Perceived risk of metabolic syndrome and attitudes towards fat-modified food concepts among European consumers

Gerard M. O’Brien a,⇑, Barbara J. Stewart-Knox a, Archie McKinley b, Maria Daniel Vaz de Almeida c, Michael J. Gibney d

a Northern Ireland Centre for Food and Health (NICHE), School of Biomedical Sciences, University of Ulster, Coleraine, Northern Ireland, United Kingdom
b School of Environmental Sciences, University of Ulster, Coleraine, Northern Ireland, United Kingdom
c Faculty of Nutrition and Food Sciences, University of Porto, Portugal
d Institute of Food and Health, University College Dublin, Ireland

A R T I C L E   I N F O

Article history:
Received 16 November 2010
Received in revised form 14 July 2011
Accepted 8 August 2011
Available online 12 August 2011

Keywords:
Metabolic syndrome
Functional foods
Consumer
Survey
Attitudes
LIPGENE

A B S T R A C T

European consumer willingness to purchase fat-modified foods was surveyed as part of the LIPGENE study. Representative samples of consumers (n = 5967) were interviewed in six countries (France, Great Britain, Portugal, Germany, Poland, and Italy). Of these 2025 were considered as “reporters” who indicated having at least one of: high cholesterol; high blood pressure; central obesity; and/or high blood sugar. Perceived risk from these conditions was also assessed on a 10-point scale. Principal component analysis suggested that those who perceived themselves at greater risk of conditions associated with metabolic syndrome, and those who were reporters, more frequently indicated willingness to purchase “healthy” fat-modified food products. The most preferred ‘vehicles’ for fat modification were fish and cheese. Acceptance of fat-modified fish, red meat and cheese product concepts, both standard and GM, was positively associated with perceived risk of conditions associated with metabolic syndrome. Over 20% of reporters were willing to purchase GM fat-modified fish and cheese products. Our results indicate that if standard and GM fat-modified food products can be shown to ameliorate the risks presented by conditions associated with metabolic syndrome, there is a ready market for such foods.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Concern has been expressed regarding current and projected levels of overweight, obesity and impaired cardiovascular health in Europe and the accompanying social and financial costs (García-Villar & Quintana-Domeque, 2009; Whitlock et al., 2009). Much interest has focused on a cluster of pre-disease conditions known as the ‘metabolic syndrome’, the prevention or treatment of which may help prevent or mitigate chronic diseases, such as Type 2 diabetes and coronary heart disease (Buttriss & Nugent, 2005; Kinnunen, Kokkonen, Kaprio, & Pulkkinen, 2005). Four particular conditions are considered to be associated with the metabolic syndrome: high cholesterol; high blood pressure; central obesity; and unstable blood sugar (Buttriss & Nugent, 2005; de Almeida, Pinhão, Stewart-Knox, Parr, & Gibney, 2006b).

The main approach taken to combat the metabolic syndrome is based on behavioural changes, such as increased physical activity and alterations to the diet (Nugent, 2005). As increased physical activity may not always represent a practical or appealing strategy for overweight and obese individuals (Atlantis, Barnes, & Ball, 2008; Miller & Miller, 2010), the availability of food products that can help prevent or minimise the effects of the syndrome (e.g. through altered fatty acid profile) is clearly important. An association between elevated blood triglyceride (TG) levels and the range of metabolic syndrome conditions, including Type 2 diabetes has been highlighted previously (Eslick, Howe, Smith, Priest, & Benson, 2009); hence, the need for fat-modified foods to prevent and/or treat the metabolic syndrome. Genetic modification (GM) technology offers the possibility of altering the fatty acid profiles of a variety of food products, whether these be fat-modified GM plant products, or products derived from farmed fish/animals that have been reared using feeds that contain fat-modified GM plant products (Cox, Evans, & Lease, 2008).

