

## Article

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# Food allergies and perceptions towards food allergen labelling in Mauritius

## Abstract

There remains a paucity of research in food allergies in Sub-saharan Africa. It is the aim of this study to determine the self-reported prevalence of food allergies and consumers' perceptions towards food allergen labelling in Mauritius. A survey was conducted in four supermarkets in the Municipalities of Vacoas-Phoenix, Quatre-Bornes and Moka during the period of September to November 2017. The questionnaire was designed based on previous studies and administered using a face-to-face interview approach to increase completion rate. Descriptive analysis and one-way ANOVA between subjects design were conducted. Shellfish was reported as the most common causative agent followed by fish, egg and peanut. Respondents were satisfied with the current font size and general information provided in food labels. Respondents agreed that it could be problematic to identify suitable foods for individuals suffering from food allergies or intolerances. Variations of PAL statements and generic terms provided in food labels, and location of allergy warnings were cause for concern. More than 80% of the respondents felt that allergens in ingredient list should be emphasised (e.g. bold font) and plain English or French language should be used to describe allergenic ingredients. The findings in this study provide practical insights on food allergen labelling issues for policy makers and stakeholders in the food supply chain. Determining the prevalence of food allergies in the country will inform policy makers to consider adding shellfish and other major allergenic ingredients to the list of ingredients requiring mandatory allergen warning label in Mauritius.

**Keywords:** food allergy; food regulations; precautionary allergen labelling; shellfish

## Introduction

Food allergy is a specific immunological adverse reaction to a trigger food while food intolerance is a form of non-immunologically mediated reaction (Fraser, Sumar, & Sumar, 2000). Examples of food intolerance include lactose intolerance where the individual lacks the ability to produce sufficient lactase needed to digest lactose. Food allergies can cause life-threatening anaphylactic reactions and reduce the quality of life of individuals with food allergies (Franzese, 2017). Food allergy affects up to

30 10% of the global population (Sicherer, & Sampson, 2018) and is increasingly reported in developed  
31 nations. For example, the prevalence of food allergy is estimated to be 5 – 10% in infants and 5% in  
32 young children in Japan (Ebisawa *et al.*, 2017), 6% in Europe (Nwaru *et al.*, 2014) and 8% of  
33 children in US (Gupta *et al.*, 2011). Codex stated that the eight common food allergens (cereals  
34 containing gluten, egg, milk, soy, peanuts, tree nuts, fish and shellfish) shall be declared (Codex Stan  
35 1-1985). There is still a paucity of research in less developing countries such as in the Africa region  
36 (Prescott *et al.*, 2013). Africa is also burdened by infectious and non-communicable diseases and lack  
37 of recognition of allergy as a clinical specialty due to limited health care infrastructure (El-Gamal,  
38 Hossny, El-Sayed, & Reda, 2017; Potter *et al.*, 2010). To date there are some reports of surrogate  
39 measures of food allergy such as self-reported reactions or sensitisation to food (Kung, Steenhoff, &  
40 Gray, 2014) such as those reported in Mozambique (Lunet, Falcao, Sousa, Bay, & Barros, 2005) and  
41 Tanzania (Justin-Temu, Risha, Abla, & Massawe, 2008). Gray *et al.* (2014) and Basera *et al.* (2015)  
42 also assessed the prevalence of food allergy in South Africa using questionnaires, skin prick testing  
43 and oral food challenge whilst Obeng *et al.* (2011) studied the prevalence of food sensitisation and  
44 reported food allergy among schoolchildren in Ghana. There is one report of food hypersensitivity in  
45 Mauritius which revealed that 20% of the participants reported symptoms of food allergies (Pugo-  
46 Gunsam, Cahoolessur, & Subratty, 2008).

