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Factors influencing adolescent whole grain intake: A theory-based qualitative study

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ABSTRACT

Whole grain consumption is associated with reduced risk of chronic disease. One-fifth of UK adults and children do not consume any whole grains, and adolescents have low consumption rates. Factors affecting whole grain intake among adolescents are not well understood. This study examined the socio-economic, environmental, lifestyle and psychological factors likely to influence consumption and explored whether outcomes aligned with behavioural predictors proposed in the Reasoned Action Approach. Five focus groups explored young people's attitudes towards, knowledge and consumption of wholegrain foods, as well as barriers to, and facilitators of, consumption. Participants were male and female adolescents *(n=50)* aged 11-16 years from mixed socioeconomic backgrounds and ethnicities, recruited through schools in the city of Leeds, UK. Focus groups were analysed using thematic analysis. Most participants had tried wholegrain food products, with cereal products being the most popular. Many recognised whole grain health benefits related to digestive health but not those related to heart disease or cancers. Several barriers to eating whole grains were identified including: difficulties in identifying wholegrain products and their health benefits; taste and visual appeal; and poor availability outside the home. Suggested facilitators of consumption were advertisements and educational campaigns, followed by improved sensory appeal, increased availability and choice, and tailoring products for young people. All constructs of the Theory of Reasoned Action were identifiable in the data, suggesting that the factors influencing whole grain intake in adolescents are well captured by this model. Study outcomes may inform research and health promotion to increase whole grain intake in this age group.

Keywords (maximum of 6)

Adolescents; wholegrain; qualitative research; focus groups; correlates; reasoned action approach

INTRODUCTION

Whole grains are a major source of dietary fibre and are rich in protein, vitamins, minerals, and phyto-chemicals (McKeown, et al., 2013; Slavin, Jacobs, Marquart, & Weimer, 2001). Systematic reviews indicate that increased whole grain consumption may lead to improved insulin sensitivity and reductions in blood pressure, total and LDL cholesterol, colorectal cancer, breast cancer, and CVD risk (Aune, et al., 2011; Kelly, Summerbell, Brynes, Whittaker, & Frost, 2007; Mellen, Walsh, & Herrington, 2008; Slavin, 2000; Ye, Chacko, Chou, Kugizaki, & Liu, 2012) as well as improved weight status and reduced waist circumference (Du, et al., 2010; Harland & Garton, 2008).

It has been suggested that daily intake of around one to three 30g servings of wholegrain foods per day can achieve improvement in health and disease outcomes (Bjorck, et al., 2012; HEALTHGRAIN EU, 2005-2010; Seal & Brownlee, 2015). Although the U.S. Department of Agriculture (USDA) recommends 85g of wholegrain foods per day (converted from ounce equivalents), (Reicks, Jonnalagadda, Albertson, & Joshi, 2014; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010) the most recent National Health and Nutrition Examination Survey (NHANES) 2011-2012 data show that the mean intakes among American adults and children were around 27g/day and 21g/day, respectively (Albertson, Reicks, Joshi, & Gugger, 2016). Similarly low levels of intake are reported in the United Kingdom (UK). The U.K.'s National Dietary Survey of British Adults (NDNS) (2008-2011) reported that 18% of adults and 15% of children/adolescents do not consume any wholegrain foods, with the median intake for adults and children/teenagers being around 20g/day and 13g/day respectively (Mann, Pearce, McKevith, Thielecke, & Seal, 2015; Mann, Pearce, McKevith, Thielecke, & Seal, 2015). In the UK, adolescents and individuals from lower socio-economic groups appear to have the lowest levels of intake (Mann, et al., 2015; Mann, et al., 2015; Nelson, 2007).

