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Second Generation M Foods: Perspectives on Likely Future Acceptance by Fish Consumers



**The National
Food Centre**

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SECOND GENERATION GM FOODS:

PERSPECTIVES ON LIKELY FUTURE

ACCEPTANCE BY IRISH CONSUMERS

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SUMMARY

Two hypothetical second-generation genetically-modified (GM) products, a yogurt and a dairy spread, were evaluated by consumers. Second-generation GM food products offer specific consumer benefits - in the case of this study, health benefits.

The purpose of this research was threefold. Firstly, to determine the level of acceptance of second-generation GM products by Irish consumers. Secondly, it sought to establish whether different segments of consumers existed on the basis of acceptance. Thirdly, it set out to profile any segments identified on the basis of various demographic, behaviour and food choice attitude variables.

Yogurt

In terms of overall acceptance, the majority of Irish yogurt consumers surveyed were not in favour of a GM yogurt and rejected a GM yogurt even when it offered the ultimate consumer health benefit, an anti-cancer benefit. Four attributes were tested and their ideal yogurt was one with no GM ingredients, a low fat content, the respondent's normal brand of yogurt, and a European Food Safety Authority (EFSA) seal of approval. In regard to preference, the GM attribute was the dominating influence on acceptance.

In terms of acceptance, four different segments were found to exist. Segmentation analysis found about one-third of the sample, "2nd generation rejecters", specifically rejected the second-generation GM yogurt. A further 25%, "anti-GM", were outright rejecters of the product. Nonetheless, a GM yogurt offering specific consumer benefits was acceptable to 21% of the sample ("conditional accepters"), which implies that such a food could represent a niche market within the overall food market in the future. The remaining 21% of the sample, called "2nd generation accepters", were receptive to the concept of a second-generation GM yogurt. Irish consumers of yogurt would also have confidence in a European seal of approval.

Thus, two segments comprising 59.3% of the sample rejected the GM yogurt.

On the other hand, the remainder, 41.7 %, were receptive to a GM yogurt offering the anti-cancer benefit.

There was a greater percentage of “2nd generation accepters” in the Dublin area and the lowest percentage of respondents from the AB socio-economic group. There were greater proportions of “2nd generation rejecter” respondents in the AB socio-economic group and in Munster. The “anti-GM” cluster contained the highest percentage of respondents who claimed that they were the chief income earner in their household.

The “conditional accepters” were the most regular consumers of yogurt while the “2nd generation accepters” were the least regular.

Profiling on attitudes to food choice provided further insight into differences between the segments. The “conditional accepters” were more health-oriented and more receptive of products with natural ingredients than the “2nd generation rejecters”. The “anti-GM” group has a stronger preference for products with natural ingredients compared to the above “2nd generation accepters”. Concern about animal welfare was a more important food choice factor for “conditional accepters” and the “anti-GM” cluster compared to the “2nd generation rejecters”. Environmental protection was a more influential food choice factor for the “anti-GM” group compared to “2nd generation rejecters” and “conditional accepters”.

Dairy spread

Similar to yogurt consumers, Irish dairy spread consumers remain wary of GM foods even when these foods offer specific consumer benefits. Overall they rejected such a product. Of four attributes tested, their ideal combination was one with no GM ingredients, a price of €1.85 a tub, a low fat content and the respondent’s normal brand of dairy spread. Although the GM factor had most influence on acceptance, price was almost equally important.

Correspondingly, segmentation analysis of the results in this study identified a segment, “anti-GM”, some 24% of the sample, who were outright rejecters of a GM spread. A further 32%, “2nd generation rejecters”, did not accept a second-generation GM spread. About 30% of the sample, “pro 2nd generation”,

were positively inclined towards the second-generation spread with a further 14%, the “2nd generation accepters”, accepting the product. The “2nd generation accepters” had reservations about GM foods which they discounted on the basis of the health benefit offered by the product. They would also be particularly receptive of a second-generation GM spread offered at a competitive price.

Thus two segments, some 58.2% of the sample, rejected the GM product while 43.8 %, from the other two segments were receptive.

A greater percentage of the “anti-GM” group had their cholesterol level tested and had a higher third level education qualification. The “2nd generation rejecters” were more likely to be the chief income earner in their household.

