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No unique role for nausea attributed to eating a food in the recalled acquisition of sensory aversion for that food

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ABSTRACT

Currently in the UK, as in the USA 20 years ago, when students were asked to name a food that they did not like, more dislike for the food was attributed to nausea or vomiting after eating than to other gastrointestinal symptoms or to illness in other parts of the body. However, when members of the public first identified adverse symptoms and then attributed them to foods, and dislike for the food was first enquired about on a later occasion, there was no evidence for a unique role for a causal association with nausea in the human acquisition of food aversions. Furthermore, when there was less precision in recall of memories of the food being followed by nausea or vomiting and greater likelihood of mere coincidence rather than causal contingency, acquired sensory aversion was more prevalent than fear of the symptom. Therefore, more frequent invocation of nausea than some other symptoms as the cause of a sensory aversion to a food may result from personal theory of the body. It is less likely to have come from veridical recall of an occasion when nausea was contingent on eating the food, a precondition for the aversion to have been associatively conditioned.

INTRODUCTION

It has been widely claimed that nausea or vomiting is more likely than other adverse symptoms to condition aversions to the sensory characteristics of a food or drink. In a seminal paper, Pelchat and Rozin (1982) reviewed the evidence for this claim at that time from studies in human beings and experiments in other species. They reported the first systematic test of the hypothesis that adverse symptoms from the digestive tract are particularly potent at causing liking for a food to turn to dislike, and the most effective of these is nausea. They asked students (mainly) at the University of Pennsylvania (USA) to complete a questionnaire about a food that had been accompanied by discomfort or illness. After distinguishing those perceiving lactose malabsorption or food allergy from others, the first questions asked were about the disliked food. The respondent assigned one of Peryam and Pilgrim's (1960) nine ranked categories from *dislike extremely* to *like extremely* to their attitude to the food before it was accompanied by discomfort or illness and at the time of completing the questionnaire. They were asked to describe their symptoms freely after specifying the food and to circle it or them on a list after categorising their dislike/liking.

This questionnaire apparently had never been administered to British students and so the study was repeated at the University of Birmingham (England) after two decades. Shortly beforehand, the other authors of this paper had been collecting closely related data from members of the public during psychological and nutritional research into perceived food intolerance (Armstrong et al., 1997; Booth & Knibb, 2000; Booth, Knibb et al., 1999; Booth, Rowe & Armstrong, 1999; Knibb, Booth et al., 1999a, 1999b, 2000). A questionnaire, similar to the one used by Young et al. (1994) in their population study of food intolerance, was randomly mailed to registered voters. It asked first if respondents had suffered from any in a list of adverse symptoms and then to which sort of food or environmental agent, if any, each symptom was attributed. Respondents who blamed a food for a symptom and volunteered for further research were then interviewed in detail about their perception of food intolerance (or of food poisoning). Details of occasions when the symptom followed eating of the food were requested in order to test for veridicality of episodic memory (Knibb, Booth et al., 1999a) and to assess the likelihood of mere coincidence and of physiologically plausible brevity of delay between eating and illness. This follow-up interview also included a question whether or not liking for the food had turned to dislike after the symptom had followed consumption of that food. Thus, the idea of aversion to the food was raised only after detailed assessment of the possibility of a causal connection between food and symptom and of the perception that food caused the symptom that is expressed in associative conditioning of sensory aversion (Mackintosh, 1983; Rescorla, 1980).

The results collected by this different technique, from a more representative sample of the populace, are compared in this paper with the data collected from students of the same country using the technique of Pelchat and Rozin (1982), to seek convergent evidence for the role of nausea or vomiting in the acquisition of food aversions in human beings.

METHOD

Study One

Participants

Undergraduates (n=103) at the University of Birmingham in November 1998 were recruited from lecture classes on topics unrelated to eating behaviour.

Questionnaire

Similarly to Pelchat and Rozin (1982), the questionnaire was divided into sections, the first to be completed if the respondent suffered from a food allergy and the second if they had

suffered from physical discomfort or illness whilst or after eating a food. Both sections asked the same questions, starting with writing in which food was the culprit and then indicating which was the main symptom on the same list as that used by Pelchat and Rozin (1982). After questioning about the timing of eating the food and having the symptom, three questions about liking for the food were asked. Finally, the seriousness of the symptom and certainty that the food caused it were assessed.