LIPGENE is a large European Union-funded project aimed at developing interventions to prevent and treat the metabolic syndrome. Part of the project, a six-country survey, focused on consumer attitudes toward potential interventions, including agri-food technologies, for the prevention and treatment of conditions associated with the metabolic syndrome. To date, this appears to

* Corresponding author. Address: Northern Ireland Centre for Food and Health (NICHE), University of Ulster, Coleraine, County Londonderry, Northern Ireland, United Kingdom. Tel.: +44 2870324781; fax: +44 2870324965.
E-mail address: gm.obrien@ulster.ac.uk (G.M. O’Brien).
be the first representative study investigating cross-Europe consumer attitudes towards genetically-modified (GM) fat-modified foods. Previous studies have highlighted a generally negative perception of GM foods on the part of European consumers (Gruère, Carter, & Farzin, 2008; Knight & Gao, 2009), although evidence from some small-cohort studies has suggested that European consumers’ acceptance of GM foods is greater where there is a perceived personal benefit or incentive (Lusk et al., 2006; Schenk et al., 2011; Spence & Townsend, 2006). Previous research has also indicated the importance of sensory quality among the determinants of consumer acceptance or rejection of food products that are targeted towards health (Fogliano & Vitaglione, 2005; Villegas, Carbonell, & Costell, 2008), and that the carrier or “vehicle” may be as important as the beneficial ingredient in determining acceptance of a health-benefit targeted food product (Siegrist, Stampfl, & Kastenholz, 2008; Williams, Ridges, Batterham, Ripper, & Hung, 2008).

The purpose of this research, therefore, has been to determine, in a representative sample of European consumers, preferences for different food product vehicles for fat modification, and food product concepts that could be developed through agri-food technologies, to help prevent or minimise the effects of the metabolic syndrome. According to the Health Belief Model (HBM), perceived personal risk of/susceptibility to illness is a powerful promoter of the adoption of healthier behaviours (Bylund, Galvin, Dunet, & Reyes, 2011): the analysis described in this article seeks to compare and contrast the attitudes toward fat-modified food product concepts of consumers who perceived themselves to be at greater and lesser risk of conditions associated with the metabolic syndrome, as well as between those who reported having such conditions and those who did not.

2. Methods

2.1. Sampling

Multi-stage stratified cluster sampling with quotas was used to recruit respondents (n = 5967) in six European countries: France (n = 938); Germany (n = 991); Great Britain (n = 1011); Italy (n = 979); Poland (n = 1005); and Portugal (n = 1043). Each sample was selected to be representative of that country’s adult (aged 14+ years) population, in terms of age, gender, region, and population density.

Detail as to the sampling method has been previously described elsewhere (de Almeida et al., 2006a).

2.2. The questionnaire/procedure

All items included in the questionnaire were informed by prior qualitative research and piloted (n = 50) in each country (de Almeida et al., 2006a). Ethical approval was granted by the Office of Research Ethics Committee (OREC). The survey fieldwork was undertaken by Ipsos Mori during June 2005. Respondents were told that the survey was concerned with ‘questions about health’. To complete the questionnaire, each respondent was interviewed individually within his/her home. An early question prompted the interviewee to indicate (stating “yes” or “no” to each) whether he or she happened to have any of the following conditions associated with the metabolic syndrome: central obesity (described to interviewees as “a higher than normal amount of fat around your middle”); high blood pressure; high blood cholesterol; and/or high blood sugar. This was followed by a question enquiring as to perceived risk of each of the same four conditions associated with the metabolic syndrome (central obesity; high blood pressure; high blood cholesterol; and/or high blood sugar), each condition requiring a response on a 10 point Likert-type scale (from 0 = “no health risk at all”, to 5 = “medium risk”, to 10 = “extremely high health risk”; the scores 1, 2, 3, and 4 were placed with equal spacing between 0 and 5, while the scores 6, 7, 8, and 9 were placed with equal spacing between 5 and 10). Interviewees were then shown a series of cards in random order, each one featuring one of eight different fat-modified food product concepts (butter/cheese/egg/milk/red meat/fish/poultry/yoghurt “containing healthier fat”), and were asked “If you were told that foods had already been developed to reduce the risks of late-onset (Type 2) diabetes or heart disease, which – if any – of the following do you think you would be most likely to eat? You may choose up to three”. After having answered that question, they were then shown the same cards again, and this time were asked “If you were told that these same foods had been developed to reduce the risks of late-onset (Type 2) diabetes or heart disease using genetic modification (made with modern biotechnology which allows food to be altered at a genetic level), which – if any – of the following do you think you would be most likely to eat? You may choose up to three”.

