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Food fraud detection and reporting by food control officers in Finland

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ABSTRACT

We studied food fraud detection and the reporting of suspected cases using a questionnaire survey and interviews with Finnish food control officers (FCOs). In total, 95 FCOs responded to the questionnaire, and 17 were interviewed. We found that even though many respondents had either suspected (69.2%) or detected (43.4%) food fraud or other food-related crime during the past five years, 46.8% thought they had no realistic chance of detecting food fraud during inspections. Challenges raised by the FCOs we interviewed included inadequate resources (8/17) and difficulties in inspecting documents or establishing their authenticity (14/17). Moreover, many interviewees highlighted difficulties in assessing whether to inform the police about a suspected case (7/17), and 62% (18/29) of respondents who had detected fraud had not reported it to the police. Training in food fraud detection, increased resources and guidelines on reporting suspected food fraud would improve food fraud detection and harmonize reporting.

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Food fraud; food crime; food control; inspection; detection

Introduction

Food fraud prevention is central to food control, as food fraud has serious implications for both the public and the food sector alike (Spink and Moyer 2011; HM Government 2014; Roberts et al. 2022). Food business operators (FBOs) are responsible for the safety and quality of their food products (EC 178/2002); however, not all FBOs comply with the legislation or operate honestly. In addition, FBOs that struggle to comply with food legislation are prone to problems with other obligations as well, such as paying taxes and other fees under public law (Kartano et al. 2018). Consequently, food control officers (FCOs) operate in an environment characterized by multifaceted challenges and can play a central role in food fraud detection.

In Finland, local food control units ($N = 62$) are responsible for food control at the municipal level (FFA 2020a; Food Act 297/2021 2021). In 2019, an estimated 285 person-years were dedicated to food control in these units, and about 23,000 inspections were performed at food establishments (excluding primary production) (FFA 2020b). As these inspections are the backbone of food control, they should be as effective as possible at identifying non-compliances and fraudulent practices or products. Food fraud is often undetected and undocumented (Tähkäpää et al. 2015) and there is no extensive data regarding the number of food fraud cases in Finland. However, Tähkäpää et al. (2015) found 16 local cases processed in district courts in 2003–2012 and reported that 26% of recall notifications published by the

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Finnish Food Safety Authority (since 2019 Finnish Food Authority) in 2008–2012 could be classified as fraud or adulteration. In addition, Joenperä et al. (2022) found 127 cases resolved by the police, prosecutors, or district courts in 2008–2019. Most cases of food-related crime in Finland have previously been detected by FCOs, while notifications from consumers have also played a role (Joenperä et al. 2022). In 2010–2019, only 110 suspected food offences were recorded by the police and the Customs (SF 2022). In addition, the incidence of suspected cases varies greatly between regions (Joenperä et al. 2022). These findings emphasize the importance of investigating factors related to both the detection of food fraud during inspections and the subsequent reporting of food fraud.

Effective enforcement is necessary to address food fraud (HM Government 2014), and an increased risk of detection could reduce the opportunities for this crime (Spink and Moyer 2011). However, research on food fraud detection primarily focuses on analytical detection techniques, whereas few studies have concentrated on the role of inspections. Food fraud is, indeed, occasionally detected during inspections (Koubová et al. 2018; Joenperä et al. 2022). However, current routine inspections are limited in their ability to reveal food fraud, as they are tasked with ensuring food safety and not oriented towards finding food fraud (Gussow 2020). Therefore, there is a need to develop food control inspections to increase their ability to identify this offence.

To identify possible food fraud, official food control must be regular, risk-based, and performed at an appropriate frequency, taking account of risks and the FBO's past record (EC 2017/625). Moreover, FCOs should use varying official control methods and techniques, such as interviews, sampling, and examining FBOs' own-check practices and results (Evira 2015; EC 2017/625, 2017). For example, FCOs should be aware of material and product flow to assess possible fraud related to the origin or composition of food products, which are both commonly reported types of food fraud (EC 2022). Currently, however, only limited research exists on the use of different inspection methods in food control. In addition, FCOs' knowledge and expertise are important in food fraud detection (Gussow 2020), but no previous study has investigated FCOs' knowledge of the establishments or operations they inspect. Therefore, research on these topics is required to further improve food fraud detection.

In the EU, control authorities are obliged to issue effective, proportionate and dissuasive penalties for infringements of the law (EC 2017/625). In Finland, food control officers must report non-compliances, including suspicions of food fraud, to the police unless the act is minor and the party in question complies with the orders or prohibitions issued by the authorities (Food Act 297/2021 2021). Such discretion and the lack of guidelines for assessing when to report non-compliances may lead to the underreporting of suspected crimes, as suggested by a study focusing on environmental crime (Sahramäki and Kankaanranta 2014). In addition, many FCOs have emphasized that food safety violations should be reported to the police more often (Kettunen et al. 2017). These observations highlight the need to study factors related to the reporting of food fraud in Finland.

To improve the ability of food control inspections to recognize food fraud, research on current inspection practices is necessary. Moreover, to treat all food business operators equally and ensure consumer safety, food control should be consistent regarding the actions taken when a violation of the law is suspected. Consequently, using a questionnaire survey and interviews with FCOs, this study aimed to investigate the factors related to both food fraud detection during inspections and the reporting of suspected food fraud to the police. We hypothesized that current practices and inspections were insufficient for food fraud detection. The results of the study can be used to develop food fraud prevention in official food control.

Materials and methods

Questionnaire

We developed a questionnaire to study FCOs' experiences of food fraud and challenges concerning detection of food fraud during inspections as well as the reporting of suspected food fraud to the criminal investigation authorities. In the questionnaire, food fraud was defined as an intentional breach of food legislation and misleading consumers for economic gain (EC 2021).