The segments also differed in terms of their food choice attitudes. The “anti-GM” group had a greater preference for food with natural ingredients and which did not contain additives or artificial ingredients compared to the “pro 2nd generation” cluster. The familiarity of the food they consume and the fact that it is part of their normal routine is more important to the “2nd generation accepters” compared to the “anti-GM” group. The “anti-GM” group in turn are more influenced by issues of environmental protection when choosing food than the “2nd generation rejecters”.

Overall

The results for both questionnaires suggest that GM foods are not widely accepted by Irish yogurt and dairy spread consumers. However, the results of the segmentation analysis imply that clearly-labelled, second-generation GM dairy products with proven health benefits could attain a share of the Irish food market. As a majority reject such products, it raises the question of whether the food industry is prepared to develop them and allow consumer choice take its course.

INTRODUCTION

Public attitudes towards gene technology are a major factor influencing its future development. Irish consumer attitudes towards biotechnology have been the subject of a number of surveys conducted throughout the 1990s but studies have not examined consumer reactions to realistic products of the technology. The current study attempted to place respondents in the role of consumers by presenting them with specific examples of GM foods.

The next wave or “second-generation” of biotechnology products on the market will be targeted at the needs of the end-user or consumer, such as foods with altered nutritional qualities or foods that offer specific health-oriented benefits. Two hypothetical GM products, a yogurt and a dairy spread, presented to consumers in this study, are examples of second-generation GM products. The dairy spread claimed to contain “*a GM ingredient clinically proven to reduce cholesterol as part of a healthy diet*”, while the yogurt claimed it contained “*a GM ingredient proven to help protect against cancer as part of a healthy diet*”.

OBJECTIVES

The purposes of this study were:

1. To establish the level of Irish consumer acceptance of “second-generation” GM foods;
2. To identify if different segments of consumers exist on the basis of acceptance of “second-generation” GM foods;
3. To profile these segments on the basis of demographic, food choice attitudes and behaviour variables.

METHODS

Any food product can be considered to consist of a number of attributes. Consumers take account of attributes or characteristics that a food offers when making the decision to buy. These attributes may be intrinsic, such as colour or texture, or extrinsic, such as brand or price. In this study, the important attributes which influence the particular yogurt or spread a consumer chooses were identified. Any attribute can have a number of levels (*e.g.* high price or low price). Consumers seek to buy the combination of attributes that best meets their needs. This can be regarded as their ideal product. Conjoint analysis is a suitable technique for identifying ideal attribute combinations for consumers and was applied in this study. The importance attached to each attribute can also be estimated. Thus, a GM attribute can be considered in the context of all the other attributes influencing choice.

Four consumer focus groups, each with 7-8 respondents, and six interviews with industry representatives were conducted to ascertain important attributes when buying yogurt and dairy spreads. These attributes and their levels were then used to compile profile cards of the hypothetical second-generation GM products. Each card contained different combinations of the attributes and represented a different spread.

Consumers were asked to rate each card based on their intention to purchase using a seven-point scale on which '1' indicated they would be 'very unlikely to purchase' and '7' signified that they would be 'very likely to purchase'. The remainder of the questionnaire was designed to generate a profile of Irish consumers in terms of demographic characteristics, food choice attitudes and behaviour variables.

Each questionnaire was administered to independent samples of three hundred dairy spread and three hundred yogurt consumers.

Conjoint analysis was applied to the data to calculate both the importance of the various attributes and the part-worth utility scores of each of the attribute levels so as to determine the constituents of an "ideal" yogurt or dairy spread. The utility is a measure of consumer satisfaction with each attribute.

Cluster analysis, on the basis of the utilities derived for the GM attribute, was used to find out if different consumer segments existed. Respondents were then profiled in terms of their food choice attitudes using the adjusted food choice questionnaire (FCQ) (Lindeman and Väänänen, 2000), which places additional emphasis on ethical food choice motives in the context of overall food choice (Step toe, Pollard and Wardle, 1995). The FCQ is a multidimensional measure of motives related to food choice and comprises 36 items that provide a means of simultaneously examining the importance of nine factors thought to be important in food choice (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern). The adjusted questionnaire contained three scales complementary to the FCQ which attempted to address ethical motives (ecological welfare, political values and religion).