With both of the food product-based questions, given the fact that interviewees were permitted to accept up to three food product concepts from a total of eight, there was – with each interview – effectively a 3-in-8 (37.5%) chance of a given product concept being accepted.

2.3. Data analysis

Data analysis was carried out using SPSS® for Windows (version 13.0). Data initially underwent descriptive analysis. Responses to each part of the question regarding perceived personal risk were each on a Likert-type scale ranging from “0” (no health risk at all”) to “10” (extremely high health risk). Principal component analysis (PCA) was applied to explore interdependencies among the four perceived risk scores (fat around the middle; high blood cholesterol; high blood sugar; and high blood pressure). The data were checked using the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO), where a value of 0.84 was obtained. The loadings of principal components (PCs) were obtained for PCs having eigenvalues greater than 1. Using the eigenvalues greater than 1 rule and from observation of the scree plot one component was found to account for 80.4% of total variance. Loading of this component was found to be similar for all four risk factors, and this enabled a single new component ‘perceived risk’ component score for each individual (based on the average of the four risk-related scores) to be calculated.

Independent T tests were used to determine differences in perceived risk’ component scores between those who indicated they were likely and not likely to eat fat-modified ‘standard’ and GM product concepts.

In a further analysis of the data, those who had indicated having one or more of the four conditions associated with metabolic syndrome were classified as ‘reporters’, while those who indicated that they had no such conditions were classed as ‘non-reporters’. Responses from interviewees who did not say “yes” to any of the four conditions, but also did not say “no” to all four conditions (e.g. responding “don’t know”, or refusing to answer, for one or more conditions) were excluded from the analysis. The reporter/non-reporter data were treated as dichotomous, and were tested against likely or not likely to eat standard and GM fat-modified food product concepts, using cross-tabulation procedures with the chi-square test. A p-value of <0.05 was considered statistically significant.

A test of proportions was used to assess the significance of the difference in acceptance between standard and GM product concepts.
3. Results

3.1. Acceptance of standard and GM fat-modified product concepts

In Table 1, the total numbers of interviewees who thought they would be likely to eat each product concept, firstly as a “standard” product and then as a “GM” product are shown. Acceptance of each GM product concept was typically around 2/5 lower than that of the corresponding standard product concept. Among both standard and GM product concepts, fat-modified fish was most accepted by the interviewees (34.3% and 19.3% acceptance, respectively; \( p < 0.0005 \)), followed by fat-modified cheese (31.8% and 18.5% acceptance, respectively; \( p < 0.0005 \)).

As may be seen in Table 2, acceptance of standard fat-modified food product concepts was highest among GB and Portuguese interviewees (2542 and 2369 approvals, respectively) and lowest among German interviewees (837 approvals). While – as stated above – acceptance of each GM product concept was lower than that of the corresponding standard product concept, similar country-to-country variation in acceptance was observed, with this being greatest among Portuguese, Polish, and GB interviewees (1504, 1350, and 1310 approvals, respectively) and lowest among German interviewees (837 approvals).

