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Whole grains and health: attitudes to whole grains against a prevailing background of increased marketing and promotion

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Abstract

Objective: To explore current awareness and perceptions of whole grain foods and perceived barriers and facilitators of whole grain consumption.

Design: Focus groups were conducted to investigate consumer attitudes to whole grains. Discussions were transcribed verbatim and analysed thematically.

Setting: Discussions were held throughout Northern Ireland with adults who were at least partly responsible for food shopping.

Subjects: Seven focus groups were held (n 43; thirty-three females, ten males).

Results: All participants were aware of the term 'whole grain' and had a basic level of awareness of their health benefits. Prominent barriers and facilitators of whole grain intake were related to perceptions of the sensory properties (most dominant factor) of whole grains; knowledge of how to locate, identify and use whole grains; and awareness of the health benefits, perceived cost and family influences. Parents of young children appeared to be altruistically motivated with many stating they wanted to ensure their children consumed whole grains in order to establish good eating habits.

Conclusions: Participants were generally aware of the term 'whole grain'; however, even against a background of increased availability and promotion of whole grain foods, many key barriers to whole grain consumption were still evident. Alongside general education efforts, opportunities and challenges exist for the food industry to develop novel, but affordable, food products that are able to deliver whole grains in a wide variety of forms, including whole grains 'in disguise' for those who are most resistant to change.

Keywords
Whole grains
Barriers
Facilitators
Perceptions

A wealth of epidemiological data indicates that a high intake of whole grains is associated with a reduced risk of CVD, obesity, type 2 diabetes and certain cancers^(1,2). Despite such potential health benefits, whole grain intakes are low^(3–6). In the last decade there have been significant efforts by the food industry to increase the availability of whole grain foods and assist consumer choice, for example by highlighting whole grains on front-of-pack labelling and pursuing whole grain health claims. There is, however, little qualitative research on attitudes to whole grains^(7–11). Nearly all existing qualitative research emanates from the USA which has different dietary guidance regarding whole grains and different legislation regarding health claims compared with the UK and Europe. The USA has a quantitative whole grain recommendation to 'consume three or more ounce-equivalents of whole grain products per day'⁽¹²⁾. In contrast, the UK has a more general recommendation: 'Eat plenty of bread, rice, potatoes, pasta and other starchy foods every day. Choose whole grain varieties when you can'⁽¹³⁾. For a food

to be truly 'whole grain', it must contain the three main components, i.e. the endosperm, bran and germ, in almost the same proportions as they exist in an intact grain⁽¹⁴⁾.

The aim of the present study was to use focus groups to explore current attitudes to and awareness of whole grains, perceived barriers to and facilitators of whole grain consumption and feelings about how best to promote whole grain consumption.

Materials and methods

Focus group recruitment

Seven focus groups were conducted between February and October 2009 with participants aged 18–65 years who had some responsibility for food shopping in the household. Purposive sampling techniques were used to recruit a mix of female and male participants of different ages within Northern Ireland. Due to the pivotal role parents play in the promotion of healthy dietary habits

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Table 1 Semi-structured focus group guide