The questionnaire included six sections: 1) the respondent's knowledge and view of the establishments they inspect, 2) inspection methods, 3) food fraud detection, 4) the investigation and reporting of suspected food fraud cases, 5) the significance of food fraud, and 6) background information. The questions were either multiple choice ($N = 34$) or open-ended ($N = 5$). Answers to multiple choice questions could be clarified in an open text box. The respondents' opinions on food fraud detection were measured on a four-point Likert scale (fully disagree, partially disagree, partially agree, fully agree). Knowledge of establishments was measured using nine claims related to the establishment or its activities, such as "I know what kind of products the establishment produces" (in none of the establishments, in a few establishments, in many establishments, in all establishments). The use of different inspection methods was measured using eight claims, such as "I interview personnel responsible for the business's own-check" (never, seldom, often, always). The inspection methods investigated in the survey reflect those required in Regulation (EU) 2017/625 and the current Finnish inspection guidelines (FFA 2023). The perceived relevance of food fraud was measured with the question "How big an issue do you consider food fraud to be in Finland?" (1 = not an issue at all, 5 = a very big issue). Participants' opinions on the adequacy of the frequency and length of inspections were measured on a scale from "in none of the establishments" to "in all establishments". The response option "I don't know" was also included, but in the analyses, responses of "I don't know" were regarded as missing answers because they were not part of the measurement scale. This caused some variation in the number of responses in different questions. The number of "I don't know" responses was mainly low; however, if the number exceeded 10% of responses in a question, it was highlighted in the results and further discussed if considered meaningful.

The following background information was requested: occupation (head of the unit, veterinarian, or health inspector or similar), level of education, work experience (years), geographical region, whether the respondent performed food control inspections, the number of establishments inspected, and the number of establishments and person-years in the food control unit. None of the questions, including the background questions, were mandatory. Respondents answered the questionnaire anonymously, and, to allow them to comment freely, we did not request the name of their food control unit. Three FCOs piloted the questionnaire, which was then slightly modified according to their comments.

Interviews

In addition to the questionnaire, we conducted interviews to gain more in-depth information about the challenges of food fraud detection FCOs experienced during food control inspections and the factors affecting the reporting of suspected cases to the police. We piloted the interview with three FCOs before the actual interviews. We applied purposive sampling by requesting interviewees from local food control units based on the geographical location and size of the unit, characteristics of the area (urban vs. rural), and whether food fraud cases had been reported to the police from the unit. We asked the head of the unit and a food control officer to participate in the interviews. The following background information was collected from the interviewees: occupation, region, and whether the interviewee performed food control inspections. Of the nine participating units, seven had reported at least one suspected food fraud case to the police in 2008–2020.

Table 1. Characterization of the finnish food control officers who responded to the questionnaire ($N = 95$) or were interviewed ($N = 17$).

Variable	Number of respondents (%)	Number of interviewees (%)
Respondent		
Health inspector or similar	67 (70.5)	10 (58.9)
Veterinarian	22 (23.2)	7 (41.2)
Head of the unit	14 (14.7)	7 (41.2)
Region		
Southern Finland	43 (45.3)	4 (23.5)
Western and Inland Finland	18 (18.9)	3 (17.6)
Southwestern Finland	15 (15.8)	4 (23.5)
Eastern Finland	8 (8.4)	4 (23.5)
Northern Finland	4 (4.2)	2 (11.7)
Lapland	3 (3.2)	0 (0)
Performs food control inspections	89 (93.7)	14 (82.4)
Has participated in control tasks related to a food fraud case	53 (55.8)	13 (76.5)

Data collection

The questionnaire was directed to Finnish FCOs working in local food control units in mainland Finland ($N = 62$) because they perform food control inspections at a municipal level. The number of FCOs in these units is not available, but in 2019 there were approximately 285 person-years dedicated to food control. The questionnaire was available online (E-lomake, Eduix Oy) in Finnish and Swedish. We sent a link to the questionnaire with a cover letter to all food control units in May 2019 and asked the respondents to forward the message to all FCOs in the unit. A reminder was sent two weeks later. FCOs who did not perform food control inspections, i.e. mainly some unit heads, were asked to ignore all inspection-related questions. In addition, 17 FCOs from nine units were interviewed (Table 1). One author (JJ) conducted the interviews as semi-structured individual interviews in September and October 2020 using the video conference tool Zoom. In the interviews, the researcher used a set of pre-planned questions, but additional questions were also asked depending on the interviewee's answers. An example of the pre-planned questions was "How well are you or your subordinates able to detect food fraud during inspections?". The interviews were recorded, and an external company transcribed the recordings.

An ethical review was not required for this study according to the Finnish legislation and guidelines (TENK 2019). All study participants provided informed consent. The questionnaire form and interview questions are provided as supplementary data (Supplementary data 1,2).

Analysis

Statistical analyses were conducted using SPSS software (IBM SPSS Statistics for Windows, Versions 25.0 and 28.0, Armonk, NY: IBM Corp). A significance level of $p < 0.05$ was used in all analyses. Comparisons between respondents who had and had not reported suspicion and/or detection of a food fraud case were performed using the independent samples Mann-Whitney U test, the Chi-Square test or Fisher's exact test. Associations between respondent-related (level of education, work experience, the number of establishments inspected) and unit-related (number of establishments, human resources in food control) factors with the responses were tested with the Mann-Whitney U test or Fisher's exact test. A sum variable was created from the nine claims in the item measuring respondents' perception of their knowledge of the establishments they inspected (sum variable "knowledge of establishments"). The range was 1 to 4, in which 1 = in none of the establishments and 4 = in all establishments. Cronbach's alpha was used to examine the reliability of the sum variable (Cronbach's $\alpha = 0.704$), which exceeded the limit of 0.7 (Nunnally 1978).

Open-ended questionnaire responses were analysed using quantitative content analysis (O'Cathain and Thomas 2004). The following open-ended questions were analysed: "If you

responded 'yes' to the previous question [having suspected food fraud], what created this suspicion?" and "If you responded "yes" to the previous question [having detected fraud], what was the case like?". Interview responses were analysed using thematic analysis (Juhila 2021). Coding of the interview transcripts was conducted manually on a Microsoft Office Excel spreadsheet using an inductive approach (Tuomi and Sarajärvi 2018). After initial coding, related codes were merged into subthemes, which were then grouped into final themes. One author (JJ) independently coded the answers and developed the themes, after which they were discussed and agreed upon by both authors.

