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7 1 Background

8 1.1 What is food fraud

9 Food fraud involves 'the deliberate and intentional substitution, addition, tampering, or
10 misrepresentation of food, food ingredients, or packaging; or false or misleading statements made about
11 a product for economic gain' (Spink & Moyer, 2011). A joint Europol-Interpol operation (OPSON) in 2017
12 reported that 9,800 tonnes, 26.4 million litres and 13 million items of counterfeited and potentially
13 harmful food and drink products were seized from across 21 European Union member states, with an
14 estimated value of 230 million Euros (Europol, 2017). These fraudulent practices are perpetrated by a
15 range of food chain actors including; criminal gangs that infiltrate legitimate food chains, and legitimate
16 actors that abuse or misuse their position within the food production system (Brooks, Elliott, Spence,
17 Walsh, & Dean, 2017; Lord, Flores Elizondo, & Spencer, 2017; Spink & Moyer, 2011; van Ruth, Huisman, &
18 Luning, 2017). However, given that fraudsters will seek to avoid detection and prosecution, it is difficult
19 to estimate the true magnitude of fraudulent practices within local, national and pan-European food
20 supply chains.

21 It is accepted that fraudulent activity in the food system undermines the integrity of the European food
22 system as a whole, partly due to stakeholder (including consumer) perceptions that consumer protection
23 measures are inadequate (Premanandh, 2013). However, the impact on European consumers'
24 perceptions and attitudes to food integrity and safety has not, to date, been systematically evaluated.
25 This is relevant from the perspective of developing and implementing mitigation policies, and predicting
26 and explaining consumers' self-protective behaviours in relation to food fraud.

27 1.2 Food fraud in Europe

28 While food fraud does not necessarily represent a risk to public or environmental health, instead
29 negatively impacting food quality (e.g. the dilution of alcohol with water and/or ingredient or species
30 substitution), undisclosed contaminants in food supply chains means that food safety risks may be linked
31 to fraudulent food practices. For example, the 1981 Spanish toxic olive oil incident remains Europe's most
32 serious food fraud case in terms of mortality and morbidity of affected consumers. Fuel oil intended for
33 industrial use was sold by street vendors as "olive oil" for human consumption. The resulting toxic oil
34 syndrome experienced by people ingesting the oil was linked to the 1,200 deaths and 20,000

35 hospitalisations, with lasting health implications for the surviving consumers (Snellings, McMartin,
36 Banton, Reitman, & Klapacz, 2017). A more recent example of food poisoning fatalities caused by
37 fraudulent food practices involved spirits adulterated with methanol which were sold in the Czech
38 Republic, Poland and Slovenia in 2012, causing 38 fatalities in the Czech Republic and a further 4 fatalities
39 in Poland (Zakharov et al., 2014).

40 However, not all fraudulent food practices are necessarily harmful to human health and instead
41 represent a food or drink quality concern such as the dilution of spirits with water. The undisclosed
42 identification of horsemeat in processed beef products in the UK and Republic of Ireland is one such
43 example. Although potential health concerns regarding equine veterinary drug residues were voiced at
44 the time of the incident, they were assessed as being very small (Regan et al., 2015). Instead, the high
45 profile case highlighted problems associated with integrity and complexity of the beef supply chain in
46 Europe (Barnett et al., 2016) which was already a focus of consumer concern following the occurrence of
47 BSE in 1996 (Lynn, Frewer & Salter, 2002). Specifically, this particular supply chain was one which
48 consumers' expected to be highly regulated and inspected. In 2017, eggs in Belgium were found to be
49 contaminated with the veterinary insecticide 'Fipronil', a chemical forbidden for use in animals in
50 livestock production systems, but which had been deliberately used to reduce infestation in the layer
51 supply chain. Affected eggs were identified for sale in 26 European member states and 45 countries
52 worldwide (BBC News, 2017; European Commission, 2017b, 2017c).

53 Media reports about food fraud incidents across Europe have been collated since 2016 by the Knowledge
54 Centre for Food Fraud and Quality, hosted by the European Commission's Joint Research Centre. A
55 significant number of European incidents constituting fraud have been reported, associated with
56 mislabelling, adulteration, counterfeiting or theft, during the period 2016-2018. Wine, spirits, olive oil,
57 fish, meat, cheese, honey and herbs and spices represent the most commonly reported adulterated foods
58 (European Commission, 2019). Italy appears to have the most media reported incidents. Potential
59 explanations include Italy being extremely active in exposing and combatting fraud, and the high number
60 of Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and Traditional
61 Speciality Guaranteed (TSG) Italian food specialties recognized and protected by the European Union;
62 products that often command premium prices making them attractive targets for fraudsters.

63 Although the number of European food fraud incidents is high, there is no evidence available to suggest
64 the number of fraud incidents are increasing, although this possibility cannot be eliminated. However,
65 the improved governance, detection and surveillance of food fraud may have increased the detection of
66 food fraud incidents (European Commission, 2017a).

67 1.3 Governance, countermeasures and societal responses

68 The 1990s was associated with many food safety incidents in the European food chain, which
69 compromised the safety, integrity and reputation of European food globally (Thankappan, 2016). In
70 response, the European Union overhauled the governance of its food system and implemented sweeping
71 regulatory reforms (e.g. EC Regulation 178/2002). The European food system is currently recognised
72 internationally for its high levels of production quality, safety, animal welfare, and stringent regulatory
73 standards that underpin European and global consumer confidence and trust in the safety of the foods
74 (Nakyinsige, Man, & Sazili, 2012). However, the 2013 horsemeat incident was the catalyst for the
75 formation of additional, integrated notification and response mechanisms for dealing directly with the
76 threat of food fraud, presumably prompting governance changes because of the pan- European scale of
77 the incident. For example the EU Food Fraud Network (FFN)(European Commission, no date) was
78 established in order to facilitate cross-border collaboration and information sharing regarding suspected
79 intentional and economically motivated violations in Europe, and beyond, that may impact European
80 supply chains and in so doing protect and re-build consumer confidence in the integrity of European food.

81 1.4 Consumer perceptions and attitudes

82 From a consumer perspective, the study of food fraud is most appropriately addressed through the
83 consideration of: 1) perceptions and attitudes linked to food safety; 2) perception of, and attitudes
84 towards, food authenticity, and; 3) trust in institutions and experts.

85 Maintaining consumer confidence in food authenticity and the integrity of the food supply chain overall,
86 will potentially circumvent the negative economic and societal effects associated with consumer
87 concerns about the associated safety and integrity of food (De Jonge et al., 2004; European Commission,
88 2010). Food fraud events have been shown to negatively impact consumer confidence and trust in
89 affected products, food chain actors and food systems (see, inter alia, (Frewer, Howard, Hedderley, &
90 Shepherd, 1996; Lobb, 2005). Given the complexity of modern food systems, food transactions are
91 typically operationalised by organisations including primary producers, ingredient suppliers, food
92 manufacturers, regulators and enforcement services, etc. Trust in these actors is referred to as
93 institutional trust which is built and sustained by consumer perceptions that their actions and activities
94 are robust, that there is transparency in operations (i.e. regulations and enforcement), and that there is
95 effective communication with the public regarding consumer protection in relation to food.

