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1 **Developing official control in slaughterhouses through internal audits**

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28

29 Abstract

30 In the European Union, competent authorities are obligated to arrange audits to ensure that the
31 official control (comprising meat and food safety inspections) in slaughterhouses is performed
32 according to legislation. Previous information on the functionality of these audits and on non-
33 conformities observed in the official control of slaughterhouses is limited. In this study, non-
34 conformities of the official control of slaughterhouses and their correction were analysed from the
35 internal audit reports of the Finnish Food Safety Authority Evira. To further assess the benefits and
36 needs for improvement of the audits, we conducted interviews with the chief official veterinarians
37 (OVs) responsible for the controls in slaughterhouses and the auditors of Evira. According to our
38 results, non-conformities, especially in the inspection of intestines of bovines and swine, were
39 common. Regarding food safety inspections, OVs should develop their documentation, perform the
40 follow-up of the correction of non-compliances more systematically, and improve the enforcement,
41 especially in smaller red meat slaughterhouses. Based on our results, internal audits appeared to
42 be beneficial, as non-conformities in the official control were noticed, most non-conformities were
43 corrected or corrective measures had been taken, and the audits were assessed as necessary by
44 both the auditors and auditees. Our results can be utilized in improving the official control and audit
45 procedures in slaughterhouses. In the future, the uniformity of meat inspection could be improved
46 by auditing also differences in the rejections and their reasons between official auxiliaries in post-
47 mortem inspection.

48

49 Keywords: non-conformity, meat inspection, food safety inspection, non-compliance, correction

50

51 1 Introduction

52

53 In slaughterhouses, official veterinarians (OVs) bear the primary responsibility for official control
54 comprising meat and food safety inspections (European Union [EU], 2004a). The goal of meat
55 inspection, which may be performed with assistance from official auxiliaries (OAs), is to ensure
56 safe meat for consumers, secure the welfare of animals, and prevent transmissible animal

57 diseases (Alban, Steenberg, Stephensen, Olsen, & Petersen, 2011; European Food Safety
58 Authority [EFSA], 2011; EU, 2004a). Meat inspection consists of the inspection of food chain
59 information, live animals (ante-mortem inspection), and carcasses and offal (post-mortem
60 inspection). In Finland, OAs perform post-mortem inspection under the supervision of the OVs in
61 red meat and poultry slaughterhouses. Food safety inspections are performed to verify
62 slaughterhouses' compliance with food safety legislation including proper implementation of
63 slaughterhouses' obligatory self-checking systems (SCSs). These SCSs are based on basic
64 hygiene and hazard analysis and critical control point (HACCP) principles (EU, 2004c). A well-
65 implemented SCS ensures, for instance, adequate process hygiene (Blagojevic & Antic, 2014;
66 Food and Agriculture Organization, 2004), thus contributing to meat safety (Blagojevic & Antic,
67 2014; Nørrung & Buncic, 2008). In practice, food safety inspections entail a comprehensive
68 examination of various areas, such as maintenance and hygiene of premises and equipment,
69 temperature control, and employee practices. In Finland, OVs perform food safety inspections, but
70 OAs could participate by collecting information regarding good hygienic practices and HACCP-
71 based procedures (EU, 2004a).

72
73 To guarantee that official controls in food establishments, including slaughterhouses, meet their
74 objectives, the competent authorities of each EU member state are obligated to arrange either
75 internal or external audits by which the official controls are evaluated (EU, 2004b). In
76 slaughterhouses of Finland, the Finnish Food Safety Authority Evira has performed internal audits;
77 its auditors have also been involved in guiding and organizing official control in slaughterhouses.
78 Audits have been considered to be a good instrument to improve the functionality of organizations
79 (Bawole & Ibrahim, 2016; Junttila, 2014; Leeuw, 2011), but to our knowledge, their efficacy in
80 relation to slaughterhouse control has not been investigated in Finland or in other countries. In
81 some of the European countries, including Finland, the number of audits of official control has
82 decreased because of scarce economic resources (European Commission [EC], 2013). This
83 further highlights the need to assess whether the audits have been performed in the most efficient
84 way and whether they truly contribute to better control. The optimal frequency of audits should also

85 be determined. To receive a comprehensive view of the benefits and needs for improvement of the
86 internal audits, both OV's' and auditors' views should be investigated.

87

88 Non-conformities in relation to post-mortem inspection have been reported at a general level to
89 occur widely in European countries (Alban et al., 2011; EFTA [European Free Trade Association]
90 Surveillance Authority, 2012; EC, 2013), and authorities have had problems in identifying and
91 addressing non-compliance of slaughterhouses (Alban et al., 2011). In Finland, a previous study
92 indicated that more efficient control measures should be used by the OVs in some
93 slaughterhouses (Luukkanen & Lundén, 2016). In order to develop the official control in
94 slaughterhouses, more thorough investigation of the frequencies and types of non-conformities
95 should be performed.