FINDINGS

Focus groups and industry interviews

Attributes and their levels

The attributes and levels decided on are shown in Table 1 below. Brand name and fat content were identified as important factors influencing the choice of both yogurt and dairy spread

The influence of brand was apparent when respondents were discussing aspects such as taste, spreadability, texture, colour or fat content as they repeatedly used brand names to illustrate the point they were making. It was decided that the brand name attribute would be evaluated by reference to their normal brand and a fictional brand name. For the dairy spread “Flight” was the brand name and “Dairy Fresh” was chosen for yogurt.

Fat content emerged as more important for female yogurt consumers, with a number of women indicating that they bought low fat or diet yogurts. Three levels were used to devise the hypothetical yogurt profiles, namely standard fat, low fat and 0% fat. Similarly, dairy spread consumers revealed that they

choose dairy spread from the “health point of view”. Three fat levels (standard, reduced and low) were suggested and industry interviews reinforced that these were appropriate.

Price was not found to be a major consideration when buying yogurt. In contrast, dairy spread interviewees indicated that promotions or special offers enticed consumers to try a different product. They expected to pay around €1.90 for a regular tub of dairy spread. The price of products that offered a health benefit was also considered as the GM spread would have to be cheaper to properly differentiate itself. Three price levels (for a 500g tub) were used to examine the influence of price.

Table 1: Attributes and their levels used to devise the hypothetical product profiles

Dairy spread		Yogurt	
Attribute	Attribute Level	Attribute	Attribute Level
Fat content	Standard fat Low fat Reduced fat	Fat content	Standard fat Low fat 0% fat
Brand	Your normal brand “Flight” brand	Brand	Your normal brand “Dairy Fresh” brand
Price (per 500g tub)	€4.90 €3.40 €1.85	Seal of approval	DOH (Approved Department Health and Children standard) EFSA (Approved European Food Safety Authority standard) Approved company standard.
GM ingredients	GM + health claim No GM ingredients GM ingredients + no benefit	GM ingredients	GM + health claim No GM ingredients GM ingredients + no benefit

Yogurt focus group participants also suggested a “seal of approval” for a GM yogurt with most respondents interested in a medical seal. They proposed that this seal should come from “*an independent institution*”, “*a nutritionist*”, “*health board*” or “*doctor*”. This was viewed as an interesting concept to examine in light of the fact that the hypothetical GM yogurt was claiming to help protect against cancer. Three levels were used to test this construct (Table 1).

The discussion with consumers suggested that a GM attribute with three levels would permit a thorough understanding of the exact influence that the GM-related health benefit would have on purchase intention. The three levels were as follows: GM ingredient and health benefit, GM ingredient and no GM ingredients.

Consumer Survey

Yogurt

Ideal yogurt: Conjoint analysis of the consumer survey data showed that the attributes of the ideal yogurt were: a low fat content, the respondent’s normal brand of yogurt, contained “No GM ingredients” and carried a European Food Safety Authority (EFSA) seal of approval.

The GM attribute was considered to be the most important, followed by fat content, seal of approval and brand name (Table 2). Thus, the GM attribute has the most influence on the preference ratings given to the various products shown on the cards. Fat content was also considered relatively important. Within the GM attribute, “No GM ingredients” was considered to have the highest utility, followed by a GM ingredient offering a health benefit and then “GM ingredients”. This indicates that while Irish yogurt consumers are not in favour of second-generation GM foods, they appear less negatively inclined towards a product offering a benefit.

Consumer clusters: Cluster analysis revealed four consumer segments with different ideal product profiles. These were “conditional accepters”, “2nd generation rejecters”, “Anti-GM” and “2nd generation accepters”. Results for each segment are shown in Tables 2 (attributes) and 3 (utilities).