Results

Characterization of respondents and interviewees

A total of 95 FCOs responded to the questionnaire (Table 1). As the number of persons working in food control in local food control units is not reported by the authorities, a response rate could not be calculated. In addition, as there is no information regarding the demographics of the FCOs in general, we were not able to estimate the statistical representativeness of the respondents. Of all respondents, 93.7% (89/95) reported performing food control inspections, while 55.8% (53/95) had participated in control tasks related to a food fraud case or other food-related crime. We received responses from all regions in mainland Finland, most respondents being from Southern Finland (47.3% of respondents). The respondents had been working in food control for an average of 11.9 years (SD = 8.2), and only 20% (19/95) had less than five years' work experience in food control.

Of the 17 interviewees, 14 (82.4%) currently performed food control inspections (Table 1). Those who did not perform inspections themselves supervised other FCOs and were involved in decision-making. Thirteen of the interviewees (76.5%) had experience of one or more food fraud cases.

Food fraud detection

Of all questionnaire respondents who reported performing food control inspections ($N = 89$), 69.5% (57/82) had either detected or suspected food fraud or other types of food-related criminal activities in at least one establishment they had inspected during the past five years (43.3% [29/67] detected and 69.2% [54/78] suspected). Seven respondents did not respond to either of these questions and were therefore omitted from further analyses in which the groups "had suspected or detected food fraud" and "had not suspected or detected food fraud" were used. According to the associated open-ended questions, the most common observations leading to suspicion or detection of fraud were problems with documentation or traceability (42.0% of respondents), factors associated with the FBO, such as behaviour (40.0%), and factors associated with the establishment or its activities, such as operating without proper registration or approval (30.0%) (Table 2). Respondents who had either suspected or detected food fraud estimated it to be a significantly larger issue in Finland than did those who had not suspected or detected such fraud. On a scale of 1 to 5, those who had either suspected or detected fraud scored a mean of 3.0 ($N = 52$, range 2–4), while the mean score for those who had not was 2.6 ($N = 22$, range 2–4) (Mann-Whitney U test, $p = 0.034$). Respondent- or unit-related factors did not significantly differ between those who had suspected or detected fraud and those who had not (Supplementary data 3).

The perceived knowledge of establishments varied greatly between the topics and between inspectors. The mean of the sum variable "knowledge of establishments" was 2.9 (range from 2.2 to 4.0) on a scale of 1 to 4 (Table 3). However, this sum variable did not significantly correlate with having either suspected or detected fraud (Mann-Whitney U test, $p = 0.141$). Over 90% of respondents knew the products, manufacturing methods, raw materials, and customer groups in many establishments. By contrast, over 50% of respondents were aware of the use of agency-hired labour,

Table 2. Finnish food control officers' ($N = 50$) observations leading to a suspicion or detection of food fraud in an establishment (open-ended question).

Observation	Number of respondents (%)
Documentation and traceability	21 (42.0)
Problems with documentation related to food products or traceability issues	19 (38.0)
Falsified own-check documentation	2 (4.0)
Food business operator	20 (4.0)
Aggression, failure to cooperate, hindering inspections, lying, or disobedience	16 (32.0)
Operating under a false name or business ID or giving other misleading information of the company	5 (1.0)
Other offences or observations	4 (8.0)
Indifference, avoiding efforts or expenses	3 (6.0)
Establishments and activities	15 (30.0)
Unregistered or unapproved premises or activities	8 (16.0)
Poor hygiene or generally bad performance	3 (6.0)
Sales without giving receipt	2 (4.0)
Other	3 (6.0)
Information given on food products	14 (28.0)
Labelling of raw materials or products	13 (26.0)
Marketing	2 (4.0)
Food products	12 (24.0)
Suspicious or outdated products or package material	6 (12.0)
Other characteristics of the food products	5 (10.0)
The quality of the product incl. sensory or laboratory findings	4 (8.0)
Notifications, tip-offs or rumours	10 (20.0)
Pricing	6 (12.0)

social media advertising, and the financial situation of the company in only a few or none of the establishments they inspected (Table 3).

The most frequently used inspection methods among respondents who reported performing inspections were interviewing personnel responsible for own-check practices (98.8% conducted such interviews always or often), asking personnel to open possible closed cupboards or rooms (96.4%), and following operations (92.9%) (Table 4). By contrast, comparing the amount of incoming raw material with the number of final products (14.8%) or by-products (7.5%) was rare. The use of different inspection methods did not significantly differ between those who had detected or suspected fraud and those who had not. However, those who had either suspected or detected fraud were considerably more likely to compare the amount of raw material with food products (20.4% always or often) than were those who had not (4.0%) (Mann-Whitney U test, $p = 0.078$) (Table 4).

Only 7.6% (6/79) of respondents fully and 45.6% (36/79) partially agreed with the statement "I feel that I have a realistic chance of detecting food fraud during inspections" (Table 5). However, those who had either suspected or detected fraud were considerably more likely to agree fully or partially with this statement than those who had not (Mann-Whitney U test, $p = 0.065$). In all, 73.8% (59/80) of respondents at least partially agreed with the statement "I know what kind of food fraud might occur in the types of food premises that I inspect" (Table 5). The responses did not significantly differ between those who had either suspected or detected fraud (Mann-Whitney U test, $p = 0.597$) (Table 5). Furthermore, 70.3% (45/64) of respondents fully or partially agreed that in inspections performed according to the inspection guidelines, factors important to food fraud detection were not inspected (Table 5); however, 18 respondents could not answer this question. Responses to an accompanying open-ended question highlighted, for example, that the large number of issues to be inspected hindered FCO's efforts to form an overall picture of the establishments and that product price was beyond the scope of the inspection.

Twenty-two percent of questionnaire respondents (18/82) felt that inspection frequency was sufficient in only a few or none of the establishments they inspected, while the corresponding figure for inspection time was 25.6% (21/82). Those who had suspected or detected fraud were more likely

Table 3. Finnish food control officers' perceived knowledge of the establishments they inspect.