96 Food chain actors use a range of signals to communicate their trustworthiness including effective
97 knowledge exchange between stakeholders in industry, regulatory institutions and civil society
98 organisations, and certification, packaging and labelling that support consumers evaluations of credence
99 attributes such as product origin and production speciality claims, e.g. organic and fair trade claims (El
100 Benni et al., 2019; Grayson & Martinec, 2004; Liu, Yannopoulou, Bian, & Elliott, 2015). Relational trust
101 refers situations where trust is developed through reciprocal relationships, e.g. alternative food networks

102 such as farmer's markets or direct consumer-supplier relationships with local butchers. In situations
103 where there has been a breach of trust, there has been a rise in the prominence of alternative food
104 networks that are perceived by consumers as reducing the complexity of supply chains (Kendall et al.,
105 2018; Lyon & Porter, 2007; Zhang, Xu, Oosterveer, & Mol, 2016). Trust in information sources may
106 correlate with the extent to which consumers trust to food safety guarantees, information provided
107 about food safety regulation, regulatory enforcement, or the efficacy of mitigation measures (see, *inter*
108 *alia*, (Frewer et al., 2016; Hobbs & Goddard, 2015)).

109 Food choices are a ubiquitous part of everyday life and consumers are required to continually make food
110 consumption decisions without complete knowledge of a product's quality, safety or reliability. There is
111 therefore, an inbuilt asymmetry to consumer trust. Trust allows consumers to act without complete
112 knowledge of whether or not a food is risky to consume (Hansen, Holm, Frewer, Robinson, & Sandøe,
113 2003; Luhmann, 2000).

114 1.5 Authenticity

115 Under some circumstances, (e.g. packaged products), the authenticity of food may not be easily
116 observed, experienced or verified by consumers. It can only be evaluated through signalling cues
117 provided by food manufacturers and regulators that indicate the authenticity attribute (Martinez &
118 Epelbaum, 2011) consumers therefore rely on the transparency and efficacy of regulatory enforcement,
119 appropriate and proportionate mitigation measures, and their trust in food chain stakeholders and their
120 production practices, as signals of food integrity (Meijboom, Visak, & Brom, 2006). Traceability systems
121 provide information about the history of a product and allow food to be traced and followed through a
122 production chain. This enables the origin of a product and its journey through a given supply chain to be
123 documented, and facilitates implementation of mitigation actions, e.g. product recalls, if a product is
124 found to be non-compliant with quality or safety standards (Food Standards Agency, 2017; Spence,
125 Stancu, Elliott, & Dean, 2018; Van Rijswijk & Frewer, 2012). Labelling and trade standards provide
126 verifiable objective specifications and claims for authentication. Several studies have attempted to
127 summarise different aspects of authenticity, such as country of origin, reactions to specific food fraud
128 cases and public attitudes towards food safety associated with traceability (Cicia & Colantuoni, 2010;
129 Hansstein, 2014; Wendy van Rijswijk, Frewer, Menozzi, & Faioli, 2008).

130 1.6 Aims of the review

131 Given the prominence of incidents of food fraud across the Europe, it is important to understand
132 consumers' attitudes towards food fraud and their relationship with aspects of food integrity, such as
133 authenticity, trust and risk-benefit perceptions, and perceptions of the efficacy of governance and
134 regulatory practices that influence decision making. A systematic literature review will potentially provide
135 important insights to food policy makers, industry stakeholders and broader society affected by food

136 fraud, by identifying recommendations to enable risk communicators to improve the relevance of
137 consumer communication practices.

138 This systematic review therefore seeks to understand:

- 139 • What are European consumer's perceptions and attitudes towards food fraud?
- 140 • What are the risks that European consumers associate with food fraud?
- 141 • What are the benefits that European consumers associate with demonstrating the authenticity
142 of food?
- 143 • What steps are needed to enable those benefits to be realised?

144 2 Scope and approach

145 A protocol for the review was developed prior to conducting the searches and was published on
146 PROSPERO (see CRD42018088792). Minor, in-substantive, deviations from the protocol were made.

147 2.1 Search process

148 Scopus, ISC Web of Knowledge and Google Scholar were searched for empirical studies published over
149 the past 20 years i.e. 1998 onwards. In addition, reference lists of studies included were checked and key
150 authors in the field were contacted to check for unpublished and unreturned studies (Higgins & Green,
151 2011). Search terms were trialled and finalised for each database (see supplementary material A).

152 All returned results were exported into an EndNote library, with duplicates being removed. The results
153 were uploaded to dedicated systematic review analysis software 'Covidence systematic review software'.
154 The results were screened according to the inclusion and exclusion criteria (Table 1), pertinent to the
155 primary research aims. Papers were sifted in a two-stage process; first the title and abstracts were
156 screened by three independent reviewers HK, BC and CMR; second, the full text of included studies were
157 screened by the same reviewers. An overview of the search process can be found in the PRISMA flow
158 chart (Figure 1, (Moher, Liberati, Tetzlaff, & Altman, 2009)). Any differences between the three
159 researchers were resolved through discussion at each stage of the analysis.

160 INSERT FIGURE 1 HERE

161 INSERT TABLE 1 HERE

162 Qualitative and quantitative empirical studies which investigated European consumer risk-benefit
163 perceptions and/ or attitudes were included if they made explicit reference to food fraud or authenticity
164 ((Spink & Moyer, 2011), p1580). Papers that examined food traceability, or authenticity of
165 brands/local/regional produce, with no mention of food fraud, were excluded. This deviated slightly from
166 the published protocol as the definition of authenticity used was restricted to include the concept in
167 conjunction with food fraud. Methodologies included quantitative surveys, focus groups and interviews,

168 and studies that used experiments involving hypothetical scenarios or reactions to real world events.
169 Studies that examined other aspects of food fraud (e.g. analytic methods aimed at detection, legal
170 aspects of food fraud including accountability, legislation, and compliance), were excluded. Only peer
171 reviewed studies available in English were included for pragmatic reasons.

172 2.2 Assessment of risk of bias

173 A quality assessment tool developed by Clark, Stewart, Panzone, Kyriazakis, and Frewer (2016) was used
174 to quality score the empirical qualitative and quantitative methods used within the selected studies. No
175 studies were excluded based on the quality assessment, but the scorings were taken into account during
176 the analysis as part of the Grading of Recommendations, Assessment, Development and Evaluation
177 (GRADE) framework (Meader et al., 2014), which assesses the overall of strength of evidence. Again, this
178 was adapted from Clark et al. (2016), to provide a tool suitable for use in conjunction with a narrative
179 analysis. Critical appraisal was conducted independently by three reviewers (HK, BC CMR) (see
180 supplementary material B). Any differences in decisions related to study quality were resolved through
181 discussion by the same authors. Although the protocol stated that reporting standards would be assessed
182 as per the EQUATOR network guidance, this was not conducted due to overlap with the critical appraisal.

183 2.3 Data synthesis

184 Given the methodological diversity of studies included in the review, a narrative analysis of the data was
185 conducted. All included studies were exported into QSR Nvivo (QSR International Pty Ltd, 2012). A
186 thematic approach to the analysis was taken (Braun & Clarke, 2006; Thomas & Harden, 2008), and was
187 used to explore the variations and relationships in the data. The analysis followed a three-stage process.
188 First, three members of the research team (HK, BC and CR) independently undertook open coding of the
189 papers using an inductive, grounded approach (Glaser & Strauss, 1971). The key concepts and categories
190 that emerged were then discussed by the same reviewers, and an initial coding framework was
191 developed by the lead author. The second phase involved refining the coding framework, the same
192 members of the research team independently coded a subset of papers and compared the codes against
193 the framework. This inter-coder reliability process followed two iterations until there was agreement that
194 the categories within the framework reflected the data. The third stage of analysis involved the same
195 researchers coding a subset of the papers against the finalised coding framework. Any uncertainty at this
196 final coding stage was resolved through discussion between review team members.