<p>Part 1 – General food choice</p> <ul style="list-style-type: none"> • What cereal (grain)-based products do you eat for breakfast/lunch/dinner/snack? • Why do you/do not eat cereal (grain) products for breakfast/lunch/dinner/snack? • What makes some cereal (grain)-based products a better breakfast choice than others? <p>Part 2 – Knowledge of whole grains</p> <ul style="list-style-type: none"> • How many of you have heard of whole grains? • What do you think whole grains are? • Give me some examples of whole grain foods? • How do you feel about whole grains? • Does anyone know of any health benefits/difficulties associated with whole grains? • What amount of whole grains do you think we should eat every day? • Where do you get your information on whole grains from? <p>Part 3 – Information on health benefits</p> <p>An information sheet briefly describing some possible health benefits of whole grains was provided for the participants to read. They were then asked:</p> <ul style="list-style-type: none"> • How do you feel about whole grains now that you know about the potential health benefits of these foods? • Would you be more likely to consume more whole grains now that you have a better knowledge of their health benefits? 	<p>Part 4 – Whole grain products</p> <p>Participants were shown a range of whole grain products available on the market and where then asked the following questions:</p> <ul style="list-style-type: none"> • Have you seen/bought/tried any of these before? • If yes, what do you think/feel about them? • If not, why did you not buy/try them? • What could be done to encourage you to eat more whole grain foods? <p>Part 5 – New whole grain/functional whole grain cereal foods</p> <ul style="list-style-type: none"> • How appropriate would it be to develop new types of cereal (grain)-based foods in order to increase the consumption of whole grains? E.g. combining with yoghurts, smoothies, desserts, cheeses, spreads, fruit juices or as powders. • How appropriate would it to develop foods with specific health effects (functional foods with health-related claims, give examples)? • If you noticed any new whole grain products, what would make you want to buy them? • How do you feel about them? <p>Additional questions for discussion in groups of parents with toddlers</p> <ul style="list-style-type: none"> • Did you increase your whole grain intake during pregnancy? Why? • How did you begin to introduce cereal (grain)-based foods into their diets from weaning? • How did your children respond to these foods during from weaning? • Do you make more of an effort to buy whole grain foods for your children? Why?
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among children⁽¹⁵⁾, discussions were also conducted with groups of parents with young children to identify if, and how, parents incorporate whole grains into their children's diets and the reactions these products and strategies receive. Participants were recruited through word of mouth, community groups, church groups and businesses. The groups consisted of four to ten participants, all of whom provided informed verbal consent. The study protocol was approved by the Queens University of Belfast Ethical Committee.

Focus group questions

A semi-structured discussion guide (Table 1) was designed to investigate the current whole grain foods consumed (in broad descriptive terms) and the participants' knowledge and perceptions of whole grains. The guide was based on the questions from the EU HEALTHGRAIN study⁽¹⁶⁾, with the addition of specific questions relating to whole grain and parenting practices. The main topic areas covered were: participants' use of whole grains (part 1), their knowledge of whole grains (parts 2 and 3), their familiarity with whole grain products (part 4), their perceptions of whole grain functional foods (part 5) and, for the groups of parents with children, their use of whole grains while pregnant, during weaning, etc. Prompts were used when necessary to redirect or promote discussion. Questions were pretested for format, clarity, flow and duration with a pilot focus group and refined prior to implementation.

Focus group procedures

Focus group discussions were facilitated by the moderator (E.M.) in an informal setting convenient to participants.

During the introduction, participants were told that the purpose of the study was to investigate 'eating behaviour relating to cereal grain foods'. As an ice-breaker, participants were asked to introduce themselves on a first name basis and describe their eating habits. The moderator then gave instruction on ground rules (e.g. allowing everyone to speak, confidentiality), sought input from all participants (e.g. any other views?) and encouraged elaboration on the issues. After the knowledge section participants were given an information sheet which informed them of the benefits of eating whole grain foods (discussion guide part 3). Then a wide variety of whole grain products such as flapjacks, pumpnickel bread, rye crisp bread, etc. were presented to gauge consumer perception and knowledge, stimulate discussion and focus the discussion on whole grains (discussion guide part 4). Each focus group session was audio recorded, and lasted between 45 and 60 min. Subsequently, participants were thanked and were informed that they could speak to the moderator about any issues raised.