Claim	All respondents who performed inspections[a] (detectors/non-detectors[b])	% of all respondents (% of detectors/non-detectors[b])				Mean from 1 to 4[c]	p-value[d]
		In all establishments	In many establishments	In a few establishments	In none of the establishments		
I know what kind of products the establishment produces	83 (56/24)	33.7 (32.1/40.0)	66.3 (67.9/60.0)	0.0 0 (0/0)	0.0 (0/0)	3.34	0.495
I know the customer groups of the establishment	85 (57/25)	17.6 (17.5/20.0)	74.1 (70.2/80.0)	7.1 (10.5/0)	1.2 (1.8/0)	3.08	0.256
I know what the company advertises in their website	82 (55/25)	15.9 (12.7/24.0)	65.9 (67.3/60.0)	18.3 (20.0/16.0)	0.0 (0/0)	2.98	0.291
I know the establishment's manufacturing methods well	84 (57/25)	15.5 (14.0/20.0)	83.3 (84.2/80.0)	1.2 (1.8/0)	0.0 (0/0)	3.14	0.418
I know well which raw materials the establishment uses	84 (57/25)	10.7 (8.8/16.0)	83.3 (84.2/80.0)	6.0 (7.0/4.0)	0.0 (0/0)	3.05	0.299
I know whether the company uses agency-hired labour	82 (56/24)	9.8 (5.4/20.8)	35.4 (37.5/29.2)	48.8 (50.0/45.8)	6.1 (7.1/4.2)	2.49	0.262
I know where the establishment purchases their raw materials	85 (57/25)	8.2 (7.0/12.0)	77.6 (78.9/76.0)	14.1 (14.0/12.0)	0.0 (0/0)	2.94	0.539
I know what the company advertises on Facebook or other social media	82 (56/24)	7.3 (7.1/8.3)	34.1 (30.4/37.5)	48.8 (48.2/54.2)	9.8 (14.3/0)	2.39	0.220
I have a notion about the economic situation of the company	82 (56/24)	3.7 (3.6/4.2)	28.0 (26.8/33.3)	61.0 (62.5/54.2)	7.3 (7.1/8.3)	2.28	0.643
Sum variable "knowledge of establishments"	85 (57/25)					2.9 (2.8/3.0)	0.141

[a]In total, 89 respondents performed inspections, but there were 4–7 "I don't know" responses or missing answers per claim.
[b]Respondents who had suspected or detected food fraud ($N = 57$) vs. respondents who had not ($N = 25$).
[c]Answer options were coded from 1 = in none of the establishments to 4 = in all of the establishments.
[d]Significance of the difference between those who had suspected or detected fraud and those who had not (Mann-Whitney U test).

Table 4. Finnish food control officers' use of different inspection methods.

Inspection method[a]	All respondents who performed inspections[b] (detectors/non-detectors[c])	% of all respondents (% of detectors/non-detectors[c])			p-value[d]
		Always or often	Seldom	Never	
I interview personnel responsible for the business's own-check practices	83 (55/25)	98.8 (98.2/100)	1.2 (1.8/0)	0.0 (0/0)	0.294
I ask personnel to open closed cupboards, cold storage rooms or storerooms	84 (57/24)	96.4 (98.2/91.7)	3.6 (1.8/8.3)	0.0 (0/0)	0.324
I follow the operations	85 (57/25)	92.9 (91.2/96.0)	7.1 (8.8/4.0)	0.0 (0/0)	0.430
I measure temparatures myself	84 (56/25)	85.7 (85.7/84.0)	11.9 (12.5/12.0)	2.4 (1.8/4.0)	0.708
I interview management	84 (56/25)	79.8 (80.4/76.0)	19.0 (17.9/24.0)	1.2 (1.8/0)	0.784
I interview workers	83 (55/25)	77.1 (78.2/72.0)	19.3 (18.2/24.0)	3.6 (3.6/4.0)	0.785
I compare the amount of incoming raw material with the number of food products	81 (54/25)	14.8 (20.4/4.0)	46.9 (46.3/48.0)	38.3 (33.3/48.0)	0.078
I compare the amount of incoming raw material with the number of by-products	80 (53/25)	7.5 (9.4/4.0)	52.5 (50.9/56.0)	40.0 (39.6/40.0)	0.768

[a]Answer options were coded from 1 = never to 4 = always.
[b]In total, 89 respondents performed inspections, but there were 4–9 "I don't know" responses or missing answers per inspection method.
[c]Respondents who had suspected or detected food fraud ($N = 57$) vs. respondents who had not ($N = 25$).
[d]Significance of the difference between those who had suspected or detected fraud and those who had not (Mann-Whitney U test).

Table 5. Responses to inspection-related claims by food control officers who inspected food establishments and had ($N = 57$) or had not ($N = 25$) suspected or detected fraud.

Claim	% of respondents (n/N)[a]		p-value[b]
	Suspected and/or detected	Not suspected or detected	
If I suspected fraudulent activities in an establishment that I inspect, I would know how to proceed (fully or partially agree)	80.4 (45/56)	58.3 (14/24)	0.022
Unannounced inspections should be performed also outside office hours if needed to detect activities that are against the law (fully or partially agree)	92.7 (51/55)	47.6 (10/21)	0.04
I feel that I have a realistic chance of detecting food fraud during inspections (fully or partially agree)	58.9 (33/56)	39.1 (9/23)	0.065
The inspection frequency is sufficient such that I am able to adequately familiarize myself with the establishment (in all or many of the establishments)	71.9 (41/57)	92.0 (23/25)	0.076
The length of inspections is sufficient such that I am able to adequately familiarize myself with the establishment (in all or many of the establishments)	70.2 (40/57)	84.0 (21/25)	0.139
I know what kind of food fraud might occur in the types of food premises that I inspect (fully or partially agree)	73.2 (41/56)	75.0 (18/24)	0.597
In inspections performed according to the inspection guidelines, factors important to food fraud detection are not inspected (fully or partially agree)	68.8 (33/48)	75.0 (12/16)	0.965

[a]In total, there were 0–18 "I don't know" responses or missing answers per claim.
[b]Independent samples Mann-Whitney *U* test was performed using the four-point scale.

than those who had not to respond that inspection frequency was sufficient in none or only a few establishments (Mann-Whitney *U* test, $p = 0.076$) (Table 5).