3.2. Acceptance of standard fat-modified product concepts and perceived risk of conditions associated with the metabolic syndrome

As may be seen from Fig. 1, mean perceived-risk component scores of consumers who thought they would likely to eat the product concept were significantly higher (Student’s \( t \)-test) than those of consumers who thought they would not likely to eat it, in the case of: butter (mean scores 5.70 and 5.43, respectively; \( t = 3.043; \) df = 5594; \( p = 0.002 \)); cheese (mean scores 5.67 and 5.42, respectively; \( t = 2.987; \) df = 5594; \( p = 0.003 \)); milk (mean scores 5.74 and 5.42, respectively; \( t = 3.549; \) df = 5594; \( p < 0.001 \)); red meat (mean scores 6.11 and 5.26, respectively; \( t = 9.749; \) df = 5594; \( p < 0.001 \)); fish (mean scores 5.75 and 5.37, respectively; \( t = 4.712; \) df = 5594; \( p < 0.001 \)); and, poultry (mean scores 5.73 and 5.42, respectively; \( t = 3.471; \) df = 5594; \( p = 0.001 \)).

No significant difference was observed for egg (mean scores 5.66 and 5.48, respectively; \( t = 1.562; \) df = 5594; \( p = 0.118 \)) and yoghurt (mean scores 5.50 and 5.50, respectively; \( t = 0.012; \) df = 5594; \( p = 0.991 \)).

3.3. Acceptance of genetically-modified (GM) fat-modified product concepts and perceived risk of conditions associated with the metabolic syndrome

Referring again to Fig. 1, mean perceived-risk component scores were higher among those willing to eat the GM product concept than those not, in the case of: butter (mean scores 5.76 and 5.46, respectively; \( t = 2.744; \) df = 5594; \( p = 0.006 \)); cheese (mean scores 5.68 and 5.46, respectively; \( t = 2.295; \) df = 5594; \( p = 0.022 \)); egg (mean scores 5.74 and 5.47, respectively; \( t = 1.997; \) df = 5594; \( p = 0.046 \)); milk (mean scores 5.81 and 5.44, respectively; \( t = 3.396; \) df = 5594; \( p = 0.001 \)); red meat (mean scores 6.13 and 5.37, respectively; \( t = 7.350; \) df = 5594; \( p < 0.001 \)); fish (mean scores 5.88 and 5.41, respectively; \( t = 4.885; \) df = 5594; \( p < 0.001 \)); and poultry (mean scores 5.71 and 5.46, respectively; \( t = 2.286; \) df = 5594; \( p = 0.022 \)). No significant difference was observed for yoghurt (mean scores 5.51 and 5.50, respectively; \( t = 0.095; \) df = 5594; \( p = 0.924 \)).

3.4. Reporting of conditions associated with metabolic syndrome

In all 2025 respondents were classed as “reporters”, as they indicated that they had at least one of the four conditions associated with metabolic syndrome (high cholesterol; high blood pressure; “fat round the middle” or central obesity; and/or high blood sugar). A further 3676 respondents, who stated clearly that they had no such conditions were classed as ‘non-reporters’. There were also 266 interviewees who could not be classified either as reporters or as non-reporters, and these were treated as missing data.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Total Reporters</th>
<th>Non-reporters</th>
<th>( \chi^2 ) (p-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard fat-modified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butter</td>
<td>1500</td>
<td>543</td>
<td>905</td>
</tr>
<tr>
<td>Cheese</td>
<td>1897</td>
<td>702</td>
<td>1124</td>
</tr>
<tr>
<td>Egg</td>
<td>792</td>
<td>249</td>
<td>449</td>
</tr>
<tr>
<td>Milk</td>
<td>1425</td>
<td>495</td>
<td>883</td>
</tr>
<tr>
<td>Red meat</td>
<td>1653</td>
<td>618</td>
<td>975</td>
</tr>
<tr>
<td>Fish</td>
<td>2048</td>
<td>802</td>
<td>1171</td>
</tr>
<tr>
<td>Poultry</td>
<td>1535</td>
<td>612</td>
<td>867</td>
</tr>
<tr>
<td>Yogurt</td>
<td>1560</td>
<td>495</td>
<td>1020</td>
</tr>
<tr>
<td>GM fat-modified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>830</td>
<td>319</td>
<td>480</td>
</tr>
<tr>
<td>Reporters</td>
<td>1010</td>
<td>395</td>
<td>581</td>
</tr>
<tr>
<td>Non-reporters</td>
<td>1151</td>
<td>439</td>
<td>656</td>
</tr>
<tr>
<td>( \chi^2 ) (p-Value)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Each percentage figure represents the proportion of respondents in that reporter/non-reporter sub-cohort who expressed acceptance of the respective product. In all \( \chi^2 \) tests, df = 1.

