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2
3 **Abstract**

4 There is an increasing number of food allergic reactions occurring in food services including
5 takeaways. This study investigated the food allergy knowledge, attitude and practices of staff in
6 takeaways. Although more than half of the takeaways' staff (n=28) demonstrated good food allergy
7 knowledge, there still exists some misunderstanding among the respondents. There were confusion
8 about lactose intolerance and milk allergy, a third of the takeaways' staff were uncertain that hands
9 could transfer allergens. Almost half of the respondents were not aware of the danger of offering
10 water to dilute a food allergen to stop the reaction Experienced staff and managers / owners reported
11 more positive attitude and higher frequency of good food allergen management practices.
12 Respondents also strongly agreed that customers should inform staff if they have food allergies.
13 However, takeaways' staff would enquire customers if they need allergen information when taking
14 orders over the telephone. Clear communication between front service staff, customers and kitchen
15 crew are important and should be established and meals verified with cooks to ensure safe meals are
16 prepared. Managers or owners should also strongly encourage their staff to participate in food allergy
17 training. Food Standards Agency has set up a free food allergy online training that would be a
18 valuable addition to food businesses.

19
20 **Keywords:** attitude; food allergy; food handlers; knowledge; practices

21
22 **Highlights**

- 23 • 43% (12) of takeaways' staff would mistakenly offer water to dilute a food allergen to stop
24 the reaction
- 25 • Takeaways' staff unanimously agreed it is customers' responsibility to inform them of their
26 food allergies
- 27 • Managers and owners were confident they can handle a food allergy emergency in the
28 takeaways compared to kitchen crew

29
30 **Introduction**

31 Food allergy is an adverse immune reaction that occurs upon exposure to specific food and the
32 reactions are reproducible (Moore, Stewart, & deShazo, 2017). The prevalence of food allergy is on
33 the rise globally and affects up to 4% adults and 6% children worldwide (Boye, 2012). Peanuts are
34 one of the top 10 foods responsible for the majority of food allergies in the United Kingdom (UK). In
35 fact, peanut allergy among children in the UK has doubled in the last 10 years and is approximately
36 1.5% (Immune Tolerance Network, 2017). Food allergy symptoms can range from mild (e.g. resulting
37 in hives and itching) to severe symptoms (e.g. vomiting, diarrhoea, wheezing) or even cause life-
38 threatening anaphylactic reactions. Each year in the UK, 10 patients die from food-induced

39 anaphylaxis due to undeclared allergenic ingredients (Food Standards Agency [FSA], n.d.). EU Food
40 Information for Consumers Regulation No. 1169/2011 (2014) requires food services (including
41 takeaways) to inform customers if the food contains any of the 14 major food allergens. The 14 food
42 allergens include cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk, tree
43 nuts, celery, mustard, sesame seed, sulphur dioxide and sulphites (more than 10 ppm), lupin and
44 molluscs. The information can be provided on the menu, noticeboard, communicated verbally by
45 member of staff or in other formats that are made available to the customers. If communicated
46 verbally, this must be made clear to customers on how they can access the information.

47
48 The only current method to prevent food allergy is to avoid the trigger food. This requires strict and
49 careful food avoidance of the specific food allergen. When purchasing food from outlets, consumers
50 should have access to food allergen information via the menu, recipe matrix, notice or upon enquiry
51 from staff. Takeaways are food outlets where hot food is ordered and paid for at the till; with limited
52 or no sit-in option; usually open after 5pm; outlets that are part of a chain and offers phone ordering
53 (Centre for Diet and Activity Research [CEDAR], 2014). There are now more than 50,000 takeaways
54 in England (Butler, 2017) and about one-fifth of adults and children in the UK consume one takeaway
55 meal at home weekly (Adams *et al.*, 2015). Factors such as limited kitchen space, shared cooking
56 equipment, utensils and requirements to complete a food order in minutes created additional
57 challenges in takeaways. Takeaways had been reported to cause a number of fatalities, (Evans, 2016;
58 Greenfield, 2017; O'Hare, 2013; Thorp, 2014) although the exact cases remain unknown.