Challenges in food fraud detection during inspections were discussed with the interviewees ($N = 17$), and four themes emerged (Table 6). The first theme included organizational issues, such as insufficient resources ($N = 8$) and regional jurisdiction ($N = 6$). Interviewees emphasized that some

Table 6. Emerging themes in the interviews of food control officers (FCOs) ($N = 17$) working in local food control units ($N = 9$) concerning challenges related to food fraud detection at inspections.

Theme and subtheme	N	Interviewee quotes[a]
Organizational factors		
Insufficient resources	8	"If you think of resources, it is rarely possible to perform, for example, traceability cross-checks." [Head of the unit I5]
Regional jurisdiction of the food control unit	6	"When, for example, the [FBO's[b]] wholesale operations may be located on a different municipality than their retail sales, it makes it more difficult for the FCO to follow." [Health inspector I6]
Lack of analytical capability	1	"And then there is of course [the challenge that] for verifying the origin [of a product] or the species of a meat product . . . analytics may be required." [Head of the unit I11]
Inspection-related factors		
Inability to inspect or trust documentation	14	"If documents are not in order [during the inspection], [the FBO] is allowed to send them to us after the inspection. . . . And that of course makes it more difficult, as [the documents] may be forged to fulfill the required purpose." [Health inspector I1]
Lack of time during inspections or inability to concentrate on food fraud detection	7	"Then there is of course the problem that . . . we have these recommended durations for inspections, and these things cannot be noticed during a quick inspection." [Head of the unit I10]
Low inspection frequency	5	"Well, I visit the establishment once a year or once in two years and I see the situation for an hour or two. It's momentary. So that's a challenge." [Health inspector I3]
Preannouncement of inspections	4	" . . . [I]f the FBO is notified of an inspection, there is a big risk that the inspector may not see the real situation [at the establishment]." [Health inspector I17]
Inspection guidelines and practices	3	"Our inspection system Oiva strongly directs the inspections and their contents. And there are dreadfully many things that can be inspected. . . . So Oiva may not highlight things that may be important in food fraud. . . . It is possible that something substantial goes unnoticed when you are focusing on the Oiva items." [Head of the unit I5]
Other issues	3	"These [forged dates] are very difficult to detect, as the dates are not [inspected] much, unless the FBO has been careless and you see that the [original expiration date] has been covered with a new label." [Health inspector I9]
Food control officer-related factors		
Focus on other issues than fraud	4	"We are still pretty traditional food control officers and focus on hygiene. If we don't have training and awareness of observing these things, then they will remain undetected." [Head of the unit I8]
FCOs' excessive trust in the FBO	4	" . . . Finland is a society based on trust. I think that often the inspectors' first thought is . . . that an issue with import documents, for example, is due to the FBO's inexperience, ignorance, or thoughtlessness. This way of thinking is quite strong in some FCOs, that they, or we quite easily trust what the FBO says and if you go and look through the issue then the truth may be something else." [Head of the unit I5]
Unwillingness to detect food fraud	3	"I've seen that there are inspectors who don't dare to see [food fraud], I don't know whether they're scared because they haven't done that type of work before, or whether they're scared, because, for example, I have been explicitly threatened with violence." [Health inspector I14]
Insufficient knowledge of products	2	"If you don't know the product it is very difficult to suspect something. If you don't, for example, know when Finnish strawberries are in season, or that whether a certain variety is even available locally. . . . My knowledge of the products may not be good enough for alarm bells to ring." [Head of the unit I7]
Food business operator-related factors		
Challenging food establishment types	7	"There are many self-storage facilities, the operators' own storage facilities are easier to control, but we have facilities where the operator rents out storage units and there may be hundreds of FBOs [who store their products in these facilities]. And there may be, for example, an FBO that has stuff in ten different storage facilities. So this is a big challenge for food control. If you had the time to look through them, then you could find something." [Head of the unit I10]
Language barrier	2	"Well sometimes there's a language barrier between the inspector and the FBO." [Head of the unit I11]
Other issues	5	"[The FBO] has been difficult, we have not been able to perform inspections when we should have, and [the FBO's] behaviour has made performing inspections more difficult." [Head of the unit I13]

[a]In the quotes, " . . . " implies omission and text in square brackets has been added by the researcher for clarity. The original language of the interview quotes is Finnish.
[b]FBO=food business operator.

units may have too many establishments under their control, and it may not be possible to perform traceability control as thoroughly as necessary due to the lack of resources. In addition, FCOs only have jurisdiction within the region of their own food control unit, but FBOs may operate in a larger area. Other food control units may not be able to provide help when required, for example, to perform concurrent inspections.

The second theme concerned inspection-related issues, such as problems with documentation, which was raised by most interviewees ($N = 14$), short or insufficient inspections ($N = 7$), low inspection frequencies ($N = 5$), preannouncement of inspections ($N = 4$), and inspection guidelines and practices ($N = 3$). According to the interviewees, documents were often missing, deficient, or difficult to read due to the fact that they were written in a foreign language or contained poor handwriting. Further challenges with documentation included difficulties in reliably connecting them to the food products in question, or their questionable authenticity. In addition, the interviewees often commented that standard inspection times are short, but food fraud detection might require a more thorough inspection. In establishments with multiple non-compliances, FCOs may have to prioritize the most acute issues and only inspect others superficially. Some establishments are inspected only once in three years, and FCOs cannot perform inspections more often than planned unless they have a clear suspicion of non-compliances. Furthermore, the inspection guidelines direct the inspector to inspect a large number of items as individual entities, which may prevent the FCO from forming an overall picture of the establishment and its activities. All issues are not inspected at every inspection, and it may be difficult to deviate from a premade inspection plan. Other issues included for example the difficulty of overseeing online and social media marketing and the difficulty of detecting possible tampering of labelling.