96

97 Our study aimed to identify the types of non-conformities occurring in official control of
98 slaughterhouses and to examine the benefits of internal audits on official control. The optimal
99 frequency and potential need for improvement of internal audits were also investigated. The results
100 of this research can be used to enhance the official control and auditing procedures in
101 slaughterhouses.

102

103 2 Materials and methods

104

105 2.1 Audit reports

106 In total, 38 reports of internal audits of meat inspection in 19 slaughterhouses (performed by the
107 meat inspection unit of Evira) and 22 reports of internal audits of food safety inspections in 17
108 slaughterhouses (performed by the food hygiene unit of Evira) were analysed (Table 1). Audit
109 reports of meat inspection were from the period 2009-2013 and audit reports of food safety
110 inspection from the period 2010-2013, as the food hygiene unit started their audits one year after
111 the meat inspection unit. Meat inspection was audited twice, but food safety inspections only once
112 in the majority of the slaughterhouses (Table 1). Small-scale slaughterhouses processing under 20

113 livestock units (one livestock unit = one bovine or five pigs) per week, under 1000 livestock units
114 per year, or under 150 000 birds per year (Ministry of Agriculture and Forestry, 2011) were
115 excluded from the study. The audits followed clear instructions in which, for instance, the aims and
116 the course of audits were described in detail (Evira, 2010, 2011). Post-mortem inspection
117 performed by OAs was audited in red meat slaughterhouses. In poultry slaughterhouses, OVs'
118 supervisory duties in post-mortem inspection, including the inspection of a representative sample
119 of birds and a detailed inspection of a random sample of birds declared unfit for human
120 consumption by the OAs (EU, 2004a), were audited. Non-conformities (in meat and food safety
121 inspections) and targets for development (only in food safety inspections) and their numbers were
122 analysed. Auditing units had defined observations not complying with the legislation or Evira's
123 instructions as non-conformities, whereas observations that were not non-conformities, but the
124 correction of which would contribute to the efficacy of food safety inspections were defined as
125 targets for development. The correction of non-conformities was also analysed based on following
126 audits or on OVs' reports of corrective measures. One audit report and two of the OVs' reports of
127 corrective measures (one from each auditing unit) were not available because they had not been
128 filed in a uniform way.

129

130 2.2 Statistical analysis of the audit reports

131 Statistical analysis was performed with SPSS 21.0 (SPSS IBM, Armonk, NY, USA). Non-
132 conformities and targets for development were analysed between red meat and poultry
133 slaughterhouses and between slaughterhouses of different size. Slaughterhouses were divided
134 into two groups of approximately the same size based on information on the number of slaughtered
135 animals received from Evira. Larger slaughterhouses (n = 10) processed over 1000 red meat
136 animals or over 200 000 birds per week and smaller slaughterhouses (n = 9) less than these
137 figures. Statistical differences in the occurrence of non-conformities and targets for development in
138 each area of official control between slaughterhouses were tested with Fisher's exact test.
139 Differences between slaughterhouses in the number of areas of official control in which non-

140 conformities and targets for development were observed were analysed with Mann-Whitney U-test.
141 A confidence level of 95% was used in evaluating the results.

142

143 2.3 Interviews

144 To examine internal audits of meat and food safety inspections in the slaughterhouses from OVs'
145 and auditors' point of view, a semi-structured interview was conducted. In this interview method, a
146 set of questions was used and asked in a systematic order, but the researcher was also allowed
147 probing questions (Fylan, 2005). The interview included both structured and open-ended questions
148 regarding the necessity, benefits, preferred frequency, and potential need for improvement of the
149 audits. Questions on how necessary and beneficial the internal audits were had a scale ranging
150 from zero to ten (only minimum and maximum values were defined verbally). At the end of the
151 interview, the interviewees were allowed to clarify their answers. Interviews were conducted by a
152 single researcher and the answers were simultaneously written down. Before the interviews,
153 participants were informed of the purpose of the study and assured of the anonymity of their
154 responses.

155

156 In total, chief OVs from 13 slaughterhouses and 8 central officials involved in the internal audits of
157 slaughterhouses participated in the interview in May-June 2015. Henceforth, for clarity the
158 interviewed central officials are referred to as auditors, although one of interviewees had not been
159 auditing, but was closely overseeing the auditing procedures and planning the audits. At the time of
160 the interviews, Finland had 19 slaughterhouses, but two of these slaughterhouses did not have a
161 regular OV and in four slaughterhouses the chief OVs declined to participate in the interview
162 because of time constraints. Ultimately, chief OVs from 2/5 poultry slaughterhouses and 11/14 red
163 meat slaughterhouses participated. Chief OVs' interviews were conducted by Microsoft Lync 2013
164 or by telephone, and the auditors were interviewed in person. Chief OVs' interviews lasted
165 approximately 47 (range 15-80) minutes and auditors' interviews approximately 77 (range 60-90)
166 minutes.

