspectors are unable to maintain and develop their professional skills adequately. Inspectors reported that they had insufficient working hours, particularly when they were responsible for controlling large numbers of food establishments. In addition, inspectors who had more work experience perceived their working hours as insufficient. More experienced inspectors may thus be burdened with too many tasks.

6.3.2 Significance of work-related well-being

Heads of the units assessed the negative effect across all identified factors related to workplace operational efficiency in their units as lower than did inspectors, suggesting that heads do not necessarily recognize such problems in their units. This in turn prevents them from addressing the situation when needed. The reliability of the result may be weakened by the difference in the survey methods used between the groups; the heads were interviewed face-to-face, while the inspectors assessed the negative effect of the factors through electronic questionnaires (de Leeuw 2005; Laaksonen & Heiskanen,

2013). However, there is previous evidence of management assessing organizational culture and well-being of an organization more positively than operative staff (Perko & Kinnunen, 2013; 2015 Work and Well-being survey, 2015). Since dissatisfaction with working conditions may diminish both the quality of work and employee efficiency in completing tasks, the functionality of units may ultimately be severely affected by staff dissatisfaction. It has been previously noted that job satisfaction, organizational commitment, and work engagement are all very important factors for general organizational success (Meyer et al., 2002; Powell & Meyer, 2004; Bowling, 2007; Westover et al., 2010; Appelbaum et al., 2013a, 2013b, 2013c; Yalabik et al., 2013; Rayton & Yalabik, 2014). Since the more experienced inspectors assessed the combined negative effect of the 11 factors related to work efficiency as higher than did other inspectors, their excessive workload may severely affect their work-related well-being and efficiency.

Units seemed to have varying degrees of success in providing staff with the abilities to ensure the needed quality of operations. Because inspectors considered their working hours as clearly less sufficient to allow them to develop their professional competence in units with more personnel and more control objects, the amount of working time appears to be less sufficient to ensure continuous quality of the work of inspectors within these units. The inspectors in larger units also assessed the combined negative effect of the 11 factors related to work efficiency as higher than did other inspectors. These findings suggest that a high investment in establishing a healthy workplace environment is necessary, particularly in food control units with a large number of control objects and staff. It is possible that the management skills of the heads have not increased in the same proportion as the size of units. If the management skills are not paid sufficient attention, the economic objectives related to increased efficiency of official controls underlying the formation of the municipal cooperation areas (Government Proposal 51/2009) may not be met. The combined negative effect of the 11 factors was assessed as higher by the inspectors who experienced their ability to develop their professional competence as especially limited and also by the inspectors who considered the guidance papers provided by their unit regarding the inspections in practice as insufficient, further highlighting the importance of adequate management.

The RBOs operating in the control areas of larger units and units with more control objects evaluated the quality and significance of official food controls as lower than did RBOs in smaller units, suggesting that the problems in the work-related well-being of staff may also weaken the efficacy of controls. The role of the heads of units thus appears crucial for the quality and efficacy of the controls in practice, and leadership skills should be given a higher emphasis in development of the national food control system.

6.4 Improving official food controls through the national auditing system

Based on the results, the regional officials considered the auditing visits to be more useful and suitable for the purpose and had also experienced the system more positively than

municipal officials. Additionally, the municipal officials perceived that the auditors did not have sufficient expertise for auditing the tasks or for food control in practice. These results provide important information about the capability of the system to enhance the efficacy and quality of official food controls. The results suggest that the groups had divergent expectations of the auditing visits. Overall, the system appears to have served the regional officials well, but may have failed to meet the expectations of the municipal officials for practical evaluation and guidance regarding their controls in practice. The motivation of the municipal officials may also have decreased because the municipal authorities have not had a chance to decline these auditing visits due to their legislative status.