The third theme included FCO-related challenges, such as FCOs' focusing on other issues than fraud, for example hygiene, at the expense of food fraud detection ($N = 4$), and FCOs' excessive credulousness ($N = 4$). According to the interviewees, FCOs are accustomed to inspecting, for example, hygiene, and they may be less accustomed to focusing on matters that might reveal fraud. In addition, FCOs may be overly trusting regarding the FBO or documentation and expect non-compliances to be due to a mistake or error. Several interviewees remarked that even though the FCO should adopt a positive attitude towards the FBO, they should not dismiss the possibility of food fraud. Furthermore, the interviewees commented that there may be unwillingness to detect food fraud ($N = 3$) for example due to fear of adverse consequences, such as violence, if an offence is detected, and that it is difficult to suspect fraud if the FCO lacks sufficient knowledge of food products ($N = 2$).

The fourth theme included various issues related to the FBO, the most often mentioned being food establishment types that are difficult to inspect ($N = 7$), such as movable premises, seasonal sales, food production or handling in private households, self-storage facilities, and unnotified operations. The inspector and the FBO or their employees may not have a shared language ($N = 2$). In addition, other issues ($N = 5$) such as a negative attitude towards food control and misleading the FCO during inspections may hinder food fraud detection.

Preannouncement was often felt to hinder food fraud detection. As many as 69.5% (57/82) of questionnaire respondents inspected at least one establishment where inspections were always announced beforehand. Moreover, in a follow-up question answered by 56 of these 57 respondents, 44.6% (25/56) suspected that the result of an inspection might be different if the inspection were performed unannounced, although 16.1% (9/56) respondents did not know whether the result would be different. Of the respondents 55.3% (42/76) fully agreed that unannounced inspections should be performed outside office hours to detect non-compliances. This was significantly more common among respondents who had either suspected or detected fraud than it was among those who had not (Mann-Whitney U test, $p = 0.040$) (Table 5).

Actions taken when suspecting food fraud and reporting cases to the police

Of the questionnaire respondents, as many as 26.3% (21/80) fully or partially disagreed with the statement that they would know how to proceed if they suspected fraud in an establishment (Table 5). Those who had not detected or suspected fraud were significantly more likely to disagree with this statement than were those who had (Mann-Whitney U test, $p = 0.022$). Only about a half of respondents, 51.8% (43/83), knew which police officer to contact in the case of suspected food fraud; in addition, 10 respondents were unsure (i.e. answered "I don't know").

Of those respondents who had detected food fraud, only 62.1% (18/29) stated that the case had been reported to the police. Moreover, seven interviewees remarked that assessing the gravity of a suspected case and deciding whether to report it was difficult or subjective. One interviewee described the challenges related to reporting as follows:

> If there are cases that are not so serious then it is quite difficult [to decide whether to report the case to the police] because clear cases are clear cases like the one in my example, but then the other ones, drawing the line is very difficult and I would need examples and training of this from the Finnish Food Authority. [Head of the unit I8]

In the course of their work or through specific instructions, six interviewees had adopted a low-threshold approach to informing the police about suspected food fraud. Consequently, these interviewees felt that they could contact the police to discuss, for example, the necessity of requesting an investigation, which the interviewees considered extremely important. On the other hand, four interviewees stated that the threshold for contacting the police or reporting a case was high for them or for FCOs in general. Interestingly, four interviewees mentioned that genuine mistakes may occur, and such instances should not be reported; however, one also stated that many FCOs believed non-compliances to be isolated incidents or accidents, thereby leading to the possible underreporting of food fraud. Two interviewees described their views on cooperation with the police:

> . . . [W]e usually call, or at least I have called [the police officers whom the interviewee had previously worked with] and discuss with them "should we make a request for investigation of this?", I find it easier when they are familiar people, you know who they are, and you can pick up the phone and talk to them. [Head of the unit I13]

> I believe that there is a very high threshold to report a case to the police on average because most people in the profession think that these are isolated incidents and mistakes and human errors. . . . We have a clear policy in cooperation [with the police] that we can discuss matters with a low threshold, what the police think of it, should we initiate measures. But the threshold is high. [Health inspector I14]

Eight interviewees emphasized that some suspected food fraud cases could be handled with guidance or administrative enforcement measures:

> If the issue can be resolved . . . using an order for example, then we won't necessarily make a request for investigation. On the other hand, we have made [requests for investigation] for fairly small issues if they have not been resolved otherwise. So if there is disobedience, [the FBO] could clearly correct the non-compliance, but it does not happen then we'll make a request for investigation. [Health inspector I6]

In addition, one interviewee stressed that preparing a request for investigation was burdensome and time-consuming, especially for the first time.

Discussion

Food fraud detection is an important area for development in food control. The present study found several factors that negatively affected food fraud detection, from system-level challenges in food control to factors related to the FCO and food businesses. In addition, the reporting of food fraud cases was found to be challenging. Food control officers appear to exercise caution when assessing the need to report a suspected case to the police, which is likely to lead to the underreporting of food crime. The results of this study indicate that food fraud detection can be improved in several ways.

To detect food fraud efficiently, all FCOs should possess a comprehensive view of different types of food fraud (Gussow 2020) and know the signs that may indicate fraudulent activities. However, only 5% of respondents in our study fully agreed that they knew what kind of food fraud could occur in the establishments they inspected, while about half thought there was no realistic chance of detecting possible fraud. While many thought that current inspection guidelines do not consider factors that could be important for food fraud detection, a considerable number of respondents did not even know whether the guidelines lack instructions important for food fraud prevention. These results highlight wide challenges in food control: a lack of both knowledge and confidence among FCOs. On the other hand, even though many respondents were uncertain about the chance of detecting food fraud, several reported having suspected or detected fraud and, additionally, reported various types of observations that had led them to suspect such crime. Even though only some of these suspicions had led to a report to the police, this indicates that many FCOs possess awareness of food fraud. Moreover, the Finnish Food Authority (2022b) has recently reported that control authorities' recognition of food crime has improved; nonetheless, this ability appears to vary between FCOs. Food fraud detection should thus be advanced by further training and support.