167

168 2.4 Analysis of interviews

169 The interviews were analysed using inductive content analysis to identify thematic categories (Elo
170 & Kyngäs, 2008; Franzosi, 2009; Vaismoradi, Turunen, & Bondas, 2013) in relation to the following
171 questions: a) What are the benefits gained from the audits? and b) How should the audits be
172 improved in the future? An initial coding of the responses was made, related codes were grouped
173 into subcategories, and their frequencies were calculated. The final categories were formed by
174 grouping the subcategories. Initial coding and construction of the themes were manually performed
175 by one researcher. Themes were discussed with fellow authors and a consensus was reached.
176 Answers to questions with a scale from zero to ten were analysed using SPSS 21.0 (SPSS IBM,
177 Armonk, NY, USA). Differences in the means of the answers between different respondent groups
178 were analysed with Mann-Whitney U-test. The Wilcoxon signed-rank test, which is used to test the
179 distribution of dependent samples, was applied for the OVs' responses on how beneficial audits
180 were for meat and food safety inspections. A confidence level of 95% was used.

181

182 3 Results

183

184 3.1 Non-conformities in post-mortem inspection and meat inspection documentation

185 Non-conformities in the technical post-mortem inspection of bovine were observed in at least one
186 audit in nearly all (10/11) of the slaughterhouses (Table 2). The most common non-conformities
187 were related to palpation and possible incision of the gastric and mesenteric lymph nodes
188 (observed in ten slaughterhouses) and visual inspection of the udder and its lymph nodes
189 (observed in six slaughterhouses). In the technical post-mortem inspection of swine, non-
190 conformities were also observed in at least one audit in nearly all (5/7) of the slaughterhouses
191 (Table 2). The most common non-conformities were related to visual inspection of the
192 gastrointestinal tract and gastric and mesenteric lymph nodes and their palpation (observed in five
193 slaughterhouses). In the majority of the bovine or swine slaughterhouses where non-conformities
194 in palpation of the gastric and mesenteric lymph nodes or inspection of the udder were observed,
195 the correction of the non-conformity demanded structural changes to the slaughter line or recruiting

196 an extra OA. No significant difference was present in the occurrence or number of non-conformities
197 in the technical post-mortem inspection between larger and smaller red meat slaughterhouses ($p <$
198 0.05 , Fisher's exact test and Mann-Whitney U-test).

199

200 The majority of the non-conformities in the technical post-mortem inspection of bovine and swine
201 (50/60) were corrected or their correction had been initiated (Figure 1). Of the non-conformities,
202 37% (22/60) were corrected based on the subsequent audits, and in 47% (28/60) OVs had taken
203 corrective measures according to their reports (Figure 1). In one slaughterhouse, two non-
204 conformities had not been corrected according to the OV's report because proper inspection of
205 bovine gut lymph nodes and udders would have demanded structural changes to the slaughter
206 line. According to their reports, OVs had started corrective measures in two of three of the non-
207 conformities that were not corrected in subsequent audits. The correction of the rest of the non-
208 conformities was unclear because OVs had not reported the measures taken (six non-conformities)
209 (Figure 1).

210

211 In poultry slaughterhouses, auditors observed non-conformities in the daily inspections performed
212 by the OV in one of the four slaughterhouses (Table 2). In this particular slaughterhouse, the OV
213 did not perform the daily inspection of the viscera and body cavities of a representative sample in
214 all cases due to a problematic construction of the slaughter line, and also the detailed inspection of
215 a random sample of condemned carcasses was insufficient (Table 2). Both of these non-
216 conformities had been corrected based on audits.

217

218 Non-conformities in the documentation of meat inspection were uncommon (Table 2) and
219 concerned insufficiently identified animals and the meat inspection decision. These non-
220 conformities were corrected after the audit according to the OVs' reports.

221

222 3.2 Non-conformities and targets for development in food safety inspections

223 In the audits of food safety inspections, non-conformities were observed in 7/13 red meat
224 slaughterhouses and in none of the poultry slaughterhouses. The most common non-conformities
225 concerned documentation of food safety inspections and control measures (Table 3). Non-
226 conformities in documentation (observed in three smaller and two larger slaughterhouses) included
227 insufficient documentation of inspected areas, observations, or given time limits for corrections. In
228 two smaller slaughterhouses, the OV's could not present any documentation of the food safety
229 inspections. Non-conformities in control measures (observed in two smaller and two larger
230 slaughterhouses) included lack of systematically ensuring the approval of changes in operations
231 and premises, and too seldom or insufficient checks of the SCS, including HACCP. During the
232 audits OV's performed a routine food safety inspection observed by the auditors, and in two smaller
233 red meat slaughterhouses OV's did not detect non-compliance such as deficiencies in hygiene or
234 handling of by-products. The enforcement performed by the OV's was also observed to have non-
235 conformities in one larger slaughterhouse. Auditors stated that the OV had not started the required
236 enforcement measures in relation to correction of unhygienic structures. The control plan was
237 missing or insufficient in two slaughterhouses (Table 3).