47

48 Mauritius is a small island nation in the Indian Ocean with a population of more than 1.2 million  
49 (Naidoo, & Ramseook-Munhurrin, 2016). It is also a thriving international tourism hub since 1974  
50 where the travel and leisure industry contributed more than 10% of the total Gross Domestic Product  
51 (Ladkin, & Juwaheer, 2000; Statistics Mauritius, 2017). Protecting both local and international visitors  
52 are key and the Mauritian government has reinforced and updated the Food and Drugs Act with Food  
53 Act 1998 and Food Regulations (1999) since 1<sup>st</sup> January 2000 (Ministry of Health and Quality of Life,  
54 n.d.). The current food labelling regulations establish the standard labelling requirements of pre-  
55 packed food. There are currently no regulations requiring the mandatory labelling of food allergens in  
56 food products containing such ingredients (Food Regulations, 1999). This is understandable as the  
57 true prevalence of food allergy in Mauritius and a number of African countries are not known.  
58 However, there has been a report stating high self-reported symptoms of food sensitivity especially

59 towards seafood (Pugo-Gunsam *et al.*, 2008). Other food safety associated studies such as food  
60 additives (Koyratty, Aumjaud, & Neeliah, 2014), food hygiene practices (Subratty, Beeharry, & Chan  
61 Sun, 2006) and food safety management in fish industry (Ramnauth, Driver, & Vial, 2008) had been  
62 conducted in Mauritius. There is no cure for immunologically mediated food allergy and the main  
63 treatment or preventative step is avoidance of the trigger food. One of the key strategies to avoid  
64 food allergens is clear and accurate labelling. Studies on consumers' attitudes towards food allergen  
65 labelling were conducted mostly in developed nations (Cornelisse-Vermaat, Voordouw, Yiakoumaki,  
66 Theodoridis, & Frewer, 2007; Voordouw *et al.*, 2007). Food allergen labelling plays a crucial role in  
67 preventing development of food allergies among allergic individuals. Mfueni *et al.* (2018) carried out a  
68 study in Malawi and found that the country's food allergen labelling was the least demanding  
69 compared to other international regulations. This study aims to determine the self-reported incidence  
70 of food allergies and awareness of food allergen labelling in Mauritius.

71

## 72 **Methodology**

73 The questionnaire was constructed and divided into 3 sections: (i) demographics; (ii) self-reported  
74 food allergies and (iii) food allergen labelling. Several questions on using food labels in managing  
75 food allergies were included in Section III. Respondents were asked 'to what extent they agree or  
76 disagree on how serious a problem it is to identify suitable foods for individuals with food allergies or  
77 intolerances'. This was followed by a section on 'Improvements of food allergen labelling' and  
78 respondents were asked how important the improvements or changes were. The questions were  
79 developed based on Choi & Choi (2016), Cornelisse-Vermaat *et al.* (2007) and Pugo-Gunsam *et al.*  
80 (2008). A pilot study was conducted among 20 participants who were not included in the actual study  
81 to evaluate the language, clarity and suitability of wording. Four supermarkets in Municipalities of  
82 Vacoas-Phoenix, Quatre-Bornes and Moka were visited during the period of September to November  
83 2017. The supermarkets were visited on both weekdays and weekends as types of shoppers may  
84 differ. Individuals visiting the supermarkets in were approached and the purpose of the study was  
85 explained to them. The study targeted both males and females of different ages to represent a  
86 snapshot of the demographic characteristics of the participants. Participants were invited to  
87 participate in the study and interested participants were asked for their signed consent before

88 answering the survey questions. Young respondents (< 18 years old) could only participate in the  
89 survey if their parents provided the consent. The questionnaire was administered using a face-to-face  
90 interview approach as this helps to increase response and completion rate (Koyratty *et al.*, 2014).  
91 One hundred and thirteen respondents completed the survey. This is similar to Pugo-Gunsam *et al.*  
92 (2008) and Greiwe, Pazheri, & Schroer (2015).

93

#### 94 Statistical analysis

95 Statistical analyses were carried out using SPSS 24.0 (IBM Corp., NY, USA). Differences between age,  
96 gender and education levels were first analysed using one-way ANOVA between subjects design  
97 followed by pairwise comparison with Bonferroni's correction. Results were expressed as mean  $\pm$  SD  
98 and significance level was set at  $p < 0.05$ .