197 3 Key findings

198 The search process identified 15 studies eligible for inclusion. Table 2 presents a narrative overview of
199 these studies. Of these, 13 were journal articles, one was a Ph.D. thesis and another a presentation. Eight
200 studies used a quantitative methodology including; two willingness-to-pay (WTP) assessments (Agnoli,
201 Capitello, De Salvo, Longo, & Boeri, 2016; Doherty & Campbell, 2014); two online surveys (Al-Tal, 2012;
202 Barbarossa, De Pelsmacker, Moons, & Marcati, 2016); four administered surveys (Charlebois, Schwab,

203 Henn, & Huck, 2016; Chousou, Tsakiridou, & Mattas, 2018; Crane & Brown, 2013; Spence et al., 2018);
204 and one study adopted both online and administered survey methods (Yasar & Boselli, 2015). Six studies
205 were qualitative and included; one focus group study (Devaney, 2016); two studies which adopted an
206 online deliberation tool (Barnett et al., 2016; Regan et al., 2015); one employed in-depth interviews (W.
207 Van Rijswijk & Frewer, 2012) and one a social media analysis (Tse, Zhang, Doherty, Chappell, & Garnett,
208 2016). One study employed a mixed-method research design adopting focus groups and online survey
209 methods (Salih, 2017).

210 All 15 studies were published after 2012. Six explored consumers' direct responses to the 2013 European
211 horsemeat incident, while the seven remaining studies explored consumer perceptions towards the
212 mitigation of food fraud in general, including the perceived importance of product attributes in the
213 identification of authentic food, and attitudes and purchase intentions towards traceable food products.
214 Six studies examined food fraud in relation to a specific food product. This primarily included beef and
215 processed beef products, (the focus of the 2013 horsemeat incident), but also included olive oil and
216 kebab meat products that have been previously implicated in food fraud incidents. Chicken was the focus
217 of Doherty and Campbell (2014) due to its vulnerability to microbiological food safety contamination
218 arising from mislabelled (typically extended) sell-by dates etc.

219 Three studies contained consumers from both European and non-European countries; Al-Tal (2012) has a
220 relatively small sample of Italian compared to Iranian participants; Salih (2017) compared Kurdish and
221 English study participants, and Yasar and Boselli (2015) compared the attitudes of Turkish consumers
222 with a small sample of European consumers. Only the European results for these were included in the
223 current analysis¹. Prior to analysis, two studies Boeri et al. (2015), and Agnoli et al. (2016) were found to
224 contain the same study population. Boeri et al. (2015) was excluded prior to coding as the publication
225 was a conference paper, and the subsequently published article included more detailed information
226 about the empirical work conducted. The conference paper was checked to see if any additional details
227 could be provided.

228 In two studies (Doherty & Campbell, 2014; Yasar & Boselli, 2015), food fraud was assessed among a range
229 of food safety risks. The remainder distinguished food fraud from food safety, recognising that food fraud
230 may, but does not always, represent a risk to the safety of food.

231 INSERT TABLE 2 HERE

232 3.1 Quality assessment

233 The results of the critical appraisal can be found in the supplementary material (Appendix B). Overall, the
234 studies were of mixed quality, with several studies providing insufficient methodological information, in

¹ We have considered Turkish consumers to be non-European given the different food regulations in Turkey

235 relation to sampling and response rates for quantitative studies, and the role of the researcher in
236 qualitative studies.

237 The GRADE assessment criteria, used to evaluate the overall strength of evidence of the returned studies,
238 indicates an overall moderate strength of evidence (supplementary material B).

239 3.2 Emergent Themes

240 The thematic analysis yielded six themes (Table 3); “drivers of fraud”, “consumer fraud concerns”,
241 “trust”, “responsibility”, “accountability and blame”, “consumer behavioural response” and “supply chain
242 responses”. Quotes from the papers to support the thematic analysis are provided in appendix C
243 (supplementary material C).

244 INSERT TABLE 3 HERE

245 *Theme 1: Drivers of fraud*

246 Consumers’ perceptions of why food fraud occurs were related to perceived food chain vulnerabilities to
247 fraudulent activity. The complexity of supply chains and globalisation of food systems, involving multiple
248 food chains and actors, was perceived to be the most significant factor in the proliferation of food fraud
249 affecting a variety of food chains across Europe. Perpetrators of food fraud were perceived as legitimate
250 food chain actors, primarily food producers and manufacturers, rather than by external actors, e.g.
251 criminals infiltrating legitimate food systems.

252 Consumers were concerned about the food industry’s pursuit of profit over food safety as a potential
253 driver of fraud. Similarly, increased competition within the food industry, which resulted in lower profit
254 margins, was also perceived as a potential driver. Food producers and manufacturers were thought to
255 maintain and increase profits by reducing production costs through illegal means, e.g. by using inferior
256 ingredients, adulterating ingredients using cheaper or inferior quality substitutes, and mis-labelling those
257 ingredients.

258 The political, social and economic context in which food fraud occurred was considered by consumers to
259 have provided an environment conducive to fraudulent activities. Within the UK and Ireland, and
260 specifically in relation to the horsemeat incident, the economic downturn was perceived to have reduced
261 the capacity of responsible agencies to conduct effective surveillance and testing.

262 *Theme 2: Responsibility, blame and accountability*

263 Empirical research conducted in the wake of the horsemeat incident explored consumer perceptions
264 relating to whom responsibility, blame and accountability should be apportioned. These terms were used
265 interchangeably by consumers. Distinctions were made between direct versus indirect responsibility.
266 Direct responsibility for fraudulent practices was perceived as the deliberate actions of individuals within
267 the food industry, where dishonest and deceitful activity was considered to be a part of the collective

268 culture. There was recognition that blame within organisations should not be equally attributed, with
269 responsibility falling directly to those in management positions, and with food chain workers viewed as
270 “unwitting accomplices” to fraud. Regulatory agencies and authorities were perceived to be indirectly
271 responsible, owing to their responsibilities for oversight of food systems, and their moral obligation to
272 protect consumer interests. Although consumers did not consider that food authorities and regulators
273 had colluded with industry to create an environment where fraudulent activity was permissible, moral
274 judgements were made regarding industry failure to detect and stop adulteration. Specifically, failures to
275 conduct adequate testing and ingredient checks were perceived to occur before the horsemeat incident,
276 leading to criticisms that all actors, including the regulatory authorities, had not paid due attention to the
277 potential for food fraud. The role of increased consumer demand for cheap and convenience food
278 products was considered to have incentivised the food industry to produce inauthentic products.

279 *Theme 3: Consumer fraud concerns*

280 Consumers held a number of concerns in relation to fraud generally, and in relation to specific food-
281 related contexts, particularly the horsemeat incident. Concerns were focused on the deliberate and
282 deceitful nature of fraud, and intention to mislead the consumer, with malevolent activity within the food
283 system being considered to represent the food industry’s abuse of power. Actors in the food industry
284 were perceived to collude to intentionally cover-up malpractices. Concerns were raised regarding
285 widespread fraudulent activity, specifically within supply chains affected by fraud (e.g. beef and
286 processed foods). Fraud concerns over specific products, e.g. beef, frequently triggered other food
287 related concerns, such as those linked to farm animal welfare, food quality and safety.

288 Misleading product labelling led to reduced consumer confidence in product authenticity and quality, and
289 the perceived integrity of producers and legislators. Consumers also expressed a belief that the practice
290 of including unlabelled horsemeat in processed food products had been going on for many years,
291 reducing trust in the integrity of food chains and food chain actors.