Data analysis

Only the liking data are presented here. The respondent was asked how much the food was liked or disliked before the first time that it was accompanied by the adverse symptom, straight after that incident and at the time of completing the questionnaire. Each of the three answers was selected from one of the nine ordered verbal categories of the so-called hedonic scale of Peryam and Pilgrim (1960), numbered from 1 "dislike extremely" through 5 "neither dislike nor like" to 9 "like extremely." Jones, Peryam and Thurstone (1955) showed that the verbal categories were unequally spaced on the psychological dimension(s) of dislike and liking, using group discrimination statistics ("Thurstone scaling"). Moskowitz and Sidel (1971) and Schutz and Cardello (1997) supported that conclusion by comparisons with ratings of un/pleasantness under ratio instructions ("magnitude estimation"). Therefore the conventional scores 1-9 should be treated as mere ordinal data and so Kruskal-Wallis analysis of ranks was applied.

Study Two

Participants

A set of questionnaires to complete about each member of the household's experience of adverse reactions to foods (Young et al., 1994) was mailed to a randomised selection from the voting registers for economically diverse areas of Birmingham, England. This questionnaire first asked the respondent to indicate categories of adverse symptom that they had experienced. It then asked which agent, if any, the illness was attributed to, including an inclusive set of categories of food and of environmental hazards. The mailing process was stopped when 300 respondents replied that they, or one of their children, attributed one or more symptoms to one or more foods and that they were willing to contribute to further research. All such volunteers were interviewed, irrespective of age, education or ethnic origin. Parents answered for infants too young to understand the interview questions (7%). Children under the age of 16 were interviewed with one or both parents present (12%).

Interview

The interviews were conducted in the home of each interviewee at a prearranged convenient time. Each interview lasted about 30-60 minutes, depending on the number of foods reported to have caused symptoms and the complexity of the histories. Demographic data were noted first (age, gender, ethnic origin, census locality for economic score). Then information was elicited about each food and symptom identified by the interviewee, including the time between food ingestion and symptom onset, duration of symptoms and whether or not symptoms occurred every time the food was eaten. The first, subsequent and last occasions the interviewee remembered experiencing symptoms attributed to the food were also described.

Finally, interviewees were asked if they had liked the food before they attributed symptoms to it and whether they still liked it at the time of interview. If they said that they disliked the food after attributing symptoms to it, they were asked what it was that they now disliked about the food. Except for a few who gave no reason, interviewees said either that

they feared the symptoms that they now expected or that they did not like the flavour of the food.

Each account of an adverse symptom after eating a food was categorised for its likelihood to have been based on an actual episode(s) of food ingestion causing adverse symptom(s). Three sets of independent criteria were used, based on the characteristics of episodic memory (Tulving, 1984, 1993), the logic of contingency rather than coincidence, and physiological plausibility of a causal connection. This included criteria such as a short delay between food ingestion and symptoms (i.e. less than 24 hours), being asymptomatic on avoidance of the food and getting the same symptoms each time the food was eaten. Each food-symptom account was thus scored for the detail recalled, the likelihood of mere coincidence, and physiological plausibility (Knibb et al., 1999a). The higher each score, the more likely it was that the report was based on an actual episode of the symptom being caused by the eaten food.

Data analysis

With these data, there are two distinct ways in which to address the issue whether or not sensory aversion is associated most strongly with nausea and vomiting. Every reported association of a food with a symptom can be considered, although some people blamed two or more foods for their symptoms and sometimes other symptoms were reported to have occurred with nausea or vomiting. This approach maximises the number of data and so the power of the design to test the hypothesis. However, it infringes the assumption of independence of events on which the statistical analyses are based. Therefore the weaker design of taking only one food-symptom association from each interviewee is also analysed. Even if effects no longer reach statistical significance, it is important to see if the qualitative pattern of results persists in the more valid set of data.