Analysis of focus group transcripts

The focus group recordings were transcribed verbatim. An inductive thematic analysis framework, as outlined by Braun and Clarke⁽¹⁷⁾, was applied to the data to code and identify themes. The qualitative data analysis software NVivo 8 (QSR International) was used to manage the coded data. E.M. and one author (M.D., a psychologist) independently developed an early coding structure after reading and re-reading three of the transcripts. This was followed by a discussion and comparison of the codes to verify the validity and reliability of their application; this iterative process was repeated

Table 2 Demographic details of the study participants: adults aged 18–65 years, Northern Ireland, February–October 2009

Focus group	Gender	Age range (years)	Number of participants	Other factors
Group 1 (FG1MS)	Mixed	19–24	5	
Group 2 (FG2F)	Females	>50	4	
Group 3 (FG3F)	Females	30–45	5	Live with young children
Group 4 (FG4MS)	Mixed	30–45	8	Live with young children
Group 5 (FG5M)	Males	>50	7	
Group 6 (FG6F)	Females	30–45	4	Live with young children
Group 7 (FG7F)	Females	40–65	10	

several times until all discrepancies were resolved satisfactorily. The coding framework was then applied to the remaining transcripts. Previous transcript codes were adjusted as needed. E.M. and M.D. grouped the codes (and related data) into similar categories and constructed the corresponding themes with quotations to illustrate typical views.

Results

The demographic characteristics of the forty-three focus group participants are shown in Table 2. This section presents the findings from the thematic analysis, which covered barriers to increasing whole grain consumption, facilitators of whole grain consumption, attitudes towards new whole grain foods and strategies to increase whole grain intake.

Barriers to increasing whole grain consumption

Focus group participants were aware of the term ‘whole grain’ and their current grain consumption appeared to be mainly from breads and cereals. The main barriers to increasing whole grain consumption related to their sensory properties, knowledge factors, health benefits, perceived cost and family interactions (Table 3).

Sensory properties

Many participants disliked the organoleptic properties (i.e. the taste, texture, appearance and smell) of certain whole grain foods, with taste being the most dominant barrier. Some stated that they did not follow the advice of health professionals because of a dislike of the sensory properties of the whole grain foods recommended:

Like not very tasty. It's anything that's good for you, you know, it's just not going to appeal ... as much as a ... cream bun. (FG1MS)

In addition many participants viewed whole grain breads as having a shorter shelf life than their refined counterparts:

If you didn't eat it [wholemeal bread] let's say within 2 or 3 days, there was this yellow thing starting to grow on it, so we stopped buying it. It was like a mouldy thing. (FG2F)

Knowledge factors

Many participants admitted that they knew very little about whole grain foods and could only provide basic

definitions of whole grains such as ‘contain the whole of the grain’ (FG1MS), ‘natural’ (FG2F) and ‘there's nothing else added’ (FG7F). Many were uncertain about the difference between whole and refined grain foods and were reliant on product advertising or on-pack labelling to help them identify whole grains. Few were able to identify a whole grain food from an ingredient list:

I'm not quite sure what grains are counted as grains because you're counting rice, but where does maize fit in and lentils? I just don't know where they fit into the whole kind of whole grain definition. (FG4MS)

Participants were unfamiliar with most of the whole grain foods displayed during the discussions and there also seemed to be a low level of knowledge regarding how to cook some whole grain foods or how to incorporate them into meals:

I wouldn't know what to do with the Quinoa or the barley or any of that stuff. (FG1MS)

Health benefits

The majority of participants seemed to have only a basic awareness of the health benefits of whole grain foods, mainly stating that they were ‘filling’ and ‘good for your heart’. Some stated that they avoided whole grains because of health problems (such as heartburn, bloating and irritable bowel syndrome):

I've got irritable bowel and I can't eat it at all ... and sometimes [name of a wheat biscuit cereal] will start me. (FG7F)

In addition, some reported concerns that some grain foods, particularly processed foods such as some cereals, may be high in calories, fat, sugar or salt:

It's all the hidden salts and all that they don't advertise. There's so many grams of salt in this [wheat biscuit cereal]. It's all those hidden salts. (FG5M)

Perceived cost

Participants perceived whole grain foods to be more expensive than their refined counterparts. In particular, many found it difficult to be able to afford to buy whole