59
60 In fact, more than a decade ago, Pratten and Towers (2003) reported that small food service
61 providers might not be able to respond adequately to allergen-free meal request. Multiple food safety
62 studies had been conducted in the service sector (Seaman & Eves, 2006), micro food operations
63 (Green & Kane, 2014) and among food handlers (Samapundo, Cam Thanh, Xhaferi, & Devlieghere,
64 2016; Moreb, Priyadarshini, & Jaiswal, 2017). Food allergen management remains a crucial part of
65 food safety management systems. Complaints had been recorded in the dairy food processing sectors
66 (Aguiar *et al.*, 2018) and assessment of food allergen management in small food facilities and
67 processing plants were proposed (Dzwolak, 2017) and should be incorporated as part of the food
68 safety management systems (Cusato *et al.*, 2014; Njage, Opiyo, Wangoh, & Wambui 2018). A
69 number of studies on food allergy knowledge and management have been conducted among
70 restaurants (Ajala *et al.*, 2010; Dupuis *et al.*, 2016; Lee & Sozen, 2016), college and university
71 catering services (Choi & Rajagopal, 2013; Verstappen, Miroso, & Thomson, 2018). A recent study by
72 Royal Society of Public Health (RSPH) (2015) conducted among 65 takeaways found that 70% of the
73 takeaways did not provide allergen information in the correct way and 54% did not know if one of the
74 major allergens were in their food. FSA (2016) revealed that food allergic reactions occurred in 25%
75 of restaurants or café and 9% from takeaway food. Even fewer studies have looked at food allergen
76 management practices among takeaways. Overall, there is little research conducted among

77 takeaways in the UK. Hence, this study aims to investigate the food allergy knowledge, attitudes and
78 practices of staff in takeaways.

79

80 **Materials and Methods**

81 Questionnaire development

82 The questionnaire was developed based on Ahuja and Sicherer (2001), Ajala *et al.* (2010), Bailey,
83 Albardiaz, Frew, & Smith (2011) and FSA (n.d.; 2015). The questions were divided into four sections:
84 (i) demographics (8 questions); (ii) knowledge (12 questions); (iii) attitudes towards food allergen
85 management (20 questions); and (iv) practices (20 questions). In the food allergen knowledge
86 section, participants were given the choices of 'yes', 'no' or 'uncertain'. Each correct answer was given
87 1 point, whilst incorrect or uncertain answer was given 0 point. Respondents that select all 4 correct
88 food allergens in Question K1 (select the food allergens which are required to be labelled or notified
89 in the UK) received 1 point. If tomatoes or chicken were selected, 0 point was given. Maximum food
90 allergy knowledge score is 12 points. Within the attitude section, participants were asked to indicate
91 using a 5-point Likert scale of strongly disagree (1) to strongly agree (5) and never (1) to always (5)
92 in the practices section. The questionnaire was pilot-tested face-to-face with three takeaway owners
93 based in Preston, UK to identify any ambiguities. Two of the takeaways' owners suggested that a text
94 box should be provided at the end of the questionnaire to allow respondents to provide further
95 comments or suggestions. The text box was included in the final revised questionnaire.

96

97 Data collection

98 Three hundred and twenty takeaways based in north-west of England were contacted using the
99 FSA's food hygiene ratings advanced search options. 'Takeaway' under business type and cities or
100 large towns based in local authorities of the five counties (Cheshire, Cumbria, Merseyside, Greater
101 Manchester and Lancashire) were selected. Systematic sampling using the FSA hygiene rating list was
102 carried out to ensure takeaways with hygiene ratings of 0 – 5 stars were selected. The breakdown of
103 takeaways according to hygiene ratings were as follow: 5 stars (n=110), 4 stars (n=70), 3 stars
104 (n=50), 2 stars (n=50), 1 star (n=30), 0 (n=10). The takeaways were sent a postal survey containing
105 the study information sheet, consent form, questionnaire and a postage paid return envelope.
106 Takeaways' staff were invited to participate in the study and were asked to return their signed
107 consent form and the questionnaire. Descriptive statistics and independent t-tests were carried out
108 using SPSS 24.0 and significance was set at $p < 0.05$. T-tests were used to identify if there were any
109 significant differences between years of experience (less or more than 5 years) and employee
110 working position (kitchen crew or manager / supervisor) in their knowledge, attitude and practices
111 towards food allergen management.