RESULTS

Study One

The stated liking for foods immediately after their eating had supposedly been followed by an adverse symptom varied among types of symptom, with the mean for nausea or vomiting being the lowest and that for non-gastrointestinal symptoms being the highest (Table 1, data column 3). Indeed, foods blamed for nausea were the only group with mean score of the slightest dislike, i.e. below the neutral category at rank 5 (*neither like nor dislike*). This replicated the main observation by Pelchat and Rozin (1982). As they observed, this effect was not confounded by reported pre-existing likings, since all symptom groups had a mean close to the category *like moderately* (Table 1, first data column). However, the decreases in liking did not vary reliably among symptom groups, even though the largest was for nausea. This may have been at least in part because the nausea/vomiting group in fact had the lowest mean value for reported pre-existing likings - a potential indicator of some bias introduced by the thought of nausea or vomiting.

Table 1 about here

Also similarly to Pelchat and Rozin (1982), the foods were reported to be more liked by the time of answering the questionnaire; there were no longer significant differences between symptom groups (Table 1). This was interpreted by Pelchat and Rozin as partial extinction of the learnt aversive response. However, an assessment bias cannot be excluded, such as the distance in time of putative episodes when tasting the food was followed by the

symptom.

Following Pelchat and Rozin in pursuit of this change in effect, we picked out those respondents who professed not to have eaten the food since it had been followed by the illness (data in parentheses in Table 1). There was indeed a more highly significant variation among symptom groups in the stated liking immediately after the symptom had followed the food, with the other gastrointestinal (GI) symptoms group as well as the nausea/vomiting group differing significantly from the non-GI group. However, the lowering of the pre-existing liking was even more dramatic in this sub-analysis (albeit still non-significant, with sharply reduced Ns). As a result, the decrease in reported liking had a (non-significantly) higher value for other GI symptoms than that for nausea or vomiting. There is no basis in such data for concluding that an episode of nausea or vomiting had conditioned an aversion to the sensory characteristics of food, rather than an alternative interpretation of the questionnaire responses, such as the thought of nausea being extended to the food, with a rationale for such an attitude to that food's flavour being provided by the framework of questioning.

Study Two

Avoidance, dislike and aversion

The 300 volunteers for interview had between them blamed 614 foods for 863 unpleasant symptoms in their responses to the randomly mailed questionnaire; 50% attributed a symptom or symptoms to two or more foods. No mention of liking or dislike for a food had been made in the initial questionnaire.

At interview, 60% of the foods blamed for symptoms were reported to be avoided as much as possible by 65% of complainants. In 13 of these cases, the interviewee was speaking for a child under 8 on whose behalf they had completed one of the questionnaires mailed to their household. The 181 avoiders speaking for themselves were mainly adults; 19 were under 16 years of age.

During the interview, 35% of these avoiders (68 out of 194) stated that they had acquired a "dislike" of the food after they realised that its consumption induced the symptom (Table 2). These "dislikes" were reported to have begun at ages of 1 to 70 years (with a mean of 26 and median of 28). Half of these foods had been a regular part of the avoider's diet; the other half were reported to have been eaten rarely or tried for the first time when the symptom(s) occurred.

Table 2 about here

For 38 of these people (avoiding 48 foods), the "dislike" was characterised as a fear of experiencing unpleasant symptoms if they ate the food, and not an aversion to the food itself (Table 2). Another 29 avoiders (of 35 foods) stated that they had acquired a dislike of the "flavour" of the food, not a fear of eating it. Nobody expressed both a fear of consequences and a sensory aversion to any of the foods avoided. Three interviewees did not give a reason for their acquired dislike of three of the foods.

The ages at which "flavour" aversion was reported to have been acquired (mean: 20 years; median: 19 years) were lower than those at which fear was reportedly induced (mean: 33 years; median: 35 years), $t(76) = -3.4$, $p < 0.001$. The proportions of those who had professed to have come to "dislike" the blamed food and those who had become averse to the "flavour" did not vary appreciably between the genders or among ethnic origins or occupational categories.

All foods and symptoms

In the analysis of all food-symptom reports, the types of food to which a sensory aversion had been acquired differed from the food types whose supposed adverse effects had become feared by the interviewees (Table 3, far right-hand column), $\chi^2(5) = 10.9$, $P < 0.05$. Nuts and chocolate were associated solely with a fear of symptoms, whereas acquisition of an aversion to the flavour occurred proportionately most often with alcoholic and other beverages.