In addition to sufficient knowledge of food fraud, FCOs also require comprehensive knowledge of the establishments they inspect (EC 2017/625). However, FCOs rarely considered they possessed adequate knowledge of the subjects our study enquired about in all the establishments they inspected. The topic most familiar to them was the products produced by these establishments; however, only one-third reported being aware of such products in all the establishments they inspected, and only one in 10 FCOs were knowledgeable about the raw materials used in all these establishments. This raises serious concern, as FCOs should be aware of the types of raw materials and products that are handled in every establishment they inspect. This is important because FCOs should also be able to recognize raw materials or substances that are not used in production and therefore should not be stored on the premises. Such substances can, for example, be used to conceal spoiled food products or enhance their sensory quality, as in the well-known example of tuna (EC 2022). In addition, identification of a falsified country of origin, which is a typical form of food fraud in Finland (FFA 2020a), requires knowledge of the origin of raw materials and foodstuffs, i.e. information about the FBO's purchases. Therefore, FCOs' knowledge of the establishments they inspect should be strengthened.

Some subjects were markedly less familiar to FCOs than others, including the financial situation of the company and social media marketing. Poor finances may be a driver of food fraud (van Ruth et al. 2017), and the financial standing of food businesses is therefore important knowledge for food control officers. However, until recently, there was no system in place for FCOs to acquire information on the financial situation of FBOs. This problem has now been rectified, and Finnish FCOs may currently request an obligation compliance report, which includes information about company finances and compliance with statutory obligations (FFA 2021; Food Act 297/2021 2021). This compliance report is an important tool for assessing the risk of fraud. However, the use of the compliance report should be advocated for, as it remains underutilized among food control units. In addition, the internet and social media, which are marketing platforms with wide audiences, should be considered in food control, as an increase in e-commerce and even social media marketplaces has changed the landscape, presenting new challenges for food control (Di Pinto et al. 2019; NFCU and SFCIU 2020). Thus, FCOs should be instructed and encouraged to monitor social media. In the future, web-scraping, machine learning, or similar technologies could assist FCOs in sifting through masses of data on online platforms to detect fraudulent or illegal products or marketing.

Food fraud detection requires methods that consider other factors than food safety risks alone (Roberts et al. 2022). In this study, we investigated inspection methods that may be useful in food fraud detection and found that the use of these methods varied among the respondents. While interviewing personnel, checking facilities and following operations were common methods,

approximately 40% of respondents answered that they never compared levels of raw materials, products, and by-products, although such comparisons would be of vital importance in food fraud detection (Wisniewski and Buschulte 2019; Ulberth 2020; Roberts et al. 2022). The importance of mass-balance testing and accounting audits was also acknowledged among the interviewees, but many stated that using these methods was unrealistic given the lack of resources. The lack of resources has also been observed to undermine fraud detection in a survey concerning accountants (Bierstaker et al. 2006). The use of forensic accountants, for example, was considered effective in detecting fraud, but rarely used at least partly because of resource scarcity. In addition, a previous study regarding Canadian FBOs discovered that even though the FBOs found the implementation of detection methods an efficient preventative measure against food fraud, less than one third implemented such methods; the most common reasons for this among all respondents were lack of financial means, training or knowledge (Guntzburger et al. 2020). Our finding suggests that increased resources should be allocated to allow FCOs to focus on time-consuming but productive methods.

The challenge most frequently cited by the interviewees was difficulties inspecting traceability and documentation. Several issues were raised, including missing paperwork and difficulties establishing the authenticity of documents, which in turn lead to uncertainty among inspectors on how to proceed. Inspecting traceability and documentation is especially important for food fraud detection as, in the EU and in Finland, non-compliance with documentation requirements is commonly related to food fraud (Tähkäpää et al. 2015; [EC 2022; Joenperä et al. 2022). FCOs' expertise in traceability control should be developed by training and allowing FCOs to specialize in this area, as has been suggested in the UK (HM Government 2014).

The FCOs in this study often emphasized the inadequacy of the frequency and length of inspections, which raises concern. The frequency and duration of inspections is dependent on the characteristics and risk classification of the establishment in question (FFA 2022c). However, establishment types with the highest food safety risks may not be those with the highest risk of food fraud, and vice versa. Therefore, we suggest that inspection frequencies and lengths should be critically evaluated, and adjusted accordingly, to enable adequate inspections from a food fraud prevention perspective. This evaluation should take into account not only the possible need for more resources but also the factors that influence the risk of food fraud, such as the financial situation of the FBO.

Furthermore, preannouncement of inspections is a challenge for food fraud detection. Most questionnaire respondents dealt with at least one establishment in which the inspections were always preannounced, and, in 2020, when the interviews were conducted, performing inspections with prior notice was encouraged due to the COVID-19 pandemic. However, previous studies show that inspection grades in restaurants (Kaskela et al. 2021) and food production establishments (Kosola et al. 2022) are better in preannounced inspections, as some FBOs correct non-compliances before the inspection occurs. It is obvious that preannouncement can also hinder food fraud detection, as dishonest FBOs frequently attempt to conceal their fraudulent activities (Gussow 2020). Thus, all food establishments should, at least occasionally, be inspected without prior notice to maintain the effectiveness of food control and improve food fraud detection.

Inter-authority cooperation is important in food fraud detection and prevention (FFA 2022b). This appears especially important in the light of the results regarding the challenges the regional jurisdictions create. FCOs cannot form a comprehensive understanding of the operations of FBOs that operate in multiple regions unless food control units cooperate efficiently. Therefore, it would be important for food control units to map FBOs that operate in more than one municipality and coordinate control activities directed at these FBOs to ensure comprehensive and efficient food control. Due to a change in the organization of health and social services in Finland (Finnish Government 2021), larger food control units may be formed in the future, which could improve food control in this regard.