‘Total’ refers to all respondents who expressed acceptance of the given product concept.
A small number of interviewees (n = 266) could not be classified either as reporters or as non-reporters, and these have been treated as missing data.
Interviewees were asked to choose up to a maximum of three products from a list of eight standard product concepts, and up to a maximum of three products from a list of eight GM product concepts.
The 2025 reporters included 289 who indicated having high blood pressure only, 189 who indicated having high blood cholesterol only; 59 who indicated having high blood sugar only; and 537 who indicated having central obesity (“fat around the middle”) only. There were 433 interviewees who reported two conditions, while 218 reported three, and 80 reported having all four of the conditions. The remaining 220 reporters were those who – having confirmed having at least one of the four conditions – expressed uncertainty as to whether they had one or more of the others.

### 3.5. Acceptance of standard fat-modified foods and reporting of conditions associated with the metabolic syndrome

As may be seen from Fig. 1, significantly higher proportions of reporters than non-reporters thought they would be likely to eat standard fat-modified fish, poultry, red meat, cheese and egg. More non-reporters than reporters thought they would be likely to eat standard fat-modified yogurt (Table 1).

### 3.6. Acceptance of GM fat-modified foods and reporting of conditions associated with the metabolic syndrome

Referring again to Table 1, significantly higher proportions of reporters than non-reporters thought they would be likely to eat GM fat-modified red meat, fish, poultry, cheese and butter, whilst again more non-reporters than reporters thought they would be likely to eat GM fat modified yogurt (Table 1).

### 4. Discussion

The comparatively high proportion of Portuguese interviewees who indicated acceptance of GM fat-modified food concepts is in agreement with previous research (Costa-Font, Gil, & Traill, 2008) which indicated greater tolerance of GM food in Portugal than in some other European countries. The comparatively low proportion of German interviewees who accepted GM fat-modified food concepts echoes the findings of Hartl and Hermann (2009) that Ger-

### Table 2

<table>
<thead>
<tr>
<th>Fat-modified product</th>
<th>Number and % by country</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>France</td>
</tr>
<tr>
<td>Butter</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>242</td>
</tr>
<tr>
<td>GM</td>
<td>119</td>
</tr>
<tr>
<td>Cheese</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>337</td>
</tr>
<tr>
<td>GM</td>
<td>178</td>
</tr>
<tr>
<td>Egg</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>106</td>
</tr>
<tr>
<td>GM</td>
<td>80</td>
</tr>
<tr>
<td>Milk</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>186</td>
</tr>
<tr>
<td>GM</td>
<td>113</td>
</tr>
<tr>
<td>Red meat</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>314</td>
</tr>
<tr>
<td>GM</td>
<td>168</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>392</td>
</tr>
<tr>
<td>GM</td>
<td>195</td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>242</td>
</tr>
<tr>
<td>GM</td>
<td>123</td>
</tr>
<tr>
<td>Yoghurt</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>371</td>
</tr>
<tr>
<td>GM</td>
<td>190</td>
</tr>
<tr>
<td>Total approvals</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>2190</td>
</tr>
<tr>
<td>GM</td>
<td>1166</td>
</tr>
</tbody>
</table>

* Each interviewee was allowed to choose up to three standard items and up to three GM items.
man consumers stand out among Europeans as being particularly sceptical of GM foods.

Together, these data suggest the importance within Europe of cross-cultural differences in acceptance of fat-modified and GM foods.