Table 3 about here

The types of symptoms reported to have been involved in the acquisition of a sensory aversion to the food also were significantly different from those said to have been the basis for acquiring a fear of eating the food, $\chi^2(4) = 14.7$, $p < 0.01$. Aversion was more common than fear after nausea and vomiting, but also after adverse behavioural and emotional states such as hyperactivity, irritability, anxiety and depression (Table 3, bottom row). In contrast, fear was related mainly to migraine, sinus problems, asthma and skin reactions. Nevertheless, most symptoms were implicated at interview in aversion in some cases and fear in others.

One food and symptom per person

In the second analysis, in order to test the hypothesis that nausea induces aversion, if an interviewee reported a food to which nausea or vomiting was blamed, that food and symptom was used to represent this person. The first symptom mentioned for the first food considered in the interview was used in other cases. The pattern of relationships that emerged among foods, symptoms and aversion or fear (Table 4) was similar to that seen for all food-symptom reports (Table 3), although frequencies were too low to compute χ^2. Sensory aversion was reported to have arisen after attribution of nausea or vomiting to fruit or vegetables, fried potato, meat or fish, or dairy produce. However, aversion was reported to have arisen also after attribution of behavioural and emotional symptoms to beverages or additives. Furthermore, fear was sometimes reported to have developed after nausea or vomiting in cases of attribution to the consumption of meat or fish, dairy products, additives or flavourings (Table 4). The ratio of averted to frightened individuals was high for nausea and vomiting but also for behavioural, mental and other symptoms. Aversions were also common after other digestive tract symptoms and after rashes or swellings.

Table 4 about here

Causal validity of testimony

Across all categories of adverse symptom, the more realistic in amount of detail was an account of an occasion when eating the food was followed by the symptom, the lower was the proportion of avoiders of the food professing sensory aversion to the food rather than fear of the symptom they thought it caused (Table 5), $\chi^2\ (4) = 16.6$, $p<0.002$. That is, the interviewees' testimony provided less evidence of an actual episode of eating the food followed by an adverse symptom when a sensory aversion had been acquired. The proportion of aversions to fears went up from 34/87 (39%) with a near-perfect score for detail to 24/34 (71%) where there was little of no evidence of veridicality of testimony by this measure.

This evidence that sensory aversion did not come from actual episodes of symptom following food extended across most categories of symptom (the exceptions being migraine and asthma or sinus problems: Table 5), although numbers were too small to reach significance for any single category of symptoms as all symptoms together did. Nausea or vomiting (Table 5, line 1) was associated with the highest proportion of aversions backed by

veridical memories (20/28 or 71% relative to fear). However, that datum does not distinguish between associative conditioning and semantic or imaginal attributional processes. The general pattern of increasing aversion with less veridicality was just as evident for nausea/vomiting (5/5 for episodes with the least detail). Therefore an attributional process is sufficient and so even the actual episodes may not have involved the conditioning of aversion by nausea.

Table 5 about here

Sensory aversion was particularly infrequent after skin symptoms when the interviewees provided evidence (high scores for Rarity, Table 5) against mere coincidence of eating the food and experiencing the symptom, χ^2 (4) = 11.3, $p<0.02$. For nausea and vomiting, the proportion of sensory aversions to symptom fears was also higher (63%) when there was little evidence of causal contingency between food and symptom (scores 0-2) than when testimony to a causal relation was strong (38%, for rarity scores of 3-5). However, too few interviews could be scored for this effect to approach statistical reliability.

Most accounts were highly plausible causally. Over all categories of symptoms, fear was marginally more related to high plausibility under these criteria than was sensory aversion or still liking the food (Table 5), χ^2 (4) = 8.3, $p = 0.08$. Aversions reported for nausea and vomiting were also related to high plausibility when compared with fear and still liking the food. However, that was not unique to nausea: the few behavioural symptoms showed the same extreme pattern (Table 5).

Discussion

British students two decades later gave very similar results to American students answering questions about dislike for a food and recall of the acquisition of that dislike after illness had followed eating the food (Pelchat & Rozin, 1982). Stronger aversions were attributed to the effects of nausea or vomiting than to those of other gastro-intestinal symptoms or illnesses of other sorts. The results were different when members of the public were asked first what symptoms they had suffered and what foods (if any) they attributed them to (Young et al., 1994) before being asked about liking changing to dislike. When these people were interviewed about occasions when the symptom followed eating the food, the frequency of reportedly acquired sensory aversions was no greater in attributions to nausea or vomiting than in some other symptom attributions, such as emotional distress.