238
239 Targets for development were observed in the food safety inspections in most (15/17) of the
240 slaughterhouses and in the same areas as non-conformities (Table 3). The auditors found targets
241 for development especially in documentation (in 12/17 slaughterhouses) but also in the follow-up of
242 the correction of non-compliances (in 9/16 slaughterhouses), as the auditors were left with the
243 impression that the OV's did not conduct follow-up inspections systematically after the time limit for
244 the correction had passed (Table 3). Targets for development in enforcement included, for
245 example, that the OV's should have been more prone to use enforcement measures (in two
246 slaughterhouses), as neither slaughterhouse had complied with the time limits set for corrections
247 (Table 3).

248
249 The number of smaller red meat slaughterhouses in which non-conformities or targets for
250 development (together referred to as deficiencies) were observed in at least one audit in the

251 enforcement (5/6) was significantly greater than the number of larger red meat slaughterhouses
252 with these deficiencies (1/7) ($p < 0.05$, Fisher's exact test). Food safety inspections of smaller red
253 meat slaughterhouses had also on average more areas with deficiencies per slaughterhouse than
254 larger red meat slaughterhouses, although the difference was not significant ($p = 0.051$, Mann-
255 Whitney U-test). No significant difference in the occurrence of deficiencies or in the number of
256 areas with deficiencies per slaughterhouse between red meat and poultry slaughterhouses was
257 observed ($p > 0.05$, Fisher's exact test and Mann-Whitney U-test).

258

259 Of the non-conformities in the food safety inspections, 19% (3/16) were observed to be corrected
260 on the subsequent audits, and in 56% (9/16) OV's had taken corrective measures based on their
261 reports. Non-conformities (13%) that persisted to the second audit were being corrected after the
262 audit according to OV's reports. These non-conformities included insufficient checks of the SCS
263 and inadequate enforcement. The OV's report was missing in one slaughterhouse concerning two
264 non-conformities.

265

266 3.3 Interviews

267

268 3.3.1 Necessity and benefits of the audits

269 In the interviews, both the OV's and auditors assessed internal auditing of meat and food safety
270 inspections on average as necessary, and respondent groups' answers did not differ significantly
271 ($p > 0.05$, Mann-Whitney U-test) (Figure 2). OV's considered the audits to be significantly more
272 beneficial for food safety inspection than for meat inspection ($p < 0.05$, Wilcoxon signed-rank test)
273 (Figure 2).

274

275 Benefits of the audits that were brought up by the interviewees were grouped into two categories:
276 a) improvements to the quality of official control and b) improvements to guidance, support, and
277 training (Table 4). OV's (11/13) most frequently mentioned that the audits were useful in enhancing
278 the correction of slaughterhouses' non-compliances; they deemed it beneficial that auditors also

279 were demanding corrections to non-conformities requiring slaughterhouses' actions. Audits were
280 furthermore assessed as beneficial because of improvements or corrections to the official control
281 (Table 4). Auditors (7/8) saw audits as especially important in perceiving the present state of
282 official control in slaughterhouses (Table 4), which according to them was sometimes difficult
283 based only on information available in the central authority's office. In relation to benefits to
284 guidance, support, and training, some of the OVs (6/13) and all of the auditors (8/8) mentioned
285 audits to be advantageous because of the possibility of discussion between OVs and officials from
286 the central authority (Table 4). Support received during the audits and assessment of the need for
287 instructions and training were also mentioned as benefits by a substantial number of interviewees
288 (Table 4).

289

290 3.3.2 Improving the audits

291 The need for improvement of the audits mentioned by the interviewees was grouped into four
292 categories: a) content of the audits, b) expertise of the auditor, c) audit process and practices, and
293 d) follow-up of the audits (Table 5). The most commonly mentioned need for improvement in the
294 content of the audits was that the audits, mainly the meat inspection audits (mentioned by 6/8
295 respondents), should be more thorough and the uniformity of the meat inspection should be
296 audited (mentioned by 5/13 OVs). When asked whether the validity of the rejections should be
297 audited, 11 OVs and two of three of the meat inspection auditors supported the idea. Some of the
298 OVs (n = 6) and auditors (n = 2) considered that the auditors' should have more experience of
299 meat inspection and as OVs in order to be able to audit more thoroughly (Table 5). In relation to
300 needs for improvement in the audit process and practices, two OVs stated that they needed more
301 support from their superiors when enforcement measures were deemed necessary based on
302 audits (Table 5). Most of the auditors (n = 5) noted that the follow-up of the correction of non-
303 conformities required improvement (Table 5). They mentioned that the reports should be, without
304 exception, consistently filed, and the reports received from OVs should be more unambiguous.