112

113 **Results and Discussion**

114 **Demographics**

115 Twenty nine takeaways responded to the survey and 28 completed the questionnaire and returned
116 the signed consent forms. This reflects a response rate of 8.75%. Ninety-three percent (n=26) of the
117 respondents have more than 1 year of working experience in food services whilst 86% (n=24) had
118 been working more than a year in their current takeaways. Twenty respondents have at least post-
119 secondary education. A large majority of the takeaways' staff (n=23) did not observe any food
120 allergic reaction cases in their takeaways in the past 12 months. Eight takeaways' respondents did not
121 receive any training specific to food allergen management in the past 12 months (Table 1). Food
122 businesses are required by law to ensure food handlers receive appropriate food hygiene training in
123 line with their work and they can handle food safely (FSA, 2018a). Food handlers can complete the
124 Level 2 Food Safety course that covers the principles and methods of safe food handling. FSA has
125 also set up a free food allergy online training (FSA, 2018b) which would be a valuable addition to
126 food business operators.

127

128 Insert Table 1 here

129

130 **Food allergen management knowledge**

131 At least 75% (n=21) of the respondents were aware of the food allergens required to be labelled in
132 the UK. More than 85% (n=24) of the respondents reported that they will get medical help
133 immediately if a guest is experiencing an allergic reaction. Most takeaways' staff (n=27) were aware
134 that consuming even a small amount of food allergen may cause severe reaction in food allergic
135 individuals. They were also aware of the need to use separate cooking oil for food with allergenic
136 ingredients or allergen free ingredients (n=26). However, the respondents were uncertain about the
137 differences between lactose intolerance and milk allergy (n=22). Nor were the takeaways' staff aware
138 of the danger of offering water to dilute a food allergen to stop the reaction (n=12). One third of the
139 staff did not know that allergens can be transferred by hands (Table 2). Two respondents scored full
140 points in the food allergy knowledge section whilst the majority of the takeaways' staff scored 9 or
141 10 points (Figure 1). In K1, 15 takeaways' staff selected the correct food allergens whilst 3 and 2 of
142 the staff thought chicken or tomatoes were mandatory in food allergen labelling. Independent t-test
143 between kitchen crew (including front service staff) (8.09 ± 1.70 ; n=11) and owners or managers
144 (9.12 ± 1.87 ; n=17) showed no significant difference in food allergy knowledge $t(26) = -1.47$, $p >$
145 0.05 . Although staff with more than 5 years of experience in the food service industry scored slight
146 higher (9.31 ± 2.25 ; n=13) compared to staff with less than 5 years experiences (8.20 ± 1.26 ;
147 n=15), no significance difference was observed between the two groups, $t(26) = -1.63$, $p > 0.05$.

148

149 Insert Table 2 here

150

151

152 According to EU FIC (2014), food businesses are required to inform customers of the 14 main food
153 allergens in UK/EU. This include cereal containing gluten, peanuts, soya, tree nuts, milk, egg, fish,
154 crustacean, mollusc, sesame seeds, celery, mustard, lupin and sulphites (> 10 ppm). Both chicken
155 and tomatoes are not required to be labelled but some respondents thought otherwise. Chicken meat
156 is considered hypoallergenic and avian meat allergy is uncommon (Michelet, Schluckebier, Petit, &
157 Caubet, 2017). Chicken (Kelso, Cockrell, Helm, & Wesley, 1999) and tomatoes (Pravettoni &
158 Primavesi, 2013) have been reported to cause allergic reactions. The only country which recommends
159 that chicken should be labelled as food allergen is Japan (Akiyama, Imai, & Ebisawa, 2011) while
160 tomatoes must be labelled in Korea (Gendel, 2012). Both chicken and tomatoes are not required to
161 be labelled as food allergens in the UK. Geographical location and dietary factors play a significant
162 role in influencing food allergy prevalence (Fiocchi, Dahdah, Fierro, Artesani, & Valluzi, 2018).
163 Slightly less than half of the takeaways' staff mistakenly thought one could offer water to individuals
164 suffering from allergic reaction in the hope of diluting the food allergen. Other studies revealed similar
165 results where 38% of restaurant staff (Bailey *et al.*, 2011) and 60% of Asian-Indian restaurants in UK
166 (Common *et al.*, 2013) believed that an individual experiencing an allergic reaction should drink water
167 to dilute the allergen. Other studies also reported that 71% of food handlers in Brazil (Ajala *et al.*,
168 2010) and 24% of restaurant workers in U.S. (Dupuis *et al.*, 2016) were unsure if offering water to
169 dilute the allergen was the right thing to do. The only current approved treatment of food allergy is
170 strict and careful allergen avoidance and emergency treatment with epinephrine for accidental
171 ingestions (Parrish, Kim, & Bird, 2018). There are however studies on food immunotherapy being
172 carried out to reduce sensitivity towards food allergen and to protect from accidental ingestion (Burks
173 *et al.*, 2018; Freeland *et al.*, 2017). These include oral immunotherapy (i.e. daily ingestion of allergen
174 powder) (Burks *et al.*, 2018), sublingual immunotherapy for peanut allergy (i.e. allergen extract is
175 applied in the space under the tongue) (Burks *et al.*, 2015) and epicutaneous immunotherapy (i.e.
176 where a small allergen patch is placed on the arm or back) for peanut (Jones *et al.*, 2017) and milk
177 allergy (Dupont *et al.*, 2010).