292 Consumers perceived that food system transparency was inadequate. Consumers indicated that they
293 received little information about how the food they eat is produced, its origins, and about the different
294 stakeholders involved in the supply chain. Given that this information is perceived by consumers to be
295 available to food chain actors, information asymmetry between consumers and food chain actors is
296 created, and consumers are unable to make informed choices regarding a product’s authenticity, and
297 other production related attributes. This suggests that more transparent communication and information
298 provision is required in order to alleviate consumer concerns and reduce information asymmetry.
299 Information provided by industry and institutions should address the more general and context specific
300 concerns held by consumers, and potentially reference authenticity cues.

301 The country of origin of products was seen as an important attribute denoting food integrity, with several
302 studies indicating that consumers had preferences for products from their own, or from other European,
303 countries.

304 Studies exploring consumers' response strategies, following the occurrence of horsemeat incident,
305 reported that consumers viewed such incidences as a breach of trust, reducing their confidence in the
306 integrity of food-chain actors and specific food supply chains. Consumers indicated that they intended to
307 change their purchasing habits as a result.

308 *Theme 4: Consumer perceptions and attitudes following a food fraud incident*

309 For some consumers, perceptions of effective risk management increased their trust in food risk
310 governance practices, demonstrating the value of the relevant government agencies, as well as justifying
311 their budgets. Conversely, other consumers already held a positive view of food risk governance and
312 trusted in its effectiveness. However, consumers were concerned by information asymmetry within, and
313 transparency across, the food production process. The provision of information, as well as the credibility
314 of the information source, influenced the attitude formation of consumers. Information sources were
315 evaluated in terms of trustworthiness, impartiality and accuracy. European consumers were most
316 trusting of their national government agencies, while food and drink manufacturers were the least
317 trusted. In the wake of misleading or exaggerated media stories, it was proposed that consumer concerns
318 could be moderated through the provision of scientific evidence and acknowledgements of uncertainties
319 in scientific knowledge, if and/or where this might occur.

320 Improving transparency regarding food production processes increased consumer confidence and trust in
321 the integrity of supply chains. Traceability systems were perceived to reduce information asymmetry
322 between the food industry and consumers, and offered consumers reassurances regarding a product's
323 origin, history and journey through the supply chain. In so doing, the implementation of food traceability
324 systems increased perceptions of trust through product quality and safety assurances, particularly in
325 situations of identification and rapid withdrawal of foods failing to meet quality and safety standards.
326 Trust in the effectiveness of traceability systems and information provision (e.g. labelling) also increased
327 purchase intentions of relevant products. Consumers' confidence in the trustworthiness of information
328 was increased by access to information about the institutions guaranteeing or implementing food and
329 ingredient traceability. The oversight of an independent government body increased trust in the
330 effectiveness of traceability systems. However, the food industry was perceived to be able to negatively
331 impact on the independence of food regulatory institutions and their capacity to develop and apply
332 effective food safety measures.

333 *Theme 5: Consumers behavioural response*

334 Various strategies were employed by consumers to avoid encountering fraudulent food, including their
335 reliance on integrity cues provided by manufacturers at the point of purchase. These acted as heuristics
336 signalling the quality and authenticity of products. One heuristic cue used by consumers was price.
337 Consumers recognised that more expensive products potentially offered quality guarantees. The need for
338 product information to appear directly on products (and to a lesser extent at the point of sale), and for
339 product information to be provided in a concise format with additional information provided by
340 alternative mechanisms (i.e. barcodes, Quick Response [QR] codes or websites), was perceived by
341 consumers to be important. This suggested that consumers generally have limited time for information
342 processing at the point of purchase. Furthermore, different levels of information provision were required
343 for different product types. Consumers expressed preferences for more information about processed
344 products, or products unknown to the consumer. Product certifications denoting production standards,
345 or reflecting geographic origin, enhanced the credibility or reliability of products, if supported by third-
346 party credence information to support these claims, e.g. information about a product's place of origin,
347 production process, or animal welfare claims. Consumers required certifications to be accompanied by
348 contact information to guarantee the certifying institution, and a visible "logo" or seal to be included as
349 part of the product labelling. Consumers also reported relying on sensory attributes such as appearance
350 and taste to indicate quality and authenticity, particularly for products such as olive oil and meat.

351 Behavioural responses to fraud were primarily identified in relation to specific food fraud incidents, e.g.
352 horsemeat in the beef supply chain. If a food did not meet with consumers' quality and safety
353 expectations, consumers sought recourse through complaints to suppliers or relevant institutions, (e.g.
354 explanations and/or compensation from the retailer), and informed government and consumer
355 organisations that a product had been subject to fraud. Complaining directly to the producer was the
356 least preferred option. Changes in consumption behaviours and purchasing habits in response to the
357 detection of fraud within a food chain were also observed. Such actions included brand and product
358 switching (i.e. purchasing fish or vegetarian options to replace meat), wider information searching prior
359 to purchase (i.e. via internet searches) and/or avoidance of specific products (i.e. highly processed meats
360 or convenience type foods), or retailers that were associated with food fraud incidents. Where possible,
361 consumers attempted to purchase food from trusted suppliers, e.g. in the case of meat, consumers
362 purchased from local butchers. Buying from retailers included in shorter supply chains allowed
363 consumers to ask questions and receive personal reassurances from food chain actors regarding the
364 quality and origin of products. This represented an important means of reducing perceived risks
365 associated with food fraud. For other consumers, restricting the purchase of products to those that had
366 been made in their home country was used as a means of reducing the possibility of encountering food
367 that had been adulterated.

368 *Theme 6: Supply chain responses*

369 The literature suggests that consumers require food chain actors to take both reactive and proactive
370 measures to mitigate food fraud. Consumers required increased transparency throughout the supply
371 chain in order to reduce information asymmetry, with consumers reporting that they would be willing to
372 pay a price premium for traceable products. In the wake of a food fraud incident, consumers required the
373 provision of transparent information, regardless of expert uncertainties regarding the nature and extent
374 of the risk and whether it had occurred. They also expected remedial actions to be applied following the
375 incident, such as open apologies from the food business operators and agencies responsible for the
376 governance of food systems, and information about the preventative actions taken by both parties.
377 Penalties and sanctions, including custodial sentences for those caught perpetrating fraudulent acts,
378 were considered justifiable and served as deterrents to other potential food fraudsters. They were also
379 considered to be an important mechanism for rebuilding consumer confidence in the governance of food
380 systems. In accordance with the principles of good governance practices, consumers thought that they
381 should be more engaged in the development of policies via consultative mechanisms that support
382 dialogue between policy makers and the public.

383 **4 Conclusion**

384 The published literature on public perceptions of food fraud was shown to be relatively recent, with all
385 studies included in this review published from 2012 onwards, and 11 of the studies being published after
386 2015. Six were conducted in direct response to the horsemeat adulteration incident that affected the
387 European beef supply chain in 2013, with no other specific incidents being considered (e.g. The 2012
388 Czech Republic spirit fraud), which may have influenced the analysis, as the horsemeat incident was not
389 associated with food safety concerns in a technical sense. The review did not cover the time period for
390 the major food fraud incidents of the 1980s (Spanish olive oil and Austrian wines) although an additional
391 literature search indicates that no research papers focused on public perceptions and attitudes published
392 in English were available prior to the time period which was covered by the systematic review reported
393 here.