99

### 100 **Results and Discussion**

101 A total of 113 consumers participated in the study with more females (64.6%) responding to the  
102 survey compared to males. This is similar to other studies and reflect the demographics of mostly  
103 female adults conducting the shopping as they take more responsibility for shopping and preparing  
104 meals (Helgesen & Nasset, 2010; Juwaheer, Pudaruth, & Ramdin, 2013; Liu, & Niyongira, 2017).  
105 Participants mostly belong to the age bracket 25 – 54 years (62.83%), highly educated (53.98% held  
106 at least a degree) and tend to report their knowledge on food allergen labelling as somewhat  
107 knowledgeable (79.65%). Curtin, Presser, & Singer (2000) stated that more educated people are  
108 more likely to respond to surveys and this could be largely attributable to the subject matter. All  
109 respondents reported symptoms of food allergies (including those experienced by their family  
110 members). Shellfish, egg, milk and peanuts were the most commonly reported trigger food (Table  
111 1). Most allergic reactions to seafood are IgE-mediated and can cause rapid onset of symptoms  
112 ranging from mild symptoms such as cutaneous reactions to severe anaphylactic reaction (Bahna,  
113 2016). Shellfish was the most commonly reported causative agent in Mauritius (Pugo-Gunsam *et al.*,  
114 2008) and Asia (Boye, 2012; Chiang *et al.*, 2007). Lunet *et al.* (2005) reported seafood allergy as the  
115 most frequent in Mozambique whilst crab was one of the major allergenic food in Zimbabwe  
116 (Westritschnig *et al.*, 2003). Based on Pugo-Gunsam *et al.* (2008) and this study, shellfish is reported

117 as one of the common allergenic food. Fish is an important component of Mauritian diet (Daby, &  
118 Sigurlinnason, 2003) and the strategic location enable the expansion of the fish industry in Mauritius  
119 (Ramnauth, Vial, & Driver, 2008). Due to the availability and frequency of consumption of seafood,  
120 this may have led to a higher increase in prevalence of seafood allergy (Lopata, O’Hehir, & Lehrer,  
121 2014; Sharp, & Lopata, 2014) as evident in regions such as Japan (Ebisawa *et al.*, 2017), Spain  
122 (Pascual *et al.*, 2008) and Philippines (Connett *et al.*, 2012).

123

124 Insert Table 1 here

125

126 Other food products reported to cause allergies among the respondents of this study were eggplant,  
127 food colourings, mushroom, chocolate, taro leaves and red and white beans. There are similar reports  
128 of unique ethnic food allergens such as eggplant allergy among Indians residing in US (Dinakar,  
129 Kamdar, Yarbrough, & Gupta, 2015) and India (Babu, Mahesh, & Venkatesh, 2008) and mushroom  
130 allergy (Hegde, Das, & Venkatesh, 2002). Subjects experiencing adverse reactions to eggplants could  
131 be due to pharmacologic action of histamine and other non-protein components (Babu *et al.*, 2008).  
132 Kumar *et al.* (2011) demonstrated that red beans showed cross reactivity with other legumes such as  
133 peanuts, soybean and chickpea and may induce allergic reactions in humans. Novel food allergens  
134 reported elsewhere in Africa include pineapple in Ghana, okra in Nigeria and mopane worm in  
135 Botswana (Kung *et al.*, 2014). Similarly, chocolate can trigger headache and migraine due to  
136 consumption of increased level of tyramine, which is naturally present in cocoa products (Finocchi, &  
137 Sivori, 2012). There is also a possibility of presence of milk and or nuts in chocolate that caused the  
138 sensitivity (Bedford, Yu, Wang, Garber, & Jackson, 2017).

139

140 Respondents reported having experienced symptoms mostly affecting their cutaneous (e.g. hives,  
141 eczema) and gastrointestinal (e.g. vomiting) systems followed by respiratory (e.g. shortness of  
142 breath), and circulatory systems (e.g. low blood pressure). Although not determined from this survey,  
143 anaphylactic reaction can cause hypotension or severe drop in blood pressure. Fourteen respondents  
144 reported either themselves or their family members have had experience of hypotension as one of  
145 the reactions to food. Food anaphylaxis can occur rapidly or within a few hours and is often

146 accompanied by angioedema in the lips, eye or tongue, followed by symptoms associated with other  
147 organ systems (e.g. wheezing / bronchospasm, hypotension and vomiting) (Sarinho, & Lins, 2017). In  
148 this case, epinephrine is the first line of treatment (Kemp *et al.*, 2008; Sarinho & Lins, 2017). About  
149 16% of the respondents indicated that they bring some forms of medications (e.g. anti-histamines or  
150 epi-pen) to treat a food allergic reaction. Forty percent of the respondents opted to see their general  
151 practitioner if they suffer from food allergic reactions. However, on the other end of the spectrum,  
152 37.2% of the respondents chose not to consult any healthcare professionals if they suffer from food  
153 allergic reactions (Table 1). Similar to cases of foodborne illnesses, patrons who experienced food  
154 poisoning often do not report the incident (Harrison *et al.*, 2014) or seek medical advice (Soon, Singh,  
155 & Baines, 2011).