More importantly, people who reported acquired flavour aversions were less likely than were people reporting fear of the symptom to give accounts that indicated they had actually experienced an incident when the symptom was contingent on eating the food. Sensory aversion was much more common than fear when recall performance provided less or no evidence that nausea or vomiting had actually occurred specifically after eating the blamed food. To the extent that recall performance can approach that of contemporaneous recording, the difference in the results of these two studies in the U.K. is evidence that nausea differs from other symptoms in bringing sensory aversion to mind without any real contingency between eating the food and suffering the illness. In other words, the notion of respondents to the Aversions questionnaire that nausea caused their dislike of the food is without foundation. Rather, it may be a consequence of autosuggestion, similarly to the "thirst hallucination" (Barber & Wilson, 1979). Suggestion bias similarly based on a lay psychology of the body has been seen in judgements of satiating and fattening effects of foods (Booth, 1987; Booth et al., 1981).

Thus, our interpretation of this contrast in results between the Aversions questionnaire (Pelchat & Rozin, 1982) and the Sensitivities questionnaire (Young et al., 1994) is that it

reflects a difference in the sequence of activation of semantic connections regarding common bodily events. The Aversions approach may even trigger somatosensory imagery established during a lifetime of ingestive and egestive experiences. The resulting succession of somaesthetic or chemosensory ideas or images generates the false memory that nausea occurred after "tasting" of the food. This is an illustration of the psychological view of question-and-answer research as a weakly controlled form of quasi-experimental investigation, susceptible to controlled quantitative analysis even from an open-ended conversation (Booth & Blair, 1989; Booth & Armstrong, 1993; Freeman et al., 1993).

Certainly, the Aversions questionnaire asks first for disliked foods, which is liable to provoke memory of a nasty "taste" in the mouth. It then presents a list of symptoms including (separately) nausea and vomiting (and also mouth sores or ulcers, and a sore or swollen throat). These are also liable to provoke thoughts of the oral region, more effectively than mention even of stomach pain, let alone headache, respiratory distress, skin reactions, diarrhoea etc. Thus, focussing first on food aversion is liable to prime responses to nausea and vomiting. Furthermore, with the possible exception of "heartburn or acid stomach", the taste, smell and texture of vomitus are the only concepts of stimulation of the oronasal cavity generated by a symptom on this list. (If that sentence provokes some oral, oesophageal or gastric sensations or imagery in the reader, those effects may be illustrating our thesis.)

In contrast, the Sensitivities questionnaire with which our interviewees were recruited, asked first about symptoms that the respondent had experienced. (Furthermore, these symptoms were grouped into 11 categories, so that "nausea" and "vomiting" were combined with "upset stomach" in a category of upper gastrointestinal symptoms.) Then the respondent was given a list of food groups, as well as other potential causes of adverse symptoms, and asked which origin if any was suspected for each symptom. The particular food and the specific symptoms were identified to the investigators at later interview only. Detailed questions were then asked about particular occasions when eating the food was followed by the symptom. Only after all of that were interviewees asked if they had come to dislike the blamed food. Moreover, when the reasons for "dislike" were elicited, fear of symptoms was often mentioned, not just sensory aversion. Thus, not only were alternatives to food presented at the beginning but also the idea of a nasty "taste" was not even mentioned until all the information about the past conjunctions of food and symptom had been elicited. Hence, using the method of Study 2, there was no priming of the association with nausea or vomiting by the region of tasting or by the disliked sensory characteristics themselves.

It is worth noting in addition that our results show that, in current British usage, the word "dislike" is far from exclusively confined to sensory influences on food choice. This relates to the observation of as little as 50% covariance between pleasant/unpleasant ratings and liking/dislike ranks (Tuorila-Ollikainen & Mahlamäki-Kultanen, 1985). Such findings illustrate the general thesis that, contrary to the introspective "direct scaling" assumption (e.g. Stevens, 1969), the vocabulary of a rating by itself cannot measure the specific factor controlling that response (Booth et al., 1982; Booth & Thibault, 1999).