Table 3 Barriers to increasing whole grain consumption among the study participants: adults aged 18–65 years, Northern Ireland, February–October 2009

Category	Sub-category	Illustrative quotes
Sensory properties	Taste	'Like not very tasty. [...] It's anything that's good for you, you know, it's just not going to appeal ... as much as a cream bun ... if you've got like one of them ... and like a slice of brown bread with butter on it you're going to go for the cream bun ... unless you're [name of famous celebrity] or something?' [laughs] (FG1MS) 'I mean dietitians all recommend that we eat brown bread. Well I would buy the brown bread but I end up throwing it out because he [husband] doesn't like it but I told him you know that the dietitian recommends it for him. But he doesn't eat it, and he won't eat it, he has to get white bread.' (FG2F)
	Texture	'I near broke my tooth on granary bread once.' (FG7F) 'I have to say brown pasta I still find weird. Texture wise. I can do everything else but brown pasta but my children ... brown pasta does nothing for them. They think it's disgusting.' (FG4MS)
	Appearance	'That just looks disgusting.' [dark rye bread] (FG1MS)
	Smell	'It smells alcoholic ... I don't think I can even try it.' [pumpnickel rye bread] (FG1MS)
	Shelf life	'I would find me trying to finish it off and sometimes it's mouldy before it gets used up and I hate throwing food out.' [whole meal bread] (FG2F) 'If you didn't eat it lets say within 2 or 3 days, there was this yellow thing starting to grow on it, so we stopped buying it. It was like a mouldy thing.' [whole meal bread] (FG2F)
	Knowledge	Identifying whole grains
How much to eat		'Can you actually get brown pasta?' (FG4MS)
Familiarity		'I didn't know it existed. It's because the Chinese don't do brown rice.' (FG4MS)
Cooking whole grains		'Brown rice is very hard to cook I find ... very, very hard to cook.' (FG7F) 'I wouldn't know what to do with the Quinoa or the barley or any of that stuff.' (FG1MS)
Where to find		'I never see those in the shops.' [rye bread, quinoa, couscous, buck wheat, etc.] (FG1MS) 'And also, it can be hard to get hold of.' [referring to a specific brand of oats] (FG4MS) 'Why would any supermarket, say in [name of supermarket], put those two [wheat biscuit cereal and puffed wheat cereal], all that stuff is in the cereal area, those two aren't [porridge oats and wheat germ]. They're among the health foods. So if you've gone down the cereals, you're more likely to pick the wrong cereal, because they have that in other departments; that's round where the health foods is [sic]. I don't understand why they do that.' (FG5M)
Health-related factors		Poor awareness of health benefits
	Avoid whole grains due to certain medical conditions	'I've got irritable bowel and I can't eat it at all ... and sometimes [name of a wheat biscuit cereal] will start me.' (FG7F) 'Sometimes they would give me heartburn maybe the odd time like wheaten bread and the whole grain bread' (FG2F)
	Negative perception of healthiness	'Yeah they are high in carbs so I try ... to limit them to once or twice a week.' [rice and pasta] (FG1MS) 'They're so full of fat because they've been baked in butter.' [flapjacks] (FG1MS) 'It's all the hidden salts and all that they don't advertise. There's so many grams of salt in this [wheat biscuit cereal]. It's all those hidden salts.' (FG5M)
	Will think about eating in later life	'You can imagine that being very good for your granny.' [yoghurt with added whole grain] (FG1MS) 'I'd say maybe in years to come it would be something you might think of doing cos I know my mother throws on her muesli on top of her cereal in the mornings and things like that. [...] But for now, no.' [whole grain powders/sprinkles] (FG1MS)
Cost	'I know it's dearer than everything else.' [whole grain products in general] (FG1MS) 'You see them but when you're on the brew you can't buy them. You have to wait until they're on special offer.' [some commonly consumed whole grain cereals] (FG4MS)	
Social influences	'Well I would buy the brown bread but I end up throwing it out because he [husband] doesn't like it.' (FG2F) 'I mean my ones pick most of the food I buy as they're so fussy. So I just buy them what they want. It's either that or they don't eat anything. So I buy them what they want just so they're eating something ... and get all their meals.' (FG4MS)	