156

157

158 More than 60% of the respondents agreed that the information provided in the ingredient list are  
159 easy to understand and the font size is sufficient for reading (Figure 1). This is in contrast to  
160 Cornelisse-Vermaat *et al.* (2007) and Voordouw *et al.* (2007) where the food allergic consumers  
161 reported that font sizes were too small and terminologies used in ingredients as difficult to  
162 understand. Singla (2010) also reported difficult terminologies and small font sizes were some of the  
163 major problems encountered by consumers. Fifty-nine percent of the respondents in this study felt  
164 that the ingredient list could provide more information about food allergens in the label. However,  
165 space limitation on the label limits how much information can be included (Verbeke, & Ward, 2006).  
166 There is also the potential of information overload to consider as excessive information may create  
167 confusion or even boredom among consumers (Salaun, & Flores, 2001).

168

169 Insert Figure 1

170

171 The consumers' responses were further evaluated in terms of their perceptions towards the food  
172 labels. 56.6% of the respondents agreed that it will be difficult for respondents with food allergies or  
173 intolerances if there are different variations of food labels among imported products. Males ( $3.85 \pm$   
174  $0.86$ ) were more concerned about the different labelling of imported food products ( $F = 5.97, p =$

175 0.016,  $p\eta^2 = 0.05$ ) compared to females ( $3.42 \pm 0.89$ ). Lack of harmonisation in food labelling  
176 practices across imported countries can cause confusion among consumers and may even restrict  
177 consumers' diet (Voordouw *et al.*, 2007). Gender also revealed significant difference in the  
178 information provided in E-numbers. Females ( $3.74 \pm 1.07$ ) were more concerned about details of  
179 food additives in the E-numbers ( $F=6.21$ ,  $p = 0.014$ ,  $p\eta^2 = 0.05$ ) compared to males ( $3.20 \pm 1.16$ ).  
180 There were strong agreement regarding the location of allergy warnings and usage of generic terms  
181 in ingredient lists (e.g. spices, vegetable oil). Ambiguous labels or terms may compromise consumers'  
182 ability to determine the safety of the food products (Joshi, Mofidi, & Sicherer, 2002). Consumers also  
183 felt that there is currently lack of manufacturers' or packers' details in the food labelling and that E-  
184 numbers should also provide an indication of types of ingredients. Interestingly, there were no  
185 significant differences between education levels. This could be explained by the fact that all  
186 respondents reported having experienced food allergies or intolerances themselves or by their family  
187 members. This represents a motivated group of respondents who may be keen to see changes in the  
188 current food labelling practices.

189

190 Insert Table 2

191

192 More than 80% felt that allergens in the ingredient list should be emphasised using bold or capitalised  
193 font or highlighted with suitable background colour. Different styles of emphasis could be used to  
194 emphasise the presence of allergens in the ingredient list or precautionary allergen labelling. Mfueni  
195 *et al.* (2018) revealed that bold font was the most frequently used font when declaring allergens in  
196 ingredient list. Other emphasis include contrasting colour, italics or enlarged font. Simple terms  
197 should be used to inform customers of the presence of allergens in the ingredients and this could  
198 either be in English or French terms. Complex ingredient terminology such as casein and whey for  
199 milk may compromise consumers' safety especially if they do not understand the terminologies for  
200 milk protein (Joshi *et al.*, 2002). In Joshi *et al.* (2002)'s study, only 4 of 60 parents correctly identified  
201 all the labels that indicated milk. Simons, Weiss, Furlong, & Sicherer (2005) reported that allergic  
202 reactions were attributed to misunderstanding of label terms or usage of generic terms (e.g. flavour  
203 or spice). A large proportion of the respondents felt that symbols could be used to indicate the