305

306 3.3.3 Frequency of audits

307 Of the OVs, 62% (8/13) considered that both meat inspection and food safety inspections should
308 be audited at least once every three years in each slaughterhouse, 23% (3/13) suggested every
309 other year, and 15% (2/13) every year. According to the majority (7/8) of auditors, all
310 slaughterhouses should be audited every other or third year.

311

312 4 Discussion

313

314 Our results show that non-conformities in inspection of the gastrointestinal tract, especially in
315 palpation and possible incision of the gastric and mesenteric lymph nodes, were common in post-
316 mortem inspection of bovines and swine in Finland. These non-conformities had remained
317 because their correction would have required expensive repairs to the slaughter line or recruiting of
318 an extra OA. Similar nonconformities regarding inspection of the gastrointestinal tract and related
319 lymph nodes have been observed commonly in other EU countries as well (Alban et al., 2011;
320 EFTA Surveillance Authority, 2012). These results support criticism of authorities' capacity to
321 address non-conformities and enable meat inspection to be performed according to the legislation.
322 However, a recent study conducted in the United Kingdom concluded that especially palpation and
323 possible incisions of the gastrointestinal tract and related lymph nodes of cattle, small ruminants,
324 and swine have limited importance for public health (Blagojevic, Dadios, Reinmann, Guitian, &
325 Stärk, 2015), and manual examination has been assessed to cause cross-contamination (EFSA,
326 2011; Nesbakken, Eckner, Høidal, & Røtterud, 2003; Pointon, Hamilton, Kolega, & Hathaway,
327 2000). OVs may have evaluated the contribution of the inspection of the gastrointestinal tract to be
328 of lesser importance for meat safety, with this, in part, resulting in a lack of enforcement of the
329 problems hindering proper inspection. Especially in situations where a shortage of inspection
330 personnel existed, prioritization of control tasks has probably been necessary. However, when
331 performing meat inspection according to legislation demands changes to the slaughterhouse
332 structures or requires more OAs, OVs should receive support from their superiors to ensure that
333 sufficiently effective control measures or actions are taken to reach compliance.

334

335 Relative to meat inspection, food safety inspections had fewer non-conformities, and in poultry
336 slaughterhouses in this study none were observed. However, when the targets for development
337 are taken into consideration, the results show that the OVs in Finnish slaughterhouses have room
338 for improvement, especially in the documentation of food safety inspections and in the follow-up of
339 correction of slaughterhouses' non-compliance. If follow-up inspections are not systematically
340 performed and if documentation of the inspections is scanty or missing, there is a risk that the
341 control becomes inefficient and inconsistent. Deficiencies were also observed in inspections of the
342 SCS and especially in smaller slaughterhouses regarding the enforcement. These results are
343 worrisome since smaller slaughterhouses, in particular, have been reported to have difficulties in
344 implementing their SCSs, and critical non-compliance regarding hygiene, such as problems in de-
345 hiding, sterilization of knives, and cleaning, has occurred (EFTA Surveillance Authority, 2012; Food
346 and Veterinary Office [FVO], 2002, 2013; Luukkanen & Lundén, 2016). In cases where
347 slaughterhouses' SCSs fail, it is very important that the OVs address non-compliance effectively
348 and take further actions if the necessary corrections are not performed. The audits of
349 slaughterhouses in many European countries have shown that the problems in the follow-up of
350 correction of non-compliance (FVO, 2013) and authorities' difficulties in effectively addressing non-
351 compliance (Alban et al., 2011) are universal challenges warranting attention. Finland has recently
352 implemented a national system for publishing food safety inspection results (Evira, 2013) that is
353 anticipated to improve the uniformity and efficacy of food safety inspections in Finnish
354 slaughterhouses.

355
356 Based on our results, the internal audits of slaughterhouse control appeared to be necessary and
357 beneficial for the quality of meat and food safety inspections. They were perceived to improve the
358 correction of slaughterhouses' non-compliance and proven to induce correction of non-conformities
359 in official control, with the majority of non-conformities in post-mortem inspection and its
360 documentation and in food safety inspections either corrected or their correction had been initiated.
361 All of the OVs and auditors noted that internal audits should be performed at least every three
362 years, but a considerable number of OVs stated that they should be performed even more

363 frequently. The frequency of internal audits has declined in many countries due to economic
364 difficulties (EC, 2013), but our results attest to the importance of these audits and suggest that their
365 frequency should be maintained or even increased.