394 The recent increase in research interest on food authenticity and consumer perceptions may also reflect
395 the growth in media and social attention on food fraud, including the increased role played by social
396 media in information dissemination. There is no evidence to suggest that this reflects an increase in food
397 fraud incidence. This may, however, reflect increased detection through improvements to surveillance in
398 Europe, including the introduction of the FFN. While food fraud has always posed a threat to the integrity
399 of European food chains, apart from developing detection methodology, it has only relatively recently
400 been the focus of academic study. This may, in part, signal a lack of clarity regarding the definitions of
401 food fraud and food safety, leading to fraud-related incidents with public and environmental health
402 related outcomes being subsumed into the general analysis of food safety incidents. Alternatively, it is

403 only recently that methods of analysis have been developed to detect (some) authenticity characteristics
404 (Esteki et al., 2019) This might also reflect key changes in food policy governance that was instituted in
405 the late 2000's across Europe, i.e. the demarcation between food safety and food production
406 responsibilities. Further transnational research exploring consumer perceptions and attitudes towards
407 fraud in food systems is warranted, not least because the results are likely to inform priorities in
408 regulatory and policy development.

409 Six themes relevant to our understanding of consumer attitudes towards food fraud emerged from the
410 thematic analysis. Given the limitations of the (English peer reviewed) literature available, the results
411 suggest that the public are concerned about food fraud, related to perceptions of intentional deception
412 on the part of fraudsters, and the impact that this has had upon consumers' abilities to make informed
413 decisions about the food that they purchase and consume. The findings contrast those of empirical
414 research conducted regarding the attitudes of Chinese consumers (Kendall et al., 2019; Kendall et al.,
415 2018), with results suggesting that European consumers did not appear to perceive food fraud to
416 represent such a significant risk to the safety of food as has been the case in other regions (e.g. China).
417 This conclusion may be a consequence of the time period in which the literature review was conducted,
418 inasmuch as research papers included in the review were dominated by empirical investigation of the
419 horsemeat adulteration incident, on which the consumer research identified in this review has focused,
420 and which was widely reported to carry only minor risks to food safety or public health. Thus, it is
421 predicted attitudinal responses may vary according to the countries affected by specific fraud incidents
422 studied, and the academic tradition of assessing risk perceptions and related attitudes within those
423 countries. Thus, the extent to which the review can be representative of European consumer views is
424 therefore questionable.

425 Taking the case of the Czech Republic spirit fraud case, there is evidence that the incident has opened up
426 a range of alcohol consumption issues in Czech society associated with the health risks of alcohol more
427 generally (SZU, no date), and has had a direct impact on the alcohol consumption habits of Czech citizens,
428 where consumption of spirits had declined dramatically (Přibyllová, 2014), although there is no perceptual
429 or attitudinal analysis available to explain this decline. Unsurprisingly, the incident was associated with
430 extensive media reporting of the risks and its underlying causes (Kolátorová, 2016), including a television
431 film in Czech, "Methanol", which detailed the course of events (Aktualne, 2018). The methanol affair has
432 financially damaged both small and large retailers and distributors, who have also suffered a loss of
433 consumer confidence in their products in addition to significant financial losses. Measures taken against
434 illegal production and distribution of alcohol have to some extent mitigated consumer concerns, and
435 Czech citizens are more interested in the origin and brand of alcohol than before the occurrence of the
436 incident (Hajslova, personal communication). The lack of English language publications (both in peer
437 reviewed journals and in the English language media) may be interpreted as a "construal" effect, such

438 that people mentally construe objects that are psychologically near in terms of low-level, detailed, and
439 contextualized features, whereas if they perceive the “threat” is located at a distance they construe the
440 same objects or events in terms of high-level, abstract, and stable characteristics (Trope, Liberman, &
441 Wakslak, 2007). Thus, the social scientific and media interest in this particular incident outside of the
442 Czech Republic was limited. Similarly, as noted in the introduction, Italy is the European country with the
443 highest number of food fraud incidents reported. However, peer reviewed journal articles on the impacts
444 on public perceptions about, and attitudes towards, food fraud and authenticity were not identified.
445 Further investigation examining local language publications including the grey literature may indicate
446 greater availability of information. For example, if the incidents are linked to fraudulent PDO/PGI
447 products, then there is potential for industry/organisation reports to detail responses rather than
448 academic articles.

449 Consumer trust and confidence, particularly in the food industry, was shown to be negatively affected
450 following the occurrence of a food fraud incident, with perceptions that intentional deceit was intended
451 on the part of supply chain actors undermining consumer confidence in the information they provide.
452 There was evidence that European consumer confidence could be restored relatively quickly if
453 appropriate remedial action was taken to mitigate quality or food safety problems within supply chains.
454 Food industry actors were blamed for the occurrence of food fraud. While the role of regulatory
455 organisations in the prevention of fraud was noted, these institutions were not considered by consumers
456 to have colluded with industry in perpetrating such acts. However, there appeared to be some
457 discrepancy in consumer opinion as to whether the detection of fraud in food systems by regulatory
458 authorities was evidence of their negligence, or whether it signalled vigilance and effectiveness of their
459 surveillance activities. Independent of this, consumers required immediate corrective actions to be taken
460 by all stakeholders within the food system if fraud was detected.

461 Past incidents and consistent media reports of malevolence in the food chain have potential to
462 undermine or promote consumer confidence in food systems, trust in food industry and institutional
463 actors and their actions, and in the food system as a whole. Societal discussion about an incident, in
464 particular media reporting, may amplify (increase) and subsequently attenuate (reduce) public
465 perceptions of not only the risks but other salient features of the incident such as attribution of blame
466 and institutional controllability (Kasperson et al., 1988). One consequence may be that consumers will
467 seek alternative products to those associated with the affected supply chain, supplier, or region or
468 country of production (Böcker, 2002; Jin, Zhang, & Xu, 2017), or question the motives of those tasked
469 with consumer protection.

470 Consumer reactions have also been shown to be fuelled by feelings of deceit and betrayal by
471 stakeholders in the food chain, the way in which events are portrayed by the media, and the perceived
472 efficacy of political responses and fraud mitigation actions (Kasperson, Jhaveri, & Kasperson, 2013; Regan

473 et al., 2015), together understood as “social amplification of risk”. Such effects have been documented in
474 relation to other food safety incidents (e.g. genetically modified foods, (Frewer, Miles, & Marsh, 2002)
475 BSE (Frewer & Salter, 2002; Lewis & Tyshenko, 2009). In the time period evaluated by this research, the
476 major incident which was subject to an empirical analysis of consumer attitudes was that of horsemeat in
477 the beef supply chain. The results of the thematic analysis would suggest that social amplification effects
478 had occurred in relation to concerns about the security and governance of the beef supply chain, but
479 that, in the absence of widespread reporting about major public health threats, that social amplification
480 of risk (perceptions) were not as great as has been the case for other high profile food fraud and food risk
481 incidents. The results of the systematic review as applied to the horsemeat incident would be in line with
482 the social amplification of risk framework, which suggests that the content of societal discourse about a
483 specific issue influences perceptions and attitudes, as does the absolute levels and “availability” of this
484 discourse. However, evidence about attenuation (or reduction) of these same concerns was not provided,
485 possibly because information about mitigatory actions were not reported, the timeframe of analysis was
486 too brief for attenuation to occur, or that attenuation did not result as a consequence of institutional
487 actions and societal discourse about these.

488 Consumers perceived fraud to be perpetrated by legitimate food chain actors, primarily food producers
489 and manufacturers. This is consistent with evidence about which actors have perpetrated identified cases
490 of fraud in Europe. However, food fraud can also be committed by external actors, e.g. criminals
491 infiltrating legitimate food systems, who have been acknowledged to be fraud perpetrators within the
492 wider food fraud literature (see *inter alia* (Elliott, 2014; Lord et al., 2017; van Ruth, Luning, Silvis, Yang, &
493 Huisman, 2018; van Ruth et al., 2017). This was not identified as important by consumers in the research
494 reviewed here, although questions that aimed to assess which actors were the perpetrators of fraudulent
495 activities were not explicitly included within the studies reviewed.