Table 2: Yogurt Questionnaire – Importance scores (percent) for each attribute

Attribute	Overall Sample (n=297)	Cluster 1 "conditional accepters" (20.5% of sample)	Cluster 2 "2nd generation rejecters" (33.7% of sample)	Cluster 3 "Anti-GM" (24.6% of sample)	Cluster 4 "2nd generation accepters" (21.2% of sample)
Fat content	30	26	42	11	38
Brand name	<i>11</i>	<i>11</i>	<i>12</i>	<i>9</i>	<i>13</i>
GM attribute	39	42	23	69	28
Seal of approval	20	21	23	11	21

Note: The most important attribute is shown in bold and the least important attribute is shown in italics.

The GM attribute was the most important factor for the “Conditional accepters” and “Anti-GM” segments.

“Conditional accepters” had a preference for a product with “No GM ingredients” (utility = 1.03) but were receptive to a yogurt with a GM ingredient which conferred a health benefit (utility =0.56).

The “anti-GM” cluster simply reject products with GM ingredients (“GM ingredients”: utility = -1.55 and GM product with a health benefit: utility = -1.41).

Fat content was the most important factor for the “2nd generation rejecters” and “2nd generation accepters”.

The “2nd generation rejecters” resemble “conditional accepters” in that they prefer a product with “No GM ingredients” (utility = 0.46). They differ in that they are least accepting of a GM product offering a health benefit (utility = -0.41). A low fat content was also preferred.

The fourth cluster is composed of “2nd generation accepters”. This group have an overall preference for a product that has a GM ingredient which confers a

health benefit (0.61) and are least favourably inclined towards a product that states it contains “No GM ingredients” (utility - 0.66). They are also looking for zero fat in their yogurts.

Table 3: Utility scores of yogurt attributes for overall sample and sample segments

Level of attribute	Overall sample (n=297)	Conditional accepters (n=61)	2nd generation rejecters (n=100)	Anti-GM (n=73)	2nd generation accepters (n=63)
Fat					
Standard fat	-0.23	-0.62	-0.06	-0.31	-0.01
Low fat	0.14	0.44	0.09	0.16	-0.10
0% fat	0.09	0.19	-0.03	0.16	0.11
Brand					
Normal brand	0.10	0.14	0.06	0.20	0.03
Dairy Fresh	-0.10	-0.14	-0.06	-0.20	-0.03
GM					
GM ingredients	-0.72	-1.59	-0.05	-1.55	0.05
GM ingredient + health claim	-0.24	0.56	-0.41	-1.41	0.61
No GM ingredients	0.95	1.03	0.46	2.96	-0.66
Seal of Approval					
Department of Health and Children (DOH)	0.13	0.39	-0.02	0.14	0.09
Approved company standard	-0.30	-0.47	-0.27	-0.31	-0.18
European Food Safety Authority (EFSA)	0.17	0.07	0.29	0.17	0.09

Generally a seal of approval was also relatively important for three clusters whereas brand name was attached least importance in all clusters.

Profiling of the clusters: There was a greater percentage of “2nd generation accepters” from Dublin and of “2nd generation rejecters” from Munster. The “2nd generation accepters” contained the lowest percentage of respondents from the AB socio-economic group; “2nd generation rejecters” contained the highest. The “anti-GM” cluster contained the highest percentage of respondents who claimed that they were the chief income earner in their household.

The “conditional accepters” were the most regular consumers of yogurt, with 51% stating that they consumed it on a daily basis; the “2nd generation accepters” were the least regular.

A greater insight into the attitudes held by the different consumer segments was provided by the food choice questionnaire. The “conditional accepters” were more health-oriented and more receptive of products with natural ingredients than the “2nd generation rejecters”. On the one hand, the association of a health benefit with a GM food explains their greater receptivity to a second-generation GM product while their preference for products with natural ingredients may explain why they are conditional as opposed to outright accepters.

The fact that the “anti-GM” group has a stronger preference for products with natural ingredients compared to “2nd generation accepters” suggests that the former may perceive GM foods as being unnatural or in some way artificial.

Animal welfare was a more important food choice factor for both “conditional accepters” and the “anti-GM” cluster compared to the “2nd generation rejecters”.

The “anti-GM” segment may associate GM foods with issues such as animal cloning and reject such foods on the basis of animal welfare concerns. Environmental protection also emerged as a more influential food choice factor for the “anti-GM” group compared to “2nd generation rejecters” and

“conditional accepters”. It implies that the “anti-GM” segment may reject such foods on the basis of environmental concerns.