366

367 However, some improvements to the audits appear to be necessary. Interestingly, nearly all of the
368 OVs were of the opinion that meat inspection audits, where only technical inspection is audited,
369 had not been very beneficial, and therefore, the central authority should perform audits of also the
370 rejections and the underlying reasons. In a previous study, the frequency with which OVs in
371 Finnish red meat slaughterhouses observed post-mortem inspection performed by OAs varied
372 considerably, and one-third of the OAs considered that the performance of the OAs in post-mortem
373 inspection was not sufficiently evaluated (Luukkanen, Fredriksson-Ahomaa, Nevas & Lundén,
374 2017). Insufficient supervision of meat inspection by OVs has been reported also in other EU
375 countries (EFTA Surveillance Authority, 2012; FVO, 2002, 2013), and differences between OAs in
376 rating lesions have been identified (Schleicher et al., 2013). These observations support the idea
377 that the quality and uniformity of meat inspection should be evaluated, not only by the OV present
378 at the slaughterhouse, but also by outside auditors from time to time. Should more thorough
379 evaluation of meat inspection be performed in the future, the auditors must be experienced
380 (Dittenhofer, 2001; International Organization of Supreme Audit Institutions, 2003; Lääkkö-Roto &
381 Nevas, 2014) and peer-auditing could be considered. Our findings also suggest that utilization of
382 audit results and follow-up of the correction of non-conformities should be improved; non-uniform
383 filing of reports, for instance, resulted in the correction of some of the non-conformities in meat and
384 food safety inspections remaining unclear. In addition, our results prompt more discussion between
385 OVs and auditors, as these parties raised partly various needs for improvement of the audits.
386 Auditors should be well aware of the auditees' perceptions in order to develop auditing procedures.

387

388 The auditing procedures of the official control in slaughterhouses can vary in EU countries, and
389 Finland has decided to perform internal audits, where the auditors are involved in guiding and
390 organizing official control in slaughterhouses. However, according to the European Commission

391 (EC, 2006), the auditors should be independent of the activity being audited. How the auditors'
392 involvement in the audited controls could affect audit results is difficult to determine, but possible
393 unwillingness of the auditors to spot deficiencies would be a potential drawback. However, this did
394 not appear to be the case, as many non-conformities and targets for development were observed
395 during audits. Also none of the respondents suggested that auditors' involvement in guiding and
396 organizing official control ought to be changed in the future. On the contrary, auditors' involvement
397 in the audited controls may have had some positive effects since a considerable number of the
398 OVs assessed the audits as having benefitted their guidance and support. Auditors also noted that
399 the audits had increased their knowledge of the present state of official control and its problems,
400 increased their expertise, and enabled them to assess the training needs of OVs. These are
401 important positive effects because many chief OVs in a previous study in Finland did not consider
402 central officials' knowledge of the practical problems involved in OVs' work to be sufficient
403 (Luukkanen et al., 2017).

404
405 In conclusion, the internal audits performed by the central authority in slaughterhouses proved to
406 be beneficial for the quality of official control in Finnish slaughterhouses. Most of the non-
407 conformities observed during the audits in the meat and food safety inspections were corrected or
408 their correction had been initiated as a result of the audits, and both the OVs and auditors
409 assessed the audits as necessary. When actions of a more difficult nature, such as expensive
410 correction of slaughter line structures or an increase in the number of OAs, are required, the OVs
411 should receive adequate support from their superiors. Other areas that should receive attention are
412 the enforcement of corrections, documentation of food safety inspections, and a systematic
413 approach to follow-up inspections performed by the OVs. More thorough auditing of meat
414 inspection to enhance the uniformity of controls was also proposed by the OVs.

415
416 Declarations of interest

417 None.

418

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422

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Table 1

Table 1. Internal audits performed by the Finnish Food Safety Authority Evira to evaluate meat and food safety inspections in Finnish slaughterhouses (SHs).

Number of audits	Number of red meat SHs		Number of poultry SHs		Total number of SHs
	Smaller ^a	Larger ^b	Smaller	Larger	
Meat inspection audits in 2009–2013 performed in 19 slaughterhouses					
One time	3	0	0	0	3
Two times	3	7	1	2	13
Three times	1	1	1	0	3
Food safety inspection audits in 2010–2013 performed in 17 slaughterhouses					
One time	5	3	2	2	12
Two times	1	4	0	0	5

^aprocess less than 1000 red meat animals (pigs, bovines, horses, sheep, and/or goats) or 200 000 birds per week

^bprocess over 1000 red meat animals (pigs, bovines, horses, sheep, and/or goats) or 200 000 birds per week

Table 2

Table 2. Number of slaughterhouses (SHs) with non-conformities observed in the internal audits of post-mortem inspection and the documentation of meat inspection in Finland in 2009-2013. Area of official control (number of audits)

	SHs with non-conformities observed in at least one audit/number of audited SHs
Bovine post-mortem inspection (17)	10/11
Visual inspection of carcass and offal	7/11
Palpation or incision of carcass and offal	10/11
Swine post-mortem inspection (13)	5/7
Visual inspection of carcass and offal	5/7
Palpation or incision of carcass and offal	5/7
Poultry post-mortem inspection performed by the official veterinarian (7)	1/4
Daily inspection of the viscera and body cavities of a representative sample of birds	1/4
Detailed inspection of a random sample of condemned carcasses from each batch of birds	1/4
Documentation of ante-mortem inspection (19)	1/18
Documentation of post-mortem inspection (19)	2/18

Table 3

Table 3. Number of slaughterhouses (SHs) with non-conformities and targets for development observed in the internal audits of food safety inspections in Finland in 2010-2013.