496 Consumers face a situation of information asymmetry, whereby they are required to trust the
497 information provided to them by the food industry and organisations involved in its regulation regarding
498 the integrity of food that they purchase and consume. There is evidence that consumers question the
499 integrity of information that they receive, and require increased transparency across the food system.
500 Traceability systems that allow food to be tracked and traced throughout all stages of production were
501 viewed by consumers as an important mechanism for verifying the origin of food products, and in
502 addition helped to provide consumers with authenticity assurances. The development of multiple
503 information delivery mechanisms, including on-product information linked to product origin and
504 traceability systems, may facilitate communication with consumers. Information channels including
505 barcodes, QR codes and online material can provide more detailed information about a product’s origins
506 and journey through the supply chain. Technological advances in tracking and tracing may further

507 reassure consumers about the authenticity of products, with blockchain technology in particular thought
508 to provide a particularly secure and transparent means of guaranteeing authenticity (Galvez et al., 2018).

509 Consistent with the findings of Chinese consumer research (see (El Benni et al., 2019; Kendall et al., 2019;
510 Kendall et al., 2018), the results of the review suggested that consumers in Europe had taken measures to
511 mitigate the risks associated with food fraud. Product avoidance, brand, retailer switching, and product
512 substitution were the most commonly identified consumer responses to fraud and/or the threat of fraud
513 within food supply chains. For industry this presents a significant economic motive to ensure that
514 production is compliant with European food standards, and that appropriate measures are taken to
515 reduce potential vulnerabilities to fraud within food supply chains (see Esteki et al. (2019) for a summary
516 of these), which may or may not originate from actors within these chains. Moreover, it also signals the
517 importance of communication with consumers regarding measures taken to protect their interests in
518 relation to the integrity of food and reduce information asymmetries between consumers and industries
519 (Esteki et al., 2019).

520 **5 Summary**

521 Consumer perceptions of and attitudes towards food fraud represents a relatively new addition to the
522 consumer risk literature. Food fraud is of concern to the European public, and consumer concern has
523 increased following highly publicised cases, such as the horsemeat incident. The findings of this
524 systematic review imply that reassurances surrounding product origin can engender consumer trust, as
525 can demonstrating product traceability within the supply chain. Providing evidence of effective
526 surveillance, and regulatory enforcement, need to be embedded in communication with the public. The
527 adoption of theoretically underpinned research that links risk perceptions and attitudes to (different)
528 food fraud incidents is needed, and would allow for comparisons across different consumer
529 characteristics and information needs. More research is also required to study consumer reactions to
530 food fraud incidents across Europe, and to assess the long term impacts on consumer confidence of
531 interventions designed to combat food fraud on consumer confidence.

532 **6 Strengths and weaknesses of the review**

533 This review has identified empirical research exploring European consumers' attitudes and perceptions of
534 food fraud. The 2013 horsemeat incident prompted British, Irish and Dutch researchers to examine both
535 the origin of the fraud incident perpetration and consumers' responses. However, the results of this
536 research may not be representative of European consumer perceptions of, and attitudes to, food fraud
537 more generally, as the research was linked to a specific incident with limited public or environmental
538 health impacts. In addition, this review included only studies published in English. As noted, publications
539 that may have explored consumer perceptions in relation to the Eastern European spirit adulteration
540 incident, and others that were published in European languages other than English, were excluded from
541 this review. Moreover, it is possible that there is additional inaccessible literature such as company

542 reports which may have provided additional information about consumer perceptions and attitudes.
543 Thus, it is not possible to generalise the findings of this paper to describe the attitudes of all European
544 consumers in response to all types of fraud. There is, therefore, a need to conduct consumer attitudinal
545 research as and when food incidents occur, as consumer perceptions and attitudes are likely to be
546 shaped by recently occurring events presented in a “crisis” context. Future research might also usefully
547 consider exploring the differences in consumer reactions to different food fraud incidents. Finally, the
548 time period in which the research was conducted (20 years from 1998) would eliminate the possibility of
549 including research on food fraud incidents which have occurred prior to 1998, which may be particularly
550 relevant if social amplification and attenuation of risk perceptions have occurred, i.e. increased food risk
551 perception may be temporary and time-bound, congruent to the societal discourse associated with a risk
552 event. The time frame for the review was based on the assumption that consumer research in relation to
553 food fraud is comparatively recent, in line with institutional recognition that there is a need to detect and
554 mitigate it.

555 7 References

556 Agnoli, L., Capitello, R., De Salvo, M., Longo, A., & Boeri, M. (2016). Food fraud and consumers' choices in
557 the wake of the horsemeat scandal. *British Food Journal*, 118(8), 1878-1893. doi: 10.1108/bfj-04-2016-
558 0176

559 Aktualne. (2018). "Tekutá smrt" mohla v Česku zabít 150 tisíc lidí. Kvůli lidské blbosti, říkají tvůrci filmu
560 Metanol. Retrieved 24th April 2019, from [https://magazin.aktualne.cz/televize/film-metanol-ceska-
561 televize-metanolova-afera/r~6a53f69243cc11e8a79a0cc47ab5f122/?redirected=1554673389](https://magazin.aktualne.cz/televize/film-metanol-ceska-televize-metanolova-afera/r~6a53f69243cc11e8a79a0cc47ab5f122/?redirected=1554673389)

562 Al-Tal, S. M. S. (2012). Modeling information asymmetry mitigation through food traceability systems
563 using partial least squares. *Electronic Journal of Applied Statistical Analysis*, 5(2), 237-255.

564 Barbarossa, C., De Pelsmacker, P., Moons, I., & Marcati, A. (2016). The influence of country-of-origin
565 stereotypes on consumer responses to food safety scandals: The case of the horsemeat adulteration.
566 *Food quality and preference*, 53, 71-83. doi: <https://doi.org/10.1016/j.foodqual.2016.05.015>

567 Barnett, J., Begen, F., Howes, S., Regan, A., McConnon, A., Marcu, A., . . . Verbeke, W. (2016). Consumers'
568 confidence, reflections and response strategies following the horsemeat incident. *Food Control*, 59, 721-
569 730.

570 BBC News. (2017). Fipronil egg scandal: What we know. Retrieved 29th November 2018, from
571 <https://www.bbc.co.uk/news/world-europe-40878381>

572 Böcker, A. (2002). Consumer response to a food safety incident: exploring the role of supplier
573 differentiation in an experimental study. *European Review of Agricultural Economics*, 29(1), 29-50.

574 Boeri, M., Brown, H., Longo, A., Agnoli, L., De Salvo, M., Vrontis, D., . . . Tsoukatos, E. (2015).
575 AUTHENTICITY AND FOOD SAFETY IN READY TO HEAT LASAGNE: AN EVALUATION AFTER THE 'HORSE
576 MEAT SCANDAL'.

577 Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*,
578 3(2), 77-101.

579 Brooks, S., Elliott, C. T., Spence, M., Walsh, C., & Dean, M. (2017). Four years post-horsegate: an update
580 of measures and actions put in place following the horsemeat incident of 2013. *npj Science of Food*, 1(1),
581 5.

582 Charlebois, S., Schwab, A., Henn, R., & Huck, C. W. (2016). Food fraud: An exploratory study for
583 measuring consumer perception towards mislabeled food products and influence on self-authentication
584 intentions. *Trends in Food Science & Technology*, 50, 211-218.