Table 4 Factors that facilitate the consumption of whole grain foods among the study participants: adults aged 18–65 years, Northern Ireland, February–October 2009

Category	Sub-category	Illustrative quotes
Sensory properties	Taste	'I would tend to use brown rice because I do think it does taste a bit nuttier and it gives a bit more flavour to the meal.' (FG4MS)
	Texture	'I would live on wheaten bread or toast. I mean I could eat that 3 times a day. I love it.' (FG2F) 'I would eat brown rice with salads because it keeps its, it doesn't fall apart like white rice does.' (FG4MS)
	Appearance	'I love the seeds.' [on granary and certain whole meal breads] (FG7F) 'I mean those look very good those [brand name] oat biscuits cos they're nicely packaged, they look like normal biscuits.' (FG1MS) 'Well if you put down a granary loaf and you put down a white loaf, the granary is more attractive looking than a plain white loaf. Especially [brand name] granary. Or rice.' (FG4MS)
Knowledge	Able to identify whole grains	'I would say it's the actual grain and it's crushed. And you get the husk, the content of the husk and all in it combined, the whole seed.' (FG5M) 'Provided it's whole meal. Like oats. And not bran which is almost useless as a food product. Bulker, yes.' (FG5M)
	Know where to find whole grains when shopping	'The big supermarkets have a good range of whole grain stuff.' (FG7F) 'Well there's definitely more of a range than what there used to be. Even the likes of the local wee shops here, they have more of a range of like brown bread, granary bread, than what there used to be years ago. People are wanting it more now, so they are.' (FG4MS)
Health-related factors	Positive perception of healthiness	'I would just eat brown and whole meal cos I prefer it as well, but also because it's better for you, you feel like you're killing two birds with one stone really.' (FG1MS) 'I would tend to buy things that I think are healthy.' (FG1MS) 'You could get through the day on that bowl of porridge, you could skip the rest of the day and you wouldn't get through it. And you've had everything, you've all your vitamins, you wouldn't even need a vitamin tablet, they're all in that.' (FG5M)
	Alleviate certain medical conditions	'Well this is why I started eating whole meal bread because my cholesterol levels were too high.' (FG4MS) 'Men of our age, we really should be eating whole grain because so many of us are dying with bowel cancer and all sorts of stuff like that.' (FG5M)
	Children's health	'I want to keep my kids healthy so they will grow up well and I also want to teach them the importance of eating well and looking after their health. I hope they will continue eating well throughout their lives but in today's world I don't think that will happen.' (FG6F)
Social influences	Positive social influence	'I buy the bread in our house, wheaten bread, I still live at home with my parents and my father, well my mum wouldn't touch it but my father keeps saying that bread's beautiful, go buy more of it.' (FG7F)
	Influence of health professionals	'We would have porridge most mornings because [husband] is on a special diet so I've to be careful what he has. So, they [health professionals] recommend porridge.' (FG2F)
Part of habitual diet		'The only essential food items we had to buy was [sic] flour and oats to make porridge. I mind using stone ground flour, it was very coarse, to make bread and the bread was ten times nicer than what you can buy now, or even make yourself now because of the good flour, and it was cheap. That's why we had it Our food was simple but tasty and healthy. We knew what we were eating.' (FG2F) 'I use jumbo oats and pumpkin seeds, and this is what I was reared on by the way. My father was a sergeant major and he brought me up with this fairly strict diet you know.' (FG5M)
Convenient	Quick and easy to prepare and consume	'It's quick isn't it to put a bit of butter or whatever and fill two slices of bread and a yoghurt than to stand and actually make yourself something you know, from scratch.' (FG7F) 'I give mine 4 min in the morning in the microwave and plump it up.' [porridge] (FG5M) 'It's handy you know, it's quick to ... just get cereal and milk in the morning.' (FG1MS)
	Can freeze/refrigerate	'It doesn't mould in the fridge.' [whole meal bread] (FG2F)

grain foods at full price; therefore they limited what they purchased and relied on supermarket special offers:

Yes like porridge ... it's one the plainest, most natural breakfast foods you can eat, but it's twice the price of a box of cereal. (FG6F)

Family interactions

Some reported that they did not buy certain whole grain foods if other family members (spouses, children) did not

like them, even if the participant preferred the whole grain variety:

Well I would buy the brown bread but I end up throwing it out because he [husband] doesn't like it. (FG2F)

Facilitators of whole grain consumption

Conversely, many of the barriers to whole grain intake acted as facilitators for some people, as shown in Table 4. For example, participants claimed that sensory properties,

knowledge factors, health benefits and family interactions were some of the main reasons why they consumed whole grain foods. In addition, habitual diet and convenience were cited as facilitators.

Sensory properties

An appreciation of the sensory properties of whole grains, particularly taste, was the most influential facilitator and outweighed the cost for some participants, as they felt it was worth paying the extra money for the foods they liked:

Porridge oats can be more expensive than those boxes of cereal and the muesli too but again, they're nicer so I get them anyway. (FG2F)

Knowledge factors

Those who consumed whole grain foods regularly had a good level of knowledge in relation to identifying whole grains, locating them in shops and distinguishing between whole grain and high-fibre grain foods:

I would say it's the actual grain and it's crushed. And you get the husk, the content of the husk and all in it combined, the whole seed. (FG5M)

The big supermarkets have a good range of whole grain stuff. (FG7F)

Health benefits

The majority of those who reported that they ate whole grain foods regularly viewed whole grains as 'healthy', 'filling', 'natural' and 'nutritious'. Also, many stated that they consumed various whole grain foods to alleviate certain medical conditions, such as high cholesterol, to promote good health and to reduce risk of chronic diseases:

Well this is why I started eating whole meal bread because my cholesterol levels were too high. (FG4MS)

Many participants reported making a conscious effort to get their children to eat more whole grains as part of a healthy diet and to establish good eating habits:

I want to keep my kids healthy so they will grow up well and I also want to teach them the importance of eating well and looking after their health. (FG6F)

In addition, after reading information relating to the health benefits, many but not all claimed that they would be more willing to buy whole grain varieties as they were now aware of their importance in the diet, for example:

I suppose I would make more effort to eat them now, certainly for the wee ones. (FG3F)

In addition when consumption of whole grains was considered relevant to themselves or their family, these participants were willing to start increasing their whole

grain consumption. A participant in a group of parents with young children said:

See that heart disease and diabetes, they are all in my family so I better start eating more brown bread. (FG4MS)

Other facilitators

Participants also mentioned that they found whole grain foods to be convenient:

I give mine [porridge] 4 min in the morning in the microwave and plump it up. (FG5M)

Also, some claimed they had been influenced to eat more whole grains due to family and friends' preferences, or advice from health professionals:

Well this is why I started eating whole meal bread because my cholesterol levels were too high. (FG4MS)

Further, many reported eating whole grain foods out of habit, having always consumed them since childhood:

I use jumbo oats and pumpkin seeds, and this is what I was reared on by the way. (FG5M)

All my family would eat brown bread. (FG7F)

Attitudes towards new whole grain foods

There was mixed opinion as to whether various types of novel whole grain foods would be acceptable to the participants. Products such as spreads, yoghurts, pizzas and cakes with added whole grains appeared to be acceptable to participants; however, products such as fruit juices, smoothies, milk and cheeses were not. These opinions were, as expected, based on views about the anticipated sensory properties of the novel whole grain products. Many participants described these foods as being 'unnatural', with one participant adding:

I think it would be too weird for some people. It would maybe spoil the food itself. (FG3F).