One challenge to food fraud detection commonly raised by our participants concerned the FCOs themselves. Even though food fraud has always posed a problem, it nevertheless remains a relatively new concern for food control. Therefore, according to the interviewees, food fraud may not be foremost in FCOs' minds during inspections, as several issues must be inspected in a limited amount of time, and the traditional focus of food control is hygiene (FFA 2023. In addition, FCOs may be overly credulous or cautious regarding interventions when a violation is suspected. This is not unexpected, as food control itself is based on the notion that most actors abide by the rules (FAO 2022), and Finns' trust in other people in their country is the highest in Europe (EC 2018). Previously, a similar attitude, which assumes ignorance rather than malpractice, has been reported for example among Wages Inspectorate officers (Beaumont 1979). However, a prerequisite for successful food fraud detection is that inspectors look for fraud (Gussow 2020). FCOs should remember that not all FBOs may wish to comply with the rules, that fraudulent activities or products may be actively concealed and that, even though non-compliances can be due to mistakes, negligence and deception are possible.

Underlying factors such as education, work experience, or respondents' own estimation of their knowledge of the establishments did not significantly correlate with either having suspected or detected food fraud. However, it seems that a previous suspicion or detection of fraud may affect the mindset of an FCO. In this study, those participants who had suspected and/or detected a case saw food fraud as a greater issue, more often felt that inspection frequency was insufficient, and more often responded that unannounced inspections should be performed outside office hours. Therefore, we believe that FCOs' ability to detect food fraud, i.e. the detection sensitivity of inspections, can be increased by further awareness raising and training. The Finnish Food Authority has already acted in this regard, as, in 2021, it organized nation-wide training tours for relevant authorities and introduced monthly training sessions on various topics related to food fraud (FFA 2022a). Therefore, it is likely that FCOs' awareness and knowledge of food fraud have already improved since the questionnaire survey and interviews were conducted in 2019 and 2020. Training should be continued to further increase and maintain FCOs' knowledge.

Reporting suspected food fraud to the police is extremely important for food fraud prevention, as such cases are otherwise unlikely to come to the attention of the criminal investigation authorities, as is the case with environmental crime (Sahramäki and Kankaanranta 2014). An increase in food fraud cases in the criminal justice system would also raise awareness of food fraud among the police and prosecutors and create legal praxis in a field where it is currently sparse (Koskela et al. 2022). However, our study highlighted significant challenges which may decrease reporting. For example, approximately one fourth of respondents were uncertain of how to act if they suspected fraud, and FCOs found reporting subjective and often laborious. Similar issues affecting reporting have been found in studies regarding environmental crime (du Rées 2001; Sahramäki and Kankaanranta 2014). More recently, the number of investigation requests regarding animal welfare violations has been found to be small considering that the current legislation requires that all suspected violations are reported to the police (Valtonen et al. 2021), albeit the reasons for not reporting may differ from the reasons with suspected food fraud or environmental crime. These issues, such as uncertainty on whether to report, can be improved by education and providing instructions. Currently, a template and guidelines exist for writing a request for a criminal investigation, but further training and guidelines are clearly required to harmonize reporting practices, as has been previously suggested with environmental crime and animal welfare violations (Sahramäki and Kankaanranta 2014; Valtonen et al. 2021). In addition, food control authorities that have yet to establish cooperation with the local police should initiate such cooperation to improve the reporting of suspected cases.

In this study, we focused on the FCOs' abilities to detect food fraud during inspections. However, it is also important to acknowledge other actors, such as consumers and food businesses, in this regard. A previous study found that reports from private individuals, other authorities, and even

food business employees have played a role in food fraud detection in Finland (Joenperä et al. 2022). In addition, corporate fraud (Dyck et al. 2010) and occupational fraud (ACFE 2022) are often reported by employees, and there is evidence of whistleblowing from the food industry as well (Soon and Manning 2017). Therefore, to enhance the prevention and control of food fraud, the authorities and the industry should cooperate in information gathering and sharing (HM Government 2014). Previously, stakeholders in the European food chain have shown interest in a food integrity information sharing system, but this was not without reservations (Minnens et al. 2019). Confidential information sharing between stakeholders of the food chain should be further discussed and facilitated. In addition, further cooperation between all relevant authorities should be maintained and advanced (Kuukasjärvi et al. 2022; Customs 2023).

In this study, questionnaire responses were received from FCOs operating in units from all six Regional State Administrative Agencies in the country, and the interviewees represented a diverse sample of food control units. Moreover, the questionnaire respondents and interviewees included FCOs with and without experience of food fraud. Coupled with the rather high number of questionnaire respondents, this suggests that our participants represent a wide range of FCOs. However, one limitation is that we were unable to calculate a response rate due to having no data of the number of FCOs in Finland. In addition, with the lack of demographic data of all Finnish FCOs, we were unable to estimate the representativeness of our respondents. However, we had a diverse group of respondents, which is a prerequisite for acquiring a multifaceted view of the issue. In turn, another possible limitation of the present study was that FCOs' knowledge of the establishments they inspected was investigated via self-assessment, which is vulnerable to bias, as respondents tend to overestimate their own abilities (Dunning et al. 2004). Nonetheless, self-evaluation allows the issue to be studied among many participants, thereby providing an overall indication of FCOs' level of knowledge. External evaluation of this knowledge could be a topic for future research. In addition, the respondents' answers on the use of different inspection methods may have been affected by the applicability of the methods to establishments of different type or size.

In conclusion, while many Finnish FCOs have encountered food fraud, many also experience uncertainty regarding food fraud detection and reporting. Unawareness of the types of possible food fraud in the establishments they inspect is common, and many FCOs feel that they lack a realistic chance of detecting food fraud during inspections. Several factors were found to hinder food fraud detection, from system-level challenges, such as resource constraints, to FCOs' own mindsets. In addition, the respondents differed in their use of inspection methods, with a rather large number of participants failing to utilize some methods at all. FCOs should receive further training to increase their awareness and expertise of food fraud. Moreover, they should be encouraged to use varying inspection methods to improve food fraud detection, as types of fraud are numerous and concealment is likely. Moreover, system-level changes, such as improved resources, could improve food fraud prevention by, for example, allowing FCOs to increase the inspection frequency of suspicious establishments or perform more thorough traceability checks or mass-balance testing. In addition, the reporting of suspected food fraud cases may be reduced by hesitation on whether to report. Food fraud reporting could be improved by further training, pragmatic guidelines, and increased cooperation between FCOs and the police.

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