The impact of the system has probably decreased due to the collective dissatisfaction of municipal officials. Morin (2001) found that factors such as the perception of the auditee regarding the added value and usefulness of the audit, and the satisfaction of the auditee with the auditor's work influenced the impact of audits. Thus, if the municipal officials considered the system to be more beneficial and suitable for its purpose and the expertise of the auditors to be adequate, the group would most likely also utilize the results more effectively in their work. Additionally, there are apparent needs to improve the utilization of the results in the national development and guidance of official food controls. The common experiences of non-consistency and scarce experiences of well-structured auditing visits also suggest that there is a need for improved structuring of the system.

During the survey the Regional State Administrative Agencies had the role of both guiding and auditing the municipal food control authorities. This violation of the auditing rules has since been corrected; the previous auditing task of the Regional Administrative Agencies is now called 'Evaluation and guidance' and independent bodies perform auditing. The changes in the auditing field may weaken the relevance of the results to the current situation. However, the findings and conclusions of this study are important to take into consideration in developing any evaluation or auditing system of official food controls. The current evaluation and guidance system includes more practical elements than the auditing system of 2007-2010. However, in many respects the current system still corresponds to the system used in 2007-2010.

7 CONCLUSIONS

Based on the results of this work, there are certain weaknesses in the efficacy of official food controls of retail food businesses both preparing and serving foods in Finland. However, there are also several ways to improve the efficacy of controls and to enhance the hygiene of these food establishments. Impact possibilities exist at all levels of the control chain, *i.e.* at the levels of food business operators, official inspecting staff, official inspecting staff management, and official food control evaluation.

1. Official food controls have a positive effect on the hygiene of restaurants. Inspectors can affect the hygiene of a retail food establishment, such as a restaurant, by proper justification of the issued correction demands and applied control actions. To reach optimal efficacy of official food controls and fruitful cooperation between food business operators and official food controls, guidance giving and a negotiative approach should be applied in controls. Channels providing possibilities for collective improvement of hygiene knowledge of the food business operators, their motivation to perform adequate hygiene practices, and their positive attitudes towards official food controls should be developed and implemented.
2. Based on the high rates of demands for corrective actions issued during inspections, official food controls are an important tool in detection of non-compliances and in assurance of compliance with relevant legislation. However, the main focus of inspections was not on the most critical issues for food safety, which decreases the efficacy of the inspections. Additionally, repeated demands were common, indicating a low efficacy of official controls. Implementation of the Oiva system and the further guidance provided by Evira after this study are likely to have improved the efficacy of inspections. However, long-term investments in implementation of a risk-based approach and adequate enforcement are still necessary. These investments include further training and guidance of the inspecting staff and their supervisors, focused on the risk-based inspection approaches and enforcement in practice. The nationally provided instructions and inspection tools need to be compiled in such a way that they support the application of a risk-based approach during inspections, the use of time limits, and the verification of corrective actions.
3. Inspection processes may vary depending on the unit and inspector-related factors regarding time usage during inspections, inspected items, perceptions of adequate conditions in food businesses, chosen control actions, and use of time limits for corrective actions. Weaknesses in consistency of inspection processes must be addressed resolutely both nationally and in municipal control units; this task has already been initiated through introduction of the Oiva system. At the same time, it must be accepted that the controls can never be entirely uniformly applied.

4. Food control units have invested in effective and high-quality official food controls through providing their operative staff with guidance papers, templates, and possibilities for collective discussions regarding control situations. Quality and efficacy of controls may, however, be diminished due to non-systematic utilization of the tacit knowledge available in units, poor orientation of new staff, and incomplete commitment of staff to quality systems. The role of the heads of units is crucial for the quality and efficacy of the controls in practice and should therefore be given a higher emphasis in development of the national food control system.
5. The current system of evaluation and guidance of municipal official food control can increase the efficacy and consistency of local food controls, but the purpose and structure of the control must be clarified. To reach optimal efficacy, the benefit provided for municipal food control units, the continuous training of the evaluators, and the utilization of the evaluation results should be emphasized in further development of the system. Possibilities to include municipal officials as members of the evaluating teams should be investigated.

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