Moreover, many participants expressed concern that these products would be very expensive and those on tight budgets would not be able to afford them, for example:

I'm sure they wouldn't be cheap like. They would cost a good 50p more than the plain alternative. I couldn't afford that. (FG4MS)

Strategies to increase whole grain intake

The participants discussed various strategies that would help to increase whole grain intake. The main barrier to whole grain intake was the sensory properties of whole grain foods and it was felt that if whole grain products were made more palatable, this would increase their appeal to a wider range of people:

Make them more attractive ... I suppose ... for kids to eat. (FG3F)

Another issue discussed was competitive pricing to make whole grains more affordable to all:

You would really see more people going for them if they were cheaper, or the same price as like the white bread and all. (FG4MS)

Participants also argued for better nutrition labelling with more use of the term 'whole grain' on-pack as well as for more attractive packaging and media advertising to help consumers identify what whole grains are:

If they had more labels on it saying why it was better than the other. (FG1MS)

Getting people more aware of the different types available would be very important, so people would know what's out there. (FG3F)

Further, participants wanted more education about the health benefits of whole grains and also on how to identify them and incorporate them into their diet:

But I think too that people need to hear more about whole grains either on TV like health adverts or programmes and from their doctors and all. (FG4MS)

Finally, participants also wanted more variety and availability of whole grain foods with better placement on the supermarket shelves:

Some of those things you couldn't get in a local shop, in fact most of them you couldn't get so maybe if they sold them in local shops as opposed to bigger stores. (FG1MS)

Discussion

Relatively little qualitative research has explored attitudes to whole grains. The present study was conducted against a background of increased availability, promotion and marketing of whole grain foods in the UK. Although awareness of the term 'whole grain' was good, many barriers to whole grain consumption were still very evident. The most prominent barriers were a negative perception of the sensory properties of whole grains, a lack of knowledge of what they are, where to find them and how to incorporate them into meals, and also a lack of awareness of their health benefits and how much should be consumed. Hence, while participants were aware of the term 'whole grain', many did not like the sensory properties of whole grains or they lacked the level of knowledge needed to facilitate increased intake of these foods. The sensory properties of whole grains are generally recognized as the most prominent barrier to whole grain intake^(7,9,11,16,18–20), as was the case in the present research. However, there are also individuals who prefer the taste and texture of whole grain foods and, interestingly,

some of these stated that they were prepared to pay a bit extra for them. This seems to imply that if sensory properties are acceptable then cost may not be a barrier to some. The sensory properties of whole grains were also highlighted within participants' suggested strategies on how to help consumers increase their whole grain intake, where they requested that whole grain foods should be made more palatable. This is a possible avenue that could be explored by industry.

In addition, participants desired more information about whole grains in terms of health benefits and practical assistance in identifying whole grain foods and how to incorporate them into their diet. Further, there were requests for more diversity with regard to general nutrition messages which some felt had become increasingly focused on fruit and vegetables in recent years. When information on the potential health benefits of these foods was presented, participants who saw relevance displayed openness towards trying whole grains, despite sensory aversions. This is in line with Mialon *et al.*'s findings⁽²¹⁾, where sensory-, health- and nutrition-related ratings increased for whole meal bread, multigrain muffins and fibre-enriched white bread, and decreased for low-fibre white bread, after participants received nutritional information on the fibre content of each food. A small number of studies have been conducted to evaluate the effects of various nutrition education interventions to increase consumer confidence by improving their knowledge and awareness of whole grains^(22–32), with promising results being observed in all studies. Some studies have shown that the establishment of the USA's '3 a day' whole grain recommendation⁽¹²⁾ and the promotional activity surrounding whole grain products had a positive impact on the consumption of whole grain foods^(33,34).