It is of course logically possible that the sharp contrast in results between the two British studies arises instead from the marked differences in the samples of respondents. However, there is no obvious theoretical reason why university students (now about 30% of their age-group in the U.K.) should differ so greatly in this respect from a wider self-selection from the general public. On the other hand, there are very clear reasons why the difference in sequence in testing could induce cognitive processes that yield a contrasting result. Questioning about food and drink should be designed to avoid confounding of responses by prior suggestion unintentionally implanted by the investigator.

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Table 1. Changes in Peryam-Pilgrim liking/dislike category rank attributed to adverse symptom following eating of the food in all respondents (and in respondents who had not eaten the food since such an incident). ns: Not significant (P > 0.05)

		Means of ranks for recalled liking (1-9)			
Symptom	N	Prior to symptom	Subsequent *minus* prior	Immediately after symptom	At time of questioning
Nausea or vomiting	38 (14)	6.7 (5.8)	-2.6 (-2.8)	4.0 (3.0)	5.3
Other gastro-intestinal	43 (12)	7.2 (6.7)	-2.2 (-3.5)	5.0 (3.2)	6.2
Non-gastro-intestinal	22 (14)	7.3 (7.1)	-1.6 (-1.7)	5.7 (5.4)	6.4
Ranked ANOVA P-value		ns (ns)	ns (ns)	<0.05 (<0.01)	ns

Table 2. Perceivers of food intolerance who still liked the food, feared symptoms or disliked the flavour, and who avoided or did not avoid the blamed food

	Still like the food		Dislike the food					
			Fear symptoms		Dislike taste		No reason	
	N	%	N	%	N	%	N	%
Avoid if possible	127	42	38	13	29	10	2	0.7
Restrict or still take	156	52	4	1	4	1	1	0.3
Total	283	94	42	14	33	11	3	1

Table 3. Number of foods disliked for any reason (% of these disliked because of fear of symptoms; % disliked because of sensory aversion).

Percentages do not total 100 when the nature of the dislike was unknown.

	Nausea /vomiting	Other upper GI	Lower GI tract	Skin rash / swelling	Migraine	Asthma / sinus	Behavioural / mental	Other	Total foods regardless of symptom
Fruit/ Vegetables	1 (0;100)	1 (0;100)	4 (75;25)	4 (25;50)	-	2 (100;0)	-	-	11 (45;45)
Fried foods	1 (0;100)	-	-	-	-	-	1 (100;0)	-	2 (50;50)
Meat/Fish	7 (29;71)	2 (50;50)	3 (33;67)	8 (100;0)	-	1 (100;0)	-	3 (100;0)	13 (62;38)
Dairy	10 (30;70)	5 (20;80)	10 (50;50)	9 (78;22)	7 (57;29)	5 (80;0)	1 (0;100)	5 (40;40)	30 (50;47)
Nuts	-	3 (100;0)	-	3 (100;0)	1 (100;0)	3 (100;0)	-	4 (100;0)	6 (100;0)
Chocolate	-	-	-	-	5 (100;0)	-	-	-	5 (100;0)
Beverages	-	-	-	1 (0;100)	3 (33;33)	-	1 (0;100)	1 (0;100)	6 (17;67)
Alcohol	-	-	-	-	1 (100;0)	-	1 (0;100)	1 (0;100)	3 (33;67)
Additives /flavourings	3 (67;33)	1 (100;0)	1 (100;0)	5 (40;60)	1 (100;0)	1 (0;100)	2 (0;100)	3 (100;0)	10 (60;40)
Total symptoms	22 (36;64)	12 (50;50)	18 (56;44)	30 (70;27)	18 (72;17)	12 (83;8)	6 (17;83)	17 (70;24)	86 (56;41)

Table 4. Number of PFIs who reported avoiding foods with percentage who still like the food in italics and, in parenthesis, % of avoiders who reported fear of symptoms, with % reporting aversion to the food. Any account involving nausea or vomiting is included in Nausea/vomiting and no other column. Percentages do not total 100 when the nature of the dislike was unknown.