Area of official control (number of audits)	SHs with non-conformities observed in at least one audit/number of audited SHs		SHs with targets for development observed in at least one audit/number of audited SHs		Total number of SHs with non-conformities or targets for development/number of audited SHs
	Red meat	Poultry	Red meat	Poultry	
Documentation (22)	5/13	0/4	8/13	4/4	14/17
Control measures (21)	4/13	0/4	9/13	2/4	11/17
Ensuring the approval of changes in operations and premises (20)	3/12	0/4	3/12	1/4	7/16
Inspections of self-checking plan and its implementation (21)	3/12	0/4	3/12	1/4	6/16
OV's ability to detect non-compliance (21)	2/13	0/4	0/13	0/4	2/13
Sufficient enforcement (20)	1/13	0/4	5/13	0/4	6/17
Follow-up of correction of non-compliance (21)	0/12	0/4	7/12	2/4	9/16
Planning of control and the utilization of its results (9)	2/7	0/2	6/7	0/2	6/9
Control plan (9)	2/7	0/2	2/7	0/2	4/9
Evaluation and utilization of inspection results (9)	0/7	0/2	6/7	0/2	6/9

Table 4

Table 4. Emerging categories in the interviews of the chief official veterinarians (OVs) and auditors concerning the benefits gained from internal audits of meat and food safety inspections in Finnish slaughterhouses.

Categories and subcategories	Number of interviewees who mentioned the benefit	
	OV (n = 13)	Auditor (n = 8)
Improvements to the quality of official control	13	8
Enhance slaughterhouse's correction of non-compliance	11	4
Initiate improvements and corrections to official control	10	6
Help in identifying present state of official control and its problems	4	7
Unify official control	2	3
Improvements to guidance, support, and training	7	8
Possibility for discussion between OVs and auditors	6	8
OVs receive support and second opinion	5	3
Need for instructions and training is assessed	0	7
Increase in auditors' expertise	0	4

Table 5

Table 5. Emerging categories in the interviews of the chief official veterinarians (OVs) and auditors concerning the ways in which internal audits of meat and food safety inspections should be improved in Finnish slaughterhouses.
Categories and subcategories

	Number of interviewees who mentioned the need for improvement	
	OVs (n = 13)	Auditors (n = 8)
Content of audits	8	3
Auditing should be more thorough	7	1
Include auditing of the uniformity of meat inspection	5	0
Audit less the documentation and more the practical work	4	0
Wider extent of audits	2	2
Expertise of auditor	6	2
More experience with meat inspection	4	2
More experience as an OV	4	0
Audit process and practices	5	7
More guidance and support for OVs during audits	2	2
Include an OV or an OA on the audit team	2	1
Increase co-operation between auditing units	1	4
Unify audit criteria	1	2
More risk-based audits	1	1
Follow-up of audits	1	6
Improve the follow-up of the correction of non-conformities	1	5
Improve the utilization of audit results	0	2

Figure captions

Figure captions:

Figure 1. Correction of non-conformities observed in meat inspection of swine and bovine in the internal audits of technical meat inspection in Finland in 2009-2013. OV = official veterinarian

Figure 2. Means of chief official veterinarians' (OVs') (n = 13) and auditors' (n = 8) answers regarding the necessity and benefits of the internal audits of official control in slaughterhouses in Finland. The number of respondents is presented in the bars and the range of answers as a black line segment.