178

179 Close to 79% (n=22) of the respondents were confused between lactose intolerance and milk allergy.
180 Although there is limited survey among food services regarding the differences between milk allergy
181 and lactose intolerance, there are evidence suggesting general confusion between cow's milk allergy
182 and lactose intolerance (Heine *et al.*, 2017). There are some individuals with lactose intolerance who
183 may be able to tolerate a small amount of milk products but those with cow's milk allergy may
184 experience severe allergic reactions. Food handlers and milk-allergic customers should be aware of
185 hidden dairy products in meals (e.g. yogurt in curries, milk powder in sausages, whey protein in
186 fillings or sauces) (Anibarro, Seoane, & Mugica, 20017). There were also some misunderstanding and
187 uncertainty among the respondents when it comes to cross contact of food allergens involving hands.
188 This was inversely related to their attitudes when it comes to handwashing (Table 2). Handwashing is
189 an essential training component for all food handlers and has always been associated with reducing

190 transmission of pathogens such as *Staphylococcus aureus* (Aycicek, Aydogan, Kucukkaraaslan,
191 Baysallar, & Basustaoglu, 2004; Ebert, 2018) and *Escherichia coli* (Aycicek *et al.*, 2004) from hands to
192 food or work surfaces. However, effective handwashing can reduce cross contact of allergens too
193 (FARE, n.d.). For example, Perry, Conover-Walker, Pomes, Chapman and Wood (2004) reported that
194 handwashing with common cleaning agents such as liquid or bar soap were able to remove peanut
195 allergen.

196

197 This study reveals gaps in food allergy knowledge among takeaway staff and there remains
198 misunderstanding and confusion among staff. All takeaway staff should receive training in food
199 allergen management. This includes understanding the implications of food allergic reactions, risks of
200 cross contamination, appropriate handling, storing and segregation of food allergens and symptoms
201 associated with the allergic reaction and calling for medical help.

202

203 **Attitudes towards food allergen management**

204 Respondents scored highly in inspecting food labels of ingredients upon receipt (4.68 ± 0.82) and
205 generally have positive attitude towards food allergen management. There were strong disagreement
206 among all respondents regarding the usage of the same dishcloth for all purposes (1.43 ± 0.69).