It was apparent in the focus group discussions that some participants still appeared to be unwilling to consider whole grain consumption even after reading the information on potential health benefits. It is possible that such individuals may not consider the message to be relevant to them and feel sensory enjoyment to be paramount. Others have also noted that different subgroups of people exist in relation to their views and behaviours towards cereal grain foods^(16,19,35,36). For instance, a Belgian study showed that consumers could be grouped into clusters depending on how they valued the health and sensory properties of bread⁽¹⁹⁾. The clusters included those who were: health averse (i.e. valued the sensory enjoyment of bread higher than the health aspect); health and sensory positive (valued both aspects positively); and sensory averse (valued the healthiness of bread higher than the sensory attributes). Consequently, different marketing strategies may need to be employed to increase whole grain sales in different segments of the population. More novel and surreptitious approaches may be required to enable the health averse to increase their whole grain intake. Children are likely to fall into this category; parents

in a study by Burgess-Champoux *et al.*⁽⁹⁾ indicated that providing whole grains 'in disguise' is one strategy they were keen to employ in order to increase their children's whole grain intake. In the long run, however, such a strategy would not help to address the sensory barrier to whole grain consumption and development of good whole grain habits. The importance of habitually consuming whole grains was something that came up in the present research; participants who had always consumed whole grains from childhood talked very positively about these foods. As with all areas of nutrition, it is likely that incorporation of whole grains into the diets of children from a young age, as part of a balanced diet, may encourage sustained consumption of these foods. Studies have shown that increased exposure to an unfamiliar food can increase a child's liking for it and can even break down resistance to foods that were initially disliked^(37–39). It was noteworthy and encouraging that, after reading the information on health benefits, mothers of young children discussed introducing children to whole grain foods in order to establish lifelong habits; this possible motivation towards whole grains is something that could be investigated further and potentially harnessed in future educational activities.

The food industry is already making significant advances in terms of incorporating whole grains into an increasing variety of products, as well as disguising or diluting some of the sensory properties that people find unacceptable; given the discussions reported here, there appears to still be further mileage in this approach for children and adults alike^(40,41). Participants perceived cost would be high for new whole grain products and some expressed concern that while products may be marketed as whole grain, they may also be high in fat, sugar or calories. This is a further challenge for the food industry; how to make whole grains more acceptable without compromising the nutritional integrity of their new or improved whole grain products or making the cost prohibitive for consumers.

Owing to the lack of data in this area, particularly outside the USA, the present study chose a qualitative approach to gain an in-depth insight, from a broad spectrum of ages, into attitudes to whole grains. Purposeful sampling techniques were used to recruit a mix of female and male participants of different ages; however, owing to the fact that recruitment specifically targeted individuals who were at least partly responsible for food shopping, females were over-represented in the sample. The researchers felt that saturation of ideas and themes had been reached after seven focus groups. Quantitative approaches could now be usefully employed to explore the relative prominence of and the interactions between the various barriers identified; for example, the relationship between sensory properties and perceived cost. This further research will help to guide the development of targeted interventions to increase whole grain intake.

Conclusions

Participants in the present research were generally aware of the term 'whole grain'; however, even against a background of increased availability and promotion of whole grain foods in the UK, many key barriers to whole grain consumption are still evident. Continued efforts are needed to address these barriers and encourage increased consumption to all. Alongside general education, opportunities and challenges exist for the food industry to develop novel, but affordable, food products that maintain their nutritional integrity and are able to deliver whole grains in a wide variety of forms, including whole grains 'in disguise' for those who are unlikely to accept the sensory properties of whole grains in their more obvious forms. Increasing use of the term 'whole grain' on food packaging will also help consumers overcome the fundamental barrier of identifying whole grain products. Although a number of barriers to whole grain intake were identified in the present qualitative work, many of these are not insurmountable. Action on multiple levels will be required to help more people consume more whole grains; basic but practical education of the general public is just as important in this regard as investigating novel food products.

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