585 Chousou, C., Tsakiridou, E., & Mattas, K. (2018). Valuing Consumer Perceptions of Olive Oil Authenticity.
586 *Journal of International Food and Agribusiness Marketing*, 30(1), 1-16. doi:
587 10.1080/08974438.2017.1382418

588 Cicia, G., & Colantuoni, F. (2010). Willingness to pay for traceable meat attributes: a meta-analysis.
589 *International Journal on Food System Dynamics*, 1(3), 252-263.

590 Clark, B., Stewart, G. B., Panzone, L. A., Kyriazakis, I., & Frewer, L. J. (2016). A systematic review of public
591 attitudes, perceptions and behaviours towards production diseases associated with farm animal welfare.
592 *Journal of Agricultural and Environmental Ethics*, 29(3), 455-478.

593 Covidence systematic review software. Melbourne, Australia.: Veritas Health Innovation. Retrieved from
594 www.covidence.org

595 Crane, J., & Brown, G. (2013). FSA–Consumer Attitudes to Towards the Horse Meat Contamination Issue.

596 De Jonge, J., Frewer, L., Van Trijp, H., Jan Renes, R., De Wit, W., & Timmers, J. (2004). Monitoring
597 consumer confidence in food safety: an exploratory study. *British Food Journal*, 106(10/11), 837-849.

598 Devaney, L. (2016). Good governance? Perceptions of accountability, transparency and effectiveness in
599 Irish food risk governance. *Food Policy*, 62, 1-10. doi: 10.1016/j.foodpol.2016.04.003

600 Doherty, E., & Campbell, D. (2014). Demand for safety and regional certification of food Results from
601 Great Britain and the Republic of Ireland. *British Food Journal*, 116(4), 676-689. doi: 10.1108/bfj-10-2011-
602 0266

603 El Benni, N., Stolz, H., Home, R., Kendall, H., Kuznesof, S., Clark, B., . . . Chan, M.-Y. (2019). Product
604 attributes and consumer attitudes affecting the preferences for infant milk formula in China—A latent
605 class approach. *Food quality and preference*, 71, 25-33.

606 Elliott, C. (2014). Elliott Review Into the Integrity and Assurance of Food Supply Networks-Final Report: A
607 National Food Crime Prevention Framework: Department for Environment, Food & Rural Affairs Food
608 Standards Agency.

609 Esteki, M., Regueiro, J. & Simal-Gándara, J. (2019). Tackling Fraudsters with Global Strategies to
610 Expose Fraud in the Food Chain. *Comprehensive Reviews in Food Science and Food Safety*, 18(2),
611 425-440.

612 European Commission. (2010). 2010 Eurobarometer survey report on risk perception in the EU.

613 European Commission. (2017a). The EU Food Fraud Network and the System for Administrative
614 Assistance & Food Fraud. Annual report 2017.

615 European Commission. (2017b). Fipronil in eggs.

616 European Commission. (2017c). Fipronil in eggs: Factsheet - December 2017. 5th December 2018, from
617 <https://ec.europa.eu/jrc/en/publication/brochures-leaflets/fipronil-eggs-factsheet-december-2017>

618 European Commission. (2019). Knowledge centre for food fraud and quality. Retrieved 24th April 2019,
619 from https://ec.europa.eu/knowledge4policy/food-fraud-quality_en

620 European Commission. (no date). The EU Food Fraud Network. Retrieved from
621 https://ec.europa.eu/food/safety/food-fraud/ffn_en

622 Europol. (2017). EUR 230 MILLION WORTH OF FAKE FOOD AND BEVERAGES SEIZED IN GLOBAL OPSON
623 OPERATION TARGETING FOOD FRAUD. 5th December 2018, from
624 [https://www.europol.europa.eu/newsroom/news/eur-230-million-worth-of-fake-food-and-beverages-](https://www.europol.europa.eu/newsroom/news/eur-230-million-worth-of-fake-food-and-beverages-seized-in-global-opson-operation-targeting-food-fraud)
625 [seized-in-global-opson-operation-targeting-food-fraud](https://www.europol.europa.eu/newsroom/news/eur-230-million-worth-of-fake-food-and-beverages-seized-in-global-opson-operation-targeting-food-fraud)

626 Food Standards Agency. (2017). National Food Crime Unit. Retrieved 17th April 2019, from
627 <https://www.food.gov.uk/about-us/national-food-crime-unit>

628 Frewer, L., Fischer, A., Brennan, M., Bánáti, D., Lion, R., Meertens, R., . . . Vereijken, C. (2016).
629 Risk/benefit communication about food—a systematic review of the literature. *Critical reviews in food*
630 *science and nutrition*, 56(10), 1728-1745.

631 Frewer, L., & Salter, B. (2002). Public attitudes, scientific advice and the politics of regulatory policy: the
632 case of BSE. *Science and public policy*, 29(2), 137-145.

633 Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1996). What determines trust in information
634 about food-related risks? Underlying psychological constructs. *Risk analysis*, 16(4), 473-486.

635 Frewer, L. J., Miles, S., & Marsh, R. (2002). The media and genetically modified foods: evidence in support
636 of social amplification of risk. *Risk Analysis: An International Journal*, 22(4), 701-711.

637 Galvez, J.F., Mejuto, J.C. & Simal-Gandara, J. (2018). Future challenges on the use of blockchain for
638 food traceability analysis. *TrAC Trends in Analytical Chemistry*, 107, 222-232.

639 Glaser, B. S., & Strauss, A. (1971). *The discovery of grounded theory*. . New York.

640 Grayson, K., & Martinec, R. (2004). Consumer perceptions of iconicity and indexicality and their influence
641 on assessments of authentic market offerings. *Journal of Consumer Research*, 31(2), 296-312.

642 Hansen, J., Holm, L., Frewer, L., Robinson, P., & Sandøe, P. (2003). Beyond the knowledge deficit: recent
643 research into lay and expert attitudes to food risks. *Appetite*, 41(2), 111-121.

644 Hansstein, F. V. (2014). Consumer knowledge and attitudes towards food traceability: a comparison
645 between the European Union, China and North America. Paper presented at the 2014 International
646 conference on food security and nutrition IPCBEE.

647 Higgins, J. P., & Green, S. (2011). *Cochrane handbook for systematic reviews of interventions* 5.1. 0. The
648 Cochrane Collaboration, 33-49.

649 Hobbs, J. E., & Goddard, E. (2015). Consumers and trust. *Food Policy*, 52, 71-74.

650 Jin, S., Zhang, Y., & Xu, Y. (2017). Amount of information and the willingness of consumers to pay for food
651 traceability in China. *Food Control*, 77, 163-170.

652 Kasperson, R., Jhaveri, N., & Kasperson, J. X. (2013). Stigma and the social amplification of risk: Toward a
653 framework of analysis. In J. Flynn, P. Slovic, & H. Kunreuther (Eds.), *Risk, media and stigma*.
654 *Understanding public challenges to modern science and technology* (pp. 9-27): Routledge.

655 Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., . . . Ratick, S. (1988). The social
656 amplification of risk: A conceptual framework. *Risk analysis*, 8(2), 177-187.

657 Kendall, H., Kuznesof, S., Dean, M., Chan, M.-Y., Clark, B., Home, R., . . . Brereton, P. (2019). Chinese
658 consumer's attitudes, perceptions and behavioural responses towards food fraud. *Food Control*, 95, 339-
659 351.