Dairy Spread

Ideal dairy spread: Conjoint analysis of the consumer survey data showed that the attributes of the ideal dairy spread were: low fat content, respondent’s normal brand, “no GM ingredients” and a price of €1.85 per tub.

The GM attribute was the most important, followed by price, fat content and brand name (Table 4). Similar to the yogurt questionnaire, “no GM ingredients” had the highest utility value (0.84). “GM ingredients” was least preferred with a utility of -0.66. A relatively lower negative utility value was recorded for a product with a GM-derived health benefit (utility = -0.18) (Table 5).

Table 4: Dairy spread questionnaire – Importance scores (percent) for each attribute

Attribute	Overall Sample (n=299)	Cluster 1 “pro 2nd generation” (29.4% of sample)	Cluster 2 “anti GM” (24.4% of sample)	Cluster 3 “2nd generation accepters” (14.4% of sample)	Cluster 4 “2nd generation rejecters” (31.8% of sample)
Fat content	22	27	15	22	24
Brand name	12	12	10	15	12
GM attribute	35	22	59	37	27
Price	31	39	16	26	37

Note: The most important attribute is shown in bold and the least important attribute is shown in italics.

Consumer clusters: Cluster analysis also identified four consumer segments within the overall dairy spread sample; “pro 2nd generation”, “anti-GM”, “2nd generation accepters” and “2nd generation rejecters”. Importance of each factor for these segments is shown in Table 4. The “anti-GM” and 2nd generation accepters” regarded the GM factor as being most important while the other two segments attached most importance to price. Fat content was relatively important in all segments while brand name was considered least important of the four factors examined.

The “pro 2nd generation” group were in favour both of a product with a GM ingredient which conferred a health benefit (utility = 0.38) and one which contained GM ingredients (utility = 0.08) (Table 5). This implies that they are not concerned about the GM issue and, indeed, price emerged as the most important factor influencing choice of a dairy spread for this particular group. They had a preference for a spread priced at €1.85 (utility = 0.73), suggesting that they would not pay a premium for a second-generation GM product. Fat content was also more important than the GM factor for this segment.

For the “anti-GM” group, the GM attribute was the most important factor influencing choice of a dairy spread (relative importance = 59.25%). Even when offered a health benefit, they are outright rejecters of GM products (“GM ingredients”: utility = -1.37 and GM product with health benefit: utility = -1.28).

The third cluster are not in favour of GM products (“GM ingredients”: utility = -1.53 and “No GM ingredients”: utility = 0.36) but become receptive when they offer specific consumer benefits (“GM ingredient + health claim”: utility = 1.17).

The “2nd generation rejecters” are not in favour of GM products (“GM ingredients”: utility = -0.41), even when they offer a benefit (“GM ingredient + health claim”: utility = -0.46). However, they do not feel as strongly about this issue as the “anti-GM” cluster and resemble the “pro 2nd generation” group in that price was the most important factor influencing choice.

Table 5: Utility scores of dairy spread attributes for overall sample and sample segments

Level of attribute	Overall sample (n=299)	Pro 2nd generation (n=88)	Anti-GM (n=73)	2nd generation accepters (n=43)	2nd generation rejecters (n=95)
Fat					
Standard fat	-0.38	-0.27	-0.25	-0.58	-0.49
Reduced fat	0.10	0.18	-0.06	0.04	0.17
Low fat	0.28	0.09	0.31	0.54	0.32
Brand					
“Flight”	-0.23	-0.10	-0.20	-0.56	-0.24
Normal brand	0.23	0.10	0.20	0.56	0.24
GM					
GM ingredients	-0.66	0.08	-1.37	-1.53	-0.41
GM ingredient+ health claim	-0.18	0.38	-1.28	1.17	-0.46
No GM ingredients	0.84	-0.46	2.65	0.36	0.86
Price					
€1.85	0.73	0.86	0.29	0.76	0.93
€3.40	-0.12	-0.31	0.05	-0.16	-0.06
€4.90	-0.61	-0.56	-0.33	-0.60	-0.88

Profiling of the clusters: Significant differences were identified between the segments in terms of level of education, whether the respondent was the chief income earner and had their cholesterol level tested.