In order to develop effective interventions to increase whole grain intake, we need a better understanding of the factors that influence dietary behaviour (Larson, Neumark-Sztainer, Story, & Burgess-Champoux, 2010). To our knowledge, there are no studies that explore whole grain intake correlates in UK adolescents, and only a small number of studies on whole grain intake correlates in different age groups (Burgess-Champoux, Marquart, Vickers, & Reicks, 2006; Chase, Reicks, Smith, Henry, & Reimer, 2003; Kuznesof, et al., 2012; Larson, et al., 2010; McMackin, Dean, Woodside, & McKinley, 2012; Muhihi, 2012; Rosen, Sadeghi, Schroeder, Reicks, & Marquart, 2008). Previous research has reported the following as possible barriers to whole grain intake among adults and children: lack of awareness and misconceptions about wholegrain food products; inability to identify them; lack of awareness of the health benefits; perceived or experienced negative sensory properties; high price; low availability; and lack of knowledge of preparation techniques (Adams & Engstrom, 2000; Arvola, et al., 2007; Burgess-Champoux, et al., 2006; Burgess-Champoux, Chan, Rosen, Marquart, & Reicks, 2008; Burgess-Champoux, Rosen, Marquart, & Reicks, 2008; Chase, et al., 2003; Ellis, Johnson, Fischer, & Hargrove, 2005; Kantor, Variyam, Allshouse, Putnam, & Lin, 2001; Kuznesof, et al., 2012; Larson, et al., 2010; McMackin, et al., 2012; Muhihi, 2012; Smith, 2001; Smith, Kuznesof, Richardson, & Seal, 2003).

Although many of these barriers are likely to be the same for adolescents, their sensitivity to social norms may render them particularly vulnerable to reduced dietary quality and whole grain intake (Stevenson, Doherty, Barnett, Muldoon, & Trew, 2007; Story, Neumark-Sztainer, & French, 2002). Furthermore, eating patterns and preferences established during adolescence have an impact on health outcomes, making adolescence a particularly important time to promote healthy eating (Croll, Neumark-Sztainer, & Story, 2001; Shepherd, et al., 2006; Story, et al., 2002).

The present study aimed to explore, via focus groups, adolescents' views on whole grain intake. The focus group results were considered in relation to the constructs in the Reasoned Action Approach

(RAA),(Fishbein & Ajzen, 2011; Head & Noar, 2014) We examined how well the theory reflects factors influencing whole grain intake as reported by this age group. This study was a formative stage in the development of a theory-based questionnaire study to quantify intake and measure determinants of whole grain intake in a large representative sample of UK adolescents.

Theoretical framework

The RAA was developed from Ajzen's Theory of Planned Behaviour (TPB),(Ajzen, 1991; Young, Lierman, Powell-Cope, Kasprzyk, & Benoliel, 1991) and Theory of Reasoned Action (TRA) (Fisbein & Ajzen, 1975). The TPB proposes that health behaviour can be predicted by direct and indirect determinants. Direct determinants are intentions (to perform the behaviour) and perceived behavioural control (PBC; capacity to complete the behaviour). Intentions are influenced by attitudes (to the behaviour), subjective norms (perceptions of whether others think one should engage in a behaviour) and PBC. Indirect determinants are those that underlie attitudes, subjective norms and PBC. According to the model, attitudes are underpinned by beliefs about the likelihood of important outcomes of the behaviour weighted by the evaluation of those outcomes. Subjective norms are influenced by beliefs about whether key referents think that one should perform the behaviour, weighted by the motivation to comply. Finally, PBC is affected by beliefs about the prevalence of factors facilitating or inhibiting the behaviour weighted by the perceived power of each factor to influence engagement with the behaviour (Conner 2005). The TPB appears to be an effective model for predicting food choice among adults (Conner, Norman, & Bell, 2002; McEachan, Conner, Taylor, & Lawton, 2011) and adolescents (Blanchard, et al., 2009; Conner, Hugh-Jones, & Berg, 2011).

However, although the model is helpful, a recent meta-analysis (controlling for the impact of past behaviour) indicates that it explains 19% of the variance in behaviour and 44% of the variation in intentions (McEachan, et al., 2011) suggesting that there are factors other than the model's constructs which influence engagement in health behaviour. The Reasoned Action Approach (RAA) **(see Fig. 1)**,

a recently developed, integrative health behaviour theory, contributes new environmental and knowledge-related variables that were not explicit in the TPB model, and treats them as background variables that distally influence health behaviour. Moreover, the RAA model adds that behaviour is determined by intention and moderated by actual control.