660 Kendall, H., Naughton, P., Kuznesof, S., Raley, M., Dean, M., Clark, B., . . . Zhong, Q. (2018). Food fraud
661 and the perceived integrity of European food imports into China. *PLOS One*, 13(5), e0195817.

662 Kolátorová, L. (2016). Methanol affair in the czech media (Metanolová aféra v českých médiích).
663 (Masters), Charles University Prague. Retrieved from
664 <https://is.cuni.cz/webapps/zzp/detail/139274/>,%20in

665 Lewis, R. E., & Tyshenko, M. G. (2009). The impact of social amplification and attenuation of risk and the
666 public reaction to mad cow disease in Canada. *Risk Analysis: An International Journal*, 29(5), 714-728.

667 Liu, M. J., Yannopoulou, N., Bian, X., & Elliott, R. (2015). Authenticity perceptions in the Chinese
668 marketplace. *Journal of Business Research*, 68(1), 27-33.

669 Lobb, A. (2005). Consumer trust, risk and food safety: A review. *Food Economics-Acta Agriculturae*
670 *Scandinavica*, Section C, 2(1), 3-12.

671 Lord, N., Flores Elizondo, C. J., & Spencer, J. (2017). The dynamics of food fraud: The interactions between
672 criminal opportunity and market (dys) functionality in legitimate business. *Criminology & Criminal Justice*,
673 17(5), 605-623.

674 Luhmann, N. (2000). Familiarity, confidence, trust: Problems and alternatives. *Trust: Making and breaking*
675 *cooperative relations*, 6, 94-107.

676 Lyon, F., & Porter, G. (2007). Market institutions, trust and norms: exploring moral economies in Nigerian
677 food systems. *Cambridge Journal of Economics*, 33(5), 903-920.

678 Martinez, M. G., & Epelbaum, F. B. (2011). The role of traceability in restoring consumer trust in food
679 chains *Food Chain Integrity* (pp. 294-302): Elsevier.

680 Meader, N., King, K., Llewellyn, A., Norman, G., Brown, J., Rodgers, M., . . . Stewart, G. (2014). A checklist
681 designed to aid consistency and reproducibility of GRADE assessments: development and pilot validation.
682 *Systematic reviews*, 3(1), 82.

683 Meijboom, F. L., Visak, T., & Brom, F. W. (2006). From trust to trustworthiness: Why information is not
684 enough in the food sector. *Journal of Agricultural and Environmental Ethics*, 19(5), 427-442.

685 Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic
686 reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*, 151(4), 264-269.

687 Nakyinsige, K., Man, Y. B. C., & Sazili, A. Q. (2012). Halal authenticity issues in meat and meat products.
688 *Meat Science*, 91(3), 207-214.

689 Premanandh, J. (2013). Horse meat scandal—A wake-up call for regulatory authorities. *Food Control*,
690 34(2), 568-569.

691 Příbylová, E. (2014). Effect of methanol affair on patterns of alcohol use in the Czech Republic: online
692 survey (Vliv metanolové kauzy na vzorce užívání alkoholu v ČR: internetový průzkum). (Masters), Charles
693 University Prague.

694 QSR International Pty Ltd. (2012). Nvivo qualitative data analysis software (Vol. Version 10).

695 Regan, Á., Marcu, A., Shan, L. C., Wall, P., Barnett, J., & McConnon, Á. (2015). Conceptualising
696 responsibility in the aftermath of the horsemeat adulteration incident: an online study with Irish and UK
697 consumers. *Health, Risk and Society*, 17(2), 149-167. doi: 10.1080/13698575.2015.1030367

698 Salih, S. M. (2017). Authenticity and Quality of Muscle Foods: Assessing Consumer Trust and Fraud
699 Detection Approaches.

700 Snellings, W. M., McMartin, K. E., Banton, M. I., Reitman, F., & Klapacz, J. (2017). Human health
701 assessment for long-term oral ingestion of diethylene glycol. *Regulatory Toxicology and Pharmacology*,
702 87, S1-S20.

703 Spence, M., Stancu, V., Elliott, C. T., & Dean, M. (2018). Exploring consumer purchase intentions towards
704 traceable minced beef and beef steak using the Theory of Planned Behavior. *Food Control*.

705 Spink, J., & Moyer, D. C. (2011). Defining the public health threat of food fraud. *Journal of Food Science*,
706 76(9).

707 SZU. (no date). Metanolová aféra: Jaká je role alkoholu ve výživě člověka? . Retrieved 24th April 2019,
708 from <http://www.szu.cz/metanolova-afera-jaka-je-role-alkoholu-ve-vyzive-cloveka>

709 Thankappan, S. (2016). European food regulation and accountability: the interplay of influences shaping
710 the new regulatory terrain *Ethics, Law and Society* (pp. 81-116): Routledge.

711 Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic
712 reviews. *BMC Medical Research Methodology*, 8(1), 45.

713 Trope, Y., Liberman, N., & Wakslak, C. (2007). Construal levels and psychological distance: Effects on
714 representation, prediction, evaluation, and behavior. *Journal of consumer psychology*, 17(2), 83-95.

715 Tse, Y. K., Zhang, M. H., Doherty, B., Chappell, P., & Garnett, P. (2016). Insight from the horsemeat
716 scandal Exploring the consumers' opinion of tweets toward Tesco. *Industrial Management & Data
717 Systems*, 116(6), 1178-1200. doi: 10.1108/imds-10-2015-0417

718 Van Rijswijk, W., & Frewer, L. J. (2012). Consumer needs and requirements for food and ingredient
719 traceability information. *International Journal of Consumer Studies*, 36(3), 282-290. doi: 10.1111/j.1470-
720 6431.2011.01001.x

721 van Rijswijk, W., Frewer, L. J., Menozzi, D., & Faioli, G. (2008). Consumer perceptions of traceability: A
722 cross-national comparison of the associated benefits. *Food Quality and Preference*, 19(5), 452-464. doi:
723 <http://dx.doi.org/10.1016/j.foodqual.2008.02.001>

724 van Ruth, S., Luning, P., Silvis, I., Yang, Y., & Huisman, W. (2018). Differences in fraud vulnerability in
725 various food supply chains and their tiers. *Food Control*, 84, 375-381.

726 van Ruth, S. M., Huisman, W., & Luning, P. A. (2017). Food fraud vulnerability and its key factors. *Trends*
727 *in Food Science & Technology*, 67, 70-75.

728 Yasar, S., & Boselli, E. (2015). Perception and awareness of the European Union food safety framework.
729 *Italian Journal of Food Science*, 27(1), 126-134.

730 Zakharov, S., Pelclova, D., Urban, P., Navratil, T., Diblik, P., Kuthan, P., . . . Vaneckova, M. (2014). Czech
731 mass methanol outbreak 2012: epidemiology, challenges and clinical features. *Clinical toxicology*, 52(10),
732 1013-1024.

733 Zhang, L., Xu, Y., Oosterveer, P., & Mol, A. P. (2016). Consumer trust in different food provisioning
734 schemes: evidence from Beijing, China. *Journal of Cleaner Production*, 134, 269-279.

735

736

737

738 ESTEKI, M., REGUEIRO, J. & SIMAL-GÁNDARA, J. 2019. Tackling Fraudsters with Global Strategies to Expose
739 Fraud in the Food Chain. *Comprehensive Reviews in Food Science and Food Safety*, 18, 425-440.

740 GALVEZ, J. F., MEJUTO, J. C. & SIMAL-GANDARA, J. 2018. Future challenges on the use of blockchain for food
741 traceability analysis. *TrAC Trends in Analytical Chemistry*, 107, 222-232.

742