	Nausea /vomiting	Other upper GI	Lower GI	Skin rash / swelling	Migraine	Asthma / sinus	Behavioural / mental	Other	Total foods
Fruit/ Vegetables	4;*75* (0;25)	6;*100* (0;0)	7;*57* (29;14)	13;*69* (8;15)	4;*100* (0;0)	1;*100* (0;0)	1;*100* (0;0)	-	36;*78* (8;11)
Fried foods	1;*0* (0;100)	-	-	1;*100* (0;0)	-	-	1;*0* (100;0)	-	3;*34* (33;33)
Meat/Fish	12;*58* (8;33)	4;*75* (25;0)	3;*100* (0;0)	6;*50* (50;0)	-	-	-	1;*100* (0;0)	26;*66* (19;15)
Dairy	14;*36* (21;43)	10;*70* (10;20)	8;*50* (25;25)	11;*73* (18;9)	13;*69* (23;0)	5;*60* (40;0)	1;*100* (0;0)	1;*100* (0;0)	63;*60* (21;17)
Nuts	-	4;*50* (50;0)	2;*100* (0;0)	9;*89* (11;0)	1;*0* (100;0)	5;*80* (20;0)	-	-	21;*76* (24;0)
Chocolate	-	-	-	2;*100* (0;0)	14;*79* (21;0)	-	1;*100* (0;0)	-	17;*82* (18;0)
Beverages	1;*100* (0;0)	-	-	1;*0* (0;100)	9;*67* (11;11)	-	3;*67* (0;33)	2;*50* (0;50)	16;*63* (6;25)
Alcohol	-	-	-	-	2;50 (50;0)	1;*100* (0;0)	-	2;*50* (0;50)	6;*67* (33;33)
Additives /flavourings	3;*34* (33;33)	2;*50* (50;0)	-	7;*42* (29;29)	2;*100* (0;0)	-	5;*80* (0;20)	-	19;*58* (21;21)
Gluten /wheat	1;*100* (50;50)	1;*100* (0;0)	4;*100* (0;0)	-	-	-	-	-	6;*100* (0;0)
Total symptoms	36;*50* (14;36)	27;*74* (19;7)	24;*71* (17;12)	50;*68* (18;12)	46;*74* (20;2)	12;*75* (25;0)	12;*75* (8;17)	6;*67* (0;33)	213;*68* (17;14)

Table 5. Percentage of food-symptom accounts where the food was avoided but still liked (Like = L) and was avoided from fear of the symptoms (Fear = F) or from aversion to the flavour (Aversion = A), with different scores for realistic precision (Detail), unlikelihood of coincidence (Rarity) and likelihood of a causal link of food to symptom (Plausibility).

Symptoms	Range of scores for food-symptom accounts									P-value
	(near) Zero			Middling			(near) Perfect			
Detail of episode	0-3			4-5			6-8			
	L	F	A	L	F	A	L	F	A	
Nausea/vomiting	3	0	5	4	3	10	5	8	20	
UGI pain	3	0	2	4	3	10	2	6	2	
Lower GI	5	2	5	3	5	5	3	10	5	
Skin	6	2	5	8	10	10	13	18	5	
Migraine	8	3	2	16	11	5	3	6	0	
Behavioural	1	0	2	4	0	2	2	2	2	
Asthma/sinus	2	3	2	4	5	0	3	5	0	
All symptoms	28	10	24	42	37	42	30	53	34	0.002
Rarity of episode	0-1			2			3-5			
	L	F	A	L	F	A	L	F	A	
Nausea/vomiting	2	3	0	4	0	5	6	8	5	
UGI pain	3	2	5	3	2	5	3	6	5	
Lower GI	2	5	0	5	3	10	3	8	5	
Skin	6	6	7	4	9	10	15	13	2	0.02
Migraine	18	5	7	6	9	0	4	6	0	
Behavioural	4	0	2	2	0	0	2	2	5	
Asthma/sinus	5	8	2	1	2	0	2	3	0	
All symptoms	41	30	25	25	25	29	34	45	46	
Plausibility	0-3			4			5			
	L	F	A	L	F	A	L	F	A	
Nausea/vomiting	2	3	2	4	4	10	5	4	18	
UGI pain	0.6	0	2	2	0	0	6	9	10	
Lower GI	0.5	1	0	1	3	2	9	10	12	
Skin	4	1	0	10	4	10	15	23	12	
Migraine	5	3	0	8	4	2	15	12	2	
Behavioural	0.8	0	0	1	0	4	4	1	8	
Asthma/sinus	0.8	0	0	3	3	2	4	13	2	
All symptoms	13	9	4	28	19	31	59	72	65	0.08