Figure 1

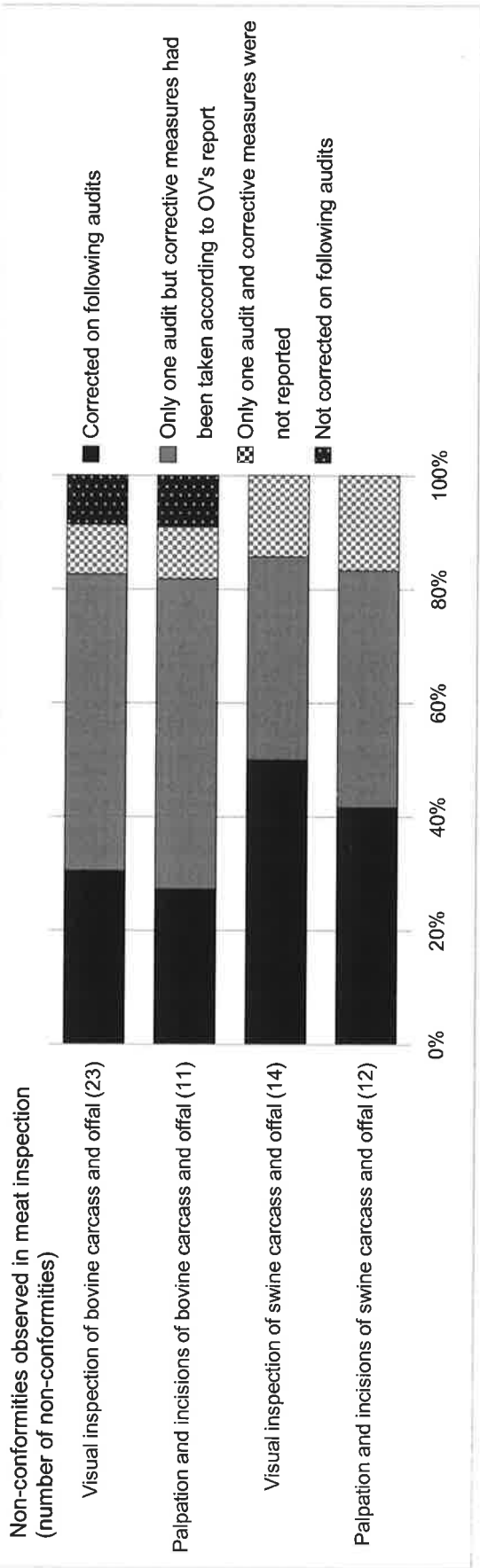


Figure 1.

Figure 2

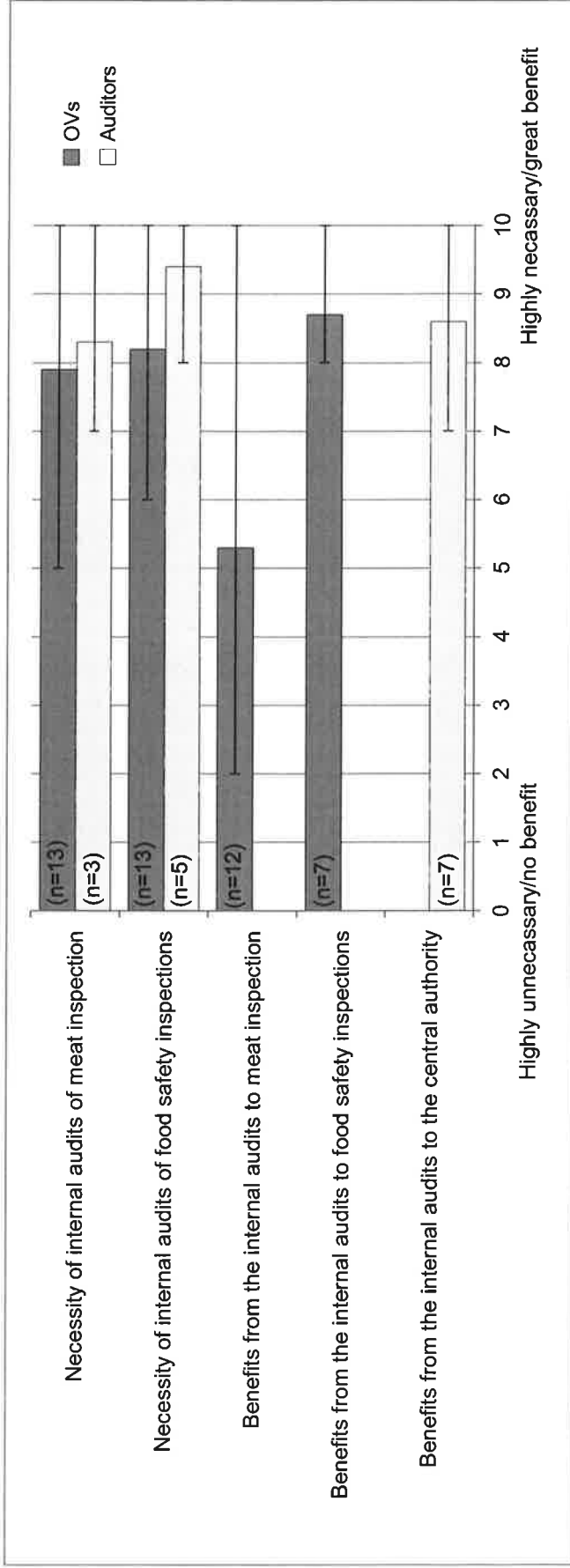


Figure 2.