207 Respondents also disagreed that it is food services' responsibility to ask customers about their food
208 allergies (2.79 ± 1.17). However, when it comes to ordering food online or by telephone, the
209 respondents somewhat agreed that they should ask customers if allergen information is required
210 (4.07 ± 0.98). The additional interface or absence of allergen notice may encourage staff to conduct a
211 quick check with the customers. There were significant differences between staff that have worked in
212 the food services for more than 5 years or less (Table 3). Those who have worked more than 5 years
213 strongly agreed that separate oil should be used to prepare allergen and non-allergen containing
214 meals ($t[26] = -2.41$, $p = 0.025$). Staff with more than 5 years of working experience also implied that
215 they were indifferent about marking food containers to identify non-allergenic dishes ($t[26] = 2.24$,
216 $p = 0.034$) and strongly felt that it is not the takeaways responsibility to ask about customers' food
217 allergy needs ($t[26] = 2.15$, $p = 0.04$). Kitchen crew and managers' attitudes differed significantly when
218 it comes to scheduling of meal preparation (i.e. if possible, non-allergenic meals should be prepared
219 before meals containing allergens) ($t[26] = -2.13$, $p = 0.04$). Manager and owners were more likely to
220 schedule the meal preparation to avoid potential cross contamination of food allergens into other
221 meals. Managerial level staff and owners usually have access to more food safety training compared
222 to kitchen crew. There is also a high turnover rate for front desk employee and kitchen staff
223 (Thaivalappil, Waddell, Greig, Meldrum, & Young, 2018) compared to managers and the owners and
224 this may have contributed to the lack of awareness among the kitchen crew. Managers and owners
225 also strongly agreed that they can handle a food allergy emergency in takeaways ($t[26] = -2.42$;
226 $p = 0.02$).

227

228 Both kitchen crew and managers strongly agreed that they checked the food labels for allergenic
229 ingredients. This differs from Ajala *et al.* (2010) where the managers in their study did not have the
230 habit of reading food labels compared to food handlers. Food labels of incoming materials need to be
231 reviewed to ensure correct ingredients and raw materials were received and to identify food allergens
232 that enter the takeaways (FSA, 2015). This is also part of the good receiving and storage practices
233 (Adams, 2018). Using different dishcloths for different purposes i.e. to dry clean utensils that had
234 been used for allergen and non-allergen meals is indeed good practice. Studies have shown that
235 dishcloths, sponges and towels are vehicles of pathogenic cross contamination (Hilton & Austin, 2000;
236 Tache & Carpentier, 2014). Although there are limited studies regarding the transfer of allergen
237 protein via dishcloths, this is an area warrant of further investigation. The respondents unanimously
238 agreed that it is the customers' responsibility to express their food allergies to the staff. This is
239 consistent with Wen and Kwon (2017) where the staff perceived that customers are responsible for
240 initiating communication with restaurant staff if they have food allergies. However, by proactively
241 asking customers if they have any food allergies will initiate the customers to voluntarily disclose their
242 allergy (Leithwich *et al.*, 2011). This can be helpful to engage with customers and prevent potential
243 food allergic reactions. Signposting of allergen information particularly in ensuring customers know
244 where to find the information or to ask a member of staff when purchasing the food at takeaways are
245 important (FSA, 2015). Although the onus is on regulators and food providers to ensure correct food
246 allergen information is provided, Begen *et al.* (2017) recommended that food allergic customers
247 should pursue their legal right to make allergen enquiries when eating out. The findings from this
248 study also clearly indicates that respondents understood that they should ask customers if allergen
249 information is required before taking an order on the telephone. This differs from a face-to-face
250 order as customers may not have direct access to visual allergen information. However, customer is
251 to be signposted to where the information can be obtained (e.g. an online menu) or the staff is to
252 provide the allergen information orally by telephone (FSA, 2015).

253

254 This study found that staff who have more than 5 years working experience did not place emphasis
255 on marking or placing stickers on food containers to identify allergenic ingredients used prior to
256 delivery. This is a cause for concern as lack of written information at the point of delivery may result
257 in difficulty in differentiating meals particularly if the food ordered are similar (e.g. stir-fried noodles
258 [with and without soy sauce]). Managers and owners agreed that if possible, non-allergenic meals
259 should be prepared before allergenic meals. But, back-of-house staff understood that orders need to
260 be fulfilled according to 'first come first serve' basis and the meals completed and delivered on time.
261 This fulfils consumers' demands for convenience and prompt delivery (Celnik, Gillespie, & Lean,
262 2012). Owners and staff with supervisory or managerial roles often have access to more food safety
263 training and this may have raised their awareness about the importance of reducing cross
264 contamination via meal scheduling. All front service staff and kitchen crew should be given refresher
265 training or online food allergen training (such as those offered by FSA) to prevent food allergy

266 incidences. Based on the number of increasing food allergic reactions in a food service setting
267 (Eisenberg & Delaney, 2018), it is crucial that members of staff are trained to recognise and respond
268 to adverse food allergic reactions. Prompt administration of epinephrine during an anaphylactic
269 reaction is the preferred method to treat anaphylaxis (Kemp, Lockey, & Simons, 2008) and guide to
270 using the self-injectable epinephrine should be included in food allergy training.