204 presence of allergens (87.6%) while 73.5% indicated that allergy warning could be placed adjacent to  
205 the ingredient list. Symbols such as asterisks (\*) were used in food labels to indicate presence of  
206 allergens. For example, an asterisk could be placed on vitamins\* to inform consumers that the  
207 vitamins \*contain soybean oil or sulphur dioxide\* to declare that the product \*contains preservative  
208 as sulphite in some fruits. Alternatively, internationally recognised symbol such as the Crossed Grain  
209 Symbol is used across Europe to signify gluten-free products that conform to high and safe standards  
210 of production (Association of European Coeliac Societies, 2015). Slightly more than 60% indicated  
211 that contact details should be included in the labelling and similar number of respondents reported  
212 that percentage of allergenic ingredients could be shown in the ingredient list. There were significant  
213 difference between age groups regarding manufacturer's contact details ( $F = 3.49$ ,  $p = 0.003$ ,  $\eta^2 =$   
214  $0.17$ ). Consumers under 17 years old ( $3.50 \pm 1.23$ ) were significantly less concern about the details  
215 compared to other age groups (more than 4.00 score). This is understandable as adults may be  
216 contacting the manufacturer on behalf of their allergic children and are responsible for finding out  
217 further information about usage of allergenic ingredients in the manufacturing environment. Contact  
218 details will enable consumers to communicate with manufacturers as indicated by Simons *et al.*  
219 (2005) where 86% consumers ( $n=486$ ) in their study contacted the manufacturers for more  
220 information. The Internet of Things (IoT) technologies could be utilised in future by integrating Quick-  
221 Response (QR) codes and radio frequency identification tag to food products to enable information  
222 sharing within the supply chain and consumers. QR codes that are a form of 2D barcodes will be  
223 useful in providing detailed information for allergic consumers (Kerbach *et al.*, 2009).

224

225 Shellfish is considered a major (self-reported) cause of food allergies in Mauritius. In the current  
226 Mauritian Food Regulations (1999), there is no specification requiring food manufacturers to declare  
227 the listing of foods causing hypersensitivity. The Codex General Standard for the Labelling of Pre-  
228 packaged Foods could be used as an international benchmark with reference to the foods and  
229 ingredients known to cause hypersensitivity (Codex Stan 1-1985). The eight foods listed in Codex –  
230 cereals containing gluten, eggs, milk, peanuts & soybeans (legumes), tree nuts & nuts, fish,  
231 crustacean and sulphite ( $> 10$  mg/kg) contribute to 90% of food allergic reactions (Bush, & Hefle,  
232 1996). This study is also of value to the food industry and healthcare practitioners as the findings

233 represent a snapshot of the food allergy status in Mauritius. Limited countries in Africa had carried  
234 out research in this area (Basra et al., 2015; Gray et al., 2014; Kung et al., 2014) and there remains  
235 numerous research and development opportunities for Mauritius and other African countries.

236 Determining the prevalence of food allergies in the country will inform policy makers to consider  
237 adding shellfish and other major allergenic ingredients to the list of ingredients requiring mandatory  
238 allergen warning label in Mauritius. Studies on assessment of food allergen management in food  
239 facilities such as those conducted by Dzwolak (2017) in Poland and Thailand (Waisarayutt et al.,  
240 2014) and costs for implementation of food safety and allergen management systems (Cusato et al.,  
241 2014) will be beneficial. Studies looking into the knowledge and practices of food handlers in food  
242 services (Ajala et al., 2010; Dupuis et al., 2017; Soon, in press) can also be carried out.

243

#### 244 **Conclusion**

245 The only current treatment for food allergies is to avoid the trigger food. This relies on accurate and  
246 clear declaration of allergens in ingredient list and unambiguous precautionary allergen labelling to  
247 inform consumers regarding the presence of allergens. Food allergy is a concern in Mauritius and  
248 more resources need to be allocated to determine the prevalence of food allergies. Mauritian  
249 consumers would like to see improvements in food allergen labelling such as using bold font to  
250 emphasise allergens in the ingredient list, plain English or French terminologies, symbol to indicate  
251 presence of allergen and the location of allergy warning adjacent to the ingredient list. Consumers  
252 would also like manufacturers or packers to include contact details on the food labels as this would  
253 allow consumers to enquire or to seek confirmation about the ingredients used and handling of food  
254 allergens on their premises. At this time, there remains extensive work in determining the prevalence  
255 of food allergies, investigating current food allergen labelling practices in pre-packaged food, and  
256 benchmarking and re-aligning the list of food allergens requiring mandatory declaration in food labels.  
257 Studies on consumers' attitudes and purchasing habits of food products with allergens will further  
258 identify the needs of public.

259

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