In terms of education, a greater percentage of the “anti-GM” group, 23%, have higher third level education (degree and postgraduate qualification) compared to 10% of the sample as a whole. This result implies that those with a greater

level of education are more likely to reject GM foods.

A greater proportion of the “2nd generation rejecters” (69%) was the chief income earner in their household compared to the sample as a whole (58%). In contrast, only 48% of those interviewed in the “pro 2nd generation” cluster were the chief income earner in their household.

About 46% of the sample claimed to have had their cholesterol level tested. It was highest for the “anti-GM” group (62%) while the majority of the “2nd generation accepters” and “pro 2nd generation” segments have not had it tested.

In terms of their food choice attitudes, the “anti-GM” group had a greater preference for food with natural ingredients and which did not contain additives or artificial ingredients compared to the “pro 2nd generation” cluster. The familiarity of the food they consume and the fact that it is part of their normal routine is more important to the “2nd generation accepters” compared to the “anti-GM” group. The latter are more influenced by issues of environmental protection when choosing food than the “2nd generation rejecters”.

DISCUSSION

Overall, the results for both questionnaires suggest that GM foods are not widely accepted by Irish yogurt and dairy spread consumers. It could be argued that rejection of the second-generation GM products could be due to those used in this study. For example, the consumer focus groups indicated that yogurt was perceived as a “*natural*” product with “*natural ingredients*” and so certain consumers may not like or agree with the use of GM ingredients in such a product. Yet an equal assertion could be that consumers were sceptical of the health claim associated with the product. They may have distrusted such a claim when it was associated with GM ingredients.

The “anti-GM” cluster consumed health-based functional spreads (*e.g.* Benecol and Flora pro-activ) more frequently than any of the other consumer segments. They were also the segment most likely to have had their cholesterol level tested which would imply that they would be more receptive

to products claiming to reduce cholesterol levels. This group possibly does not see the need for a second-generation GM product with this particular benefit as conventional alternatives are already available.

CONCLUSIONS AND RECOMMENDATIONS TO INDUSTRY

Irish yogurt consumers rejected a GM yogurt even when it offered an anti-cancer health benefit. About thirty-three percent of the sample specifically rejected a second-generation yogurt while 25% were outright rejecters of a GM yogurt. Nonetheless, a GM yogurt offering specific consumer benefits was acceptable to 21% of the sample, which implies that such a food could represent a sizeable market segment. A further 21% of the sample were receptive to the concept of a second-generation GM yogurt. However, this group had a number of complex reservations about GM foods that would have to be resolved before they would fully accept such a product.

Overall, Irish dairy spread consumers did not accept a GM spread even when it offered specific consumer benefits. Correspondingly, cluster analysis identified a segment (24%) of the sample who were outright rejecters of a GM spread while 32% did not accept a second-generation GM spread. Almost a third of the sample were positively inclined towards a second generation spread with a further 14% clearly accepting them. The “2nd generation accepters” had reservations about GM foods which they discounted on the basis of the health benefit offered by the product. The results further suggest that the “pro 2nd generation” cluster would be particularly receptive to second-generation GM spread offered at a competitive price.

The perception of benefits has been identified as the driving force behind the emergence of risk tolerant support for GM crops and foods in many European countries including Ireland. Risk tolerant supporters perceive the risk but then discount it. Such a result reinforces the importance of any new GM crops and foods meeting the public’s criterion of usefulness (Gaskell *et al.*, 2003). Second-generation GM products may be more acceptable if consumers could see that they had undergone specific clinical trials by the presence of a distinct seal of approval.

The results of the current study imply that clearly-labelled second-generation GM products with proven health benefits could occupy a share of the Irish food market. Just over twenty percent of Irish yogurt consumers and fourteen percent of Irish dairy spread consumers would accept second-generation GM products. The figure for yogurt consumers corresponds to that from an earlier study in Germany, which demonstrated that 27% of participants (n=200) would buy GM foods serving certain health functionality (Spetidis and Schamel, 2001).

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