271

272 Insert Table 3 here

273

274 **Food allergen management practices**

275 When it comes to food allergen management practices, most respondents reported that they always
276 ensure clear communication regarding allergenic ingredients in meals with their customers
277 (4.93±0.26). Similarly, if customer has a food allergy, the respondents always ensured that the
278 information is communicated clearly to the cook (4.92±0.26) or they will verify with the cook if
279 customers request for specific allergen-free meals (4.93±0.26) (Table 4). Staff with more than 5
280 years' experience reported that they clean the kitchen surfaces frequently ($t[26]=-2.43, p=0.02$) and
281 tend to review the menu for allergens more often ($t[26]=-2.17, p=0.04$). There were however no
282 significant differences in allergen management practices between kitchen crew and managers or
283 owners. Clear communication between customers and front service staff to clearly identify which food
284 allergen(s) must be omitted and proper communication between the employee and kitchen crew and
285 cook is crucial to prevent food allergy reactions. Based on previous research, there is lack of training
286 in ensuring clear communication between front service staff and kitchen crew (Lee & Xu, 2014) and
287 inadequate communication led to food allergy reactions (Kwon & Lee, 2012; Leftwich *et al.*, 2011).

288

289 Insert Table 4 here

290

291

292

293 **Practical implications**

294

295

296 **Limitations**

297 The low response rate, small sample size (n=28) and self-reported practices remain major limitations
298 of this study. Edwards *et al.* (2002) suggested various measures to increase the response rate such
299 as (i) using personalised cover letter (e.g. by including names of takeaways), (ii) keeping the number
300 of items and length of questionnaire manageable; (iii) sending postal reminder; (iv) contacting
301 potential takeaways before sending the questionnaires to them; (v) ensuring anonymity and
302 confidentiality. Alternatively, face-to-face interviews could be carried out during non-peak hours to
303 encourage completion of survey. Another limitation was that no association was determined between

304 the level of knowledge, attitude and practices towards food allergen management and the hygiene
305 ratings of the takeaways as all completed questionnaires were anonymised. Future surveys should
306 allow takeaway staff to indicate the hygiene rating of their shops. This study cannot be generalised to
307 other takeaways or food service settings and observations of food allergen management practices in
308 such outlets are strongly recommended.

309

310 **Conclusion**

311 Food allergen management in takeaways cannot be over-emphasised. This study represents the first
312 reported survey of food allergy knowledge, attitude and practices of takeaways based in North West
313 England. Takeaways face challenges in terms of limited kitchen space, shared cooking equipment,
314 utensils and staff are required to complete (and deliver) an order in minutes. All these challenges
315 represent a 'time bomb' as mistakes (e.g. cross contact or accidental addition of food allergens) can
316 be life threatening and damaging to the takeaways. Clear communication between front service staff,
317 customers and kitchen crew are important to ensure correct allergen-free meals are prepared and
318 delivered. Although most takeaways' staff demonstrated good level of food allergy knowledge, there
319 still exist some misunderstanding of food allergens. For example, staff were confused about lactose
320 intolerance and milk allergy and would also offer water to customers suffering from food allergic
321 reactions to stop the reaction. They did not realise that hands are potential vehicles of cross
322 contamination for allergens. Misunderstandings may potentially place food allergic customers at risk
323 due to cross contamination of meals with food allergens. Experienced staff and managers / owners
324 also reported more positive attitude towards food allergen management practices compared to new
325 staff and kitchen crew. In addition to food safety training, managers or owners should strongly
326 encourage their staff to participate in food allergy online training. Food allergen management in
327 takeaways and food services warrant further research, particularly in collaboration with local city
328 councils as academia and Environmental Health Officers can share resources and time to conduct
329 more mystery dining exercises as part of the food safety inspection programme. This will reflect
330 actual practices of takeaways and provide further insights on how we could improve the food safety
331 and good allergen management practices of takeaways and food services in general.

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