That acceptance of fat-modified product concepts varied considerably according to the specific type of food product concept is in agreement with the findings of a number of authors (De Jong, Ocké, Brandenhorst, & Friele, 2003; Henson, Masakure, & Cranfield, 2008; Krystallis, Maglaras, & Mamalis, 2008; Siegrist et al., 2008; Urala & Lähteenmäki, 2007; Williams et al., 2008). The product concept “fish containing healthier fat” was the most accepted, both among standard and GM product concepts (Table 1), followed by “cheese containing healthier fat” in second place. These two product concepts also occupied first and second places, respectively, in terms of acceptance by metabolic syndrome reporters. Given that fish already has a healthy image among consumers, owing largely to its association with ω-3 PUFA (Pieniak, Verbeke, Perez-Cueto, Brunso, & De Henauw, 2008), its comparative popularity in this survey may relate to its perceived “appropriateness” or “naturalness” as a source of healthy fat. This is consistent with the results of research carried out in Switzerland which indicated that health claims were viewed more favourably when the health-enhancing ingredient was carried in a product that already had a positive health image (Siegrist et al., 2008). It was encouraging to note that cheese was also relatively well received in this survey as a potential “vehicle” of fat modification. The place of cheese in European dietary tradition may also make it attractive as a potential fat-modified food vehicle. At the global level, Europe is considered the largest market for dairy products, with cheese being the single biggest dairy product category, based on 2007 sales figures (Rano, 2008). Eggs were the least favoured among the eight food product types as a potential vehicle of fat modification, irrespective of whether the concept was standard or GM (Table 1). Reporters indicated more often than non-reporters that they would be likely to eat fat-modified fish, red meat, poultry, and cheese as standard concepts, and fat-modified fish, red meat, poultry, cheese, and butter as GM concepts (Table 1).

Those who indicated acceptance of fat-modified product concepts also tended to have indicated (in the preceding questions) higher perception of risk of metabolic syndrome-related conditions than those who rejected the concepts (Fig. 1). This difference was most pronounced in the case of fat-modified fish, red meat, milk and poultry as standard concepts and fat-modified fish, red meat, and milk as GM concepts.

The greater readiness to accept fat-modified food product concepts on the part of ‘reporters’, and of individuals with heightened perceptions of personal risk from metabolic syndrome-related conditions is consistent with the logic of the Health Belief Model (HBM), with perceived susceptibility to illness exerting a positive influence upon the adoption of healthier behaviours (Bylund et al., 2011). These findings are also consistent with survey research carried out in Sweden (Landstrom, Hursti, Becker, & Magnusson, 2007) and Canada (Herath, Cranfield, & Henson, 2008), whose findings have suggested that perceived risk of disease predicted uptake of functional foods, and with the findings of a Belgian study which indicated that functional foods were more readily accepted by interviewees who indicated having an ill family member, as compared to interviewees who did not (Verbeke, 2005).

That fat-modified fish, cheese, and red meat were the three most readily accepted product concepts among reporters of metabolic syndrome conditions, both as standard and as GM products, and that heightened perceived personal risk of metabolic syndrome conditions coincided with increased acceptance of all three products (especially red meat and fish), suggests that these foods would provide appropriate models for fat modification on a Europe-wide basis. Fat-modified egg products were less likely to be accepted whether or not they were GM, suggesting that eggs would not provide a suitable vehicle for the delivery of modified fats.

Among the 5967 interviewees, likelihood of eating the products dropped by typically around 2/5 when “GM origin” was added to the concepts (Table 1). This drop in acceptance was in line with expectations: as mentioned in Section 1, there has been a generally negative perception of genetically-modified (GM) foods on the part of European consumers. At the same time, advocates of GM products might draw encouragement from the fact that around 1-in-5

Fig. 1. Mean perceived-risk composite scores (post-PCA) of interviewees accepting/rejecting standard and GM fat-modified product concepts. Note: For each product concept, the difference in mean perceived-risk component score between accepters and rejecters: **Significant at the 0.05 level. ***Significant at the 0.01 level. ****Significant at the 0.001 level; or NS, not significant. Error bars denote standard error (SE) of mean.
metabolic syndrome condition reporters expressed acceptance of GM fat-modified fish, cheese and red meat. Some small-cohort studies (Lusk et al., 2006; Spence & Townsend, 2006) have indicated a willingness among European consumers to accept GM products, provided that some clear benefit or incentive/compensation is included. Siegrist (2008) makes similar observations, citing a number of European studies conducted over the last decade. Further evidence is provided by Knight and Gao (2009) who point to survey findings from the 2006 Eurobarometer report, asserting that while European consumer attitudes towards genetic modification are generally “highly negative”, many would accept GM products if there were clear benefits.

Looking at the data from the study, in relation to both standard and GM fat-modified food product concepts, it might be argued that – with no individual product concept being accepted by more than 35% of interviewees – only a minority of interviewees in this European cross-sectional study thought they would be likely to eat fat-modified food concepts. Nonetheless, given that interviewees were asked to choose up to a maximum of three products from a list of eight (and thus each product effectively had a 3-in-8 chance of being chosen), the exact proportion of interviewees accepting a given product is of much less relevance than are the relative values relating to the different products.

Among the strengths of the study reported in this article is that it features a large representative sample, in which a wide range of demographic variables have been controlled for. To the authors’ knowledge, no previously reported large-scale EU-wide survey study has explored consumer attitudes towards metabolic syndrome-targeted fat-modified food concepts, alongside an analysis of individuals’ perceived risk in relation to metabolic syndrome-related conditions. The study also had limitations, however. For example, a situation where an interviewer presents an interviewee with a number of abstract food product concepts “containing healthier fat” was somewhat “removed” from the real-life situation that the consumer confronts while shopping in the supermarket: stated acceptance of product concepts might not necessarily translate into concrete purchasing behaviour.

It might also be argued that an exploration of consumer attitudes towards a variety of postulated modifications to the fat content of food products (rather than just the one case of “healthier fat”) would have made for a more informative study. Perhaps such a direction ought to be considered for future studies. Another limitation relates to the order in which questions were presented to interviewees: by firstly presenting “standard” fat-modified product concepts for appraisal, and secondly the GM fat-modified product concepts, some degree of bias may have been introduced in terms of the way that interviewees responded. Similarly, the categorisation of interviewees as reporters/non-reporters of metabolic syndrome-related conditions might be viewed as a further limitation: the various conditions may impact differently upon acceptance of fat-modified food concepts. The self-reported nature of these data may also depend upon the extent of knowledge that the particular individual had of his/her health, and thus may limit the clinical accuracy of the data, for example, doubts have been cast over the reliability of individuals’ self-reporting as regards overweight and obesity, with under-reporting of these aspects observed in a Chilean study (Mujica et al., 2009). A qualitative study with a small group of Australian interviewees (Heading, 2008) also found a disparity between lay people’s understanding of “healthy weight” and that defined by the World Health Organisation, and detected a tendency toward “normalisation” of obesity among the perceptions of participants. Nonetheless, whilst reporter/non-reporter status and assessment of risk of such conditions are subjective, these data provide a snapshot of consumer awareness in relation to the metabolic syndrome and the degree to which such awareness may influence consumption.

5. Conclusion

The results arising from this six-country study indicate that individuals who either have, or perceive themselves to be at risk of, conditions associated with metabolic syndrome are more likely to accept fat-modified foods tailored to its prevention and/or treatment. The food product concepts that appeared most readily-accepted among European consumers, as both standard and GM concepts/vehicles to deliver healthy-fat benefits were fish and cheese.

Acknowledgements

This work was completed on behalf of the LIPGENE Consortium and funded under the EU 6th Framework Food Quality and Safety Programme. code FOOD-CT-2003-505944. Survey Fieldwork was sub-contracted to Ipsos MORI (GB). The authors acknowledge with gratitude the advice and suggestions of Professor Gordon Rae in relation to analysis of the data.

References