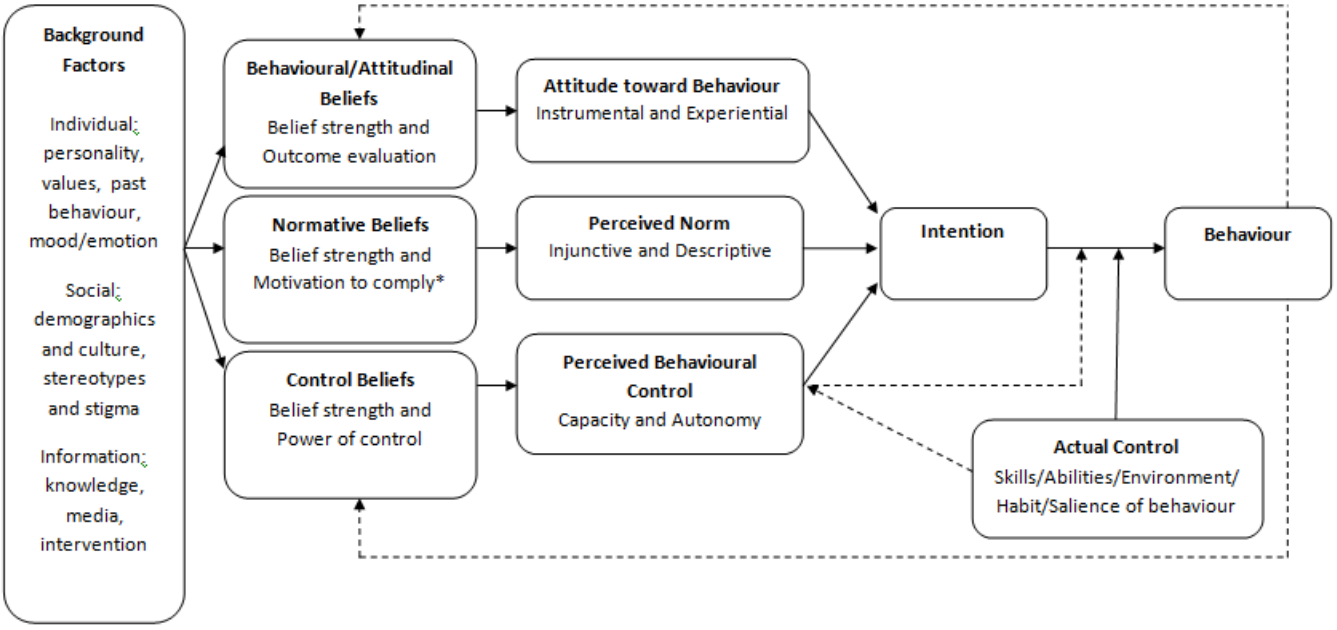

Fig. 1. The main constructs of the Reasoned Action Approach model (Fishbein, 2008)

There is a lack of qualitative research in relation to the RAA in the domain of nutrition in particular, despite evidence that such approaches could elucidate important personal, situated, and cultural influences on dietary behaviour (Hardeman, et al., 2002; Harris, et al., 2009; Zoellner, et al., 2012). Additionally, the model does not explain how determinants emerge in an individual's life or what form they take; for example, how do adolescents come to understand the norms around a particular dietary behaviour and how does it come to influence them? Furthermore, researchers rarely conduct exploratory studies to inform the targeting of appropriate theoretical determinants via intervention (Harris, et al., 2009); e.g. should dietary interventions for adolescents focus on each health behaviour determinant equally or would it be more effective to change one in particular. Better knowledge of how adolescents contextualise and personally articulate their experiences of determinants

of behaviours may help to improve the effectiveness of new RAA-informed interventions for that demographic.

METHODS

Whole grain definition used

The attempt to reach a standardised definition of whole grains has been an ongoing and controversial process (Ferruzzi, et al., 2014). Researchers and organisations have adopted and proposed many definitions, with varying percentages of whole grain content in foods required to qualify as a wholegrain product (Bjorck, et al., 2012; Ferruzzi, et al., 2014; Richardson, et al., 2003; Ross, Kristensen, Seal, Jacques, & McKeown, 2015; van der Kamp, Poutanen, Seal, & Richardson, 2014). In this study, the recently proposed definition in 2014 will be used, which states that "a food providing at least 8g of whole grains/30-g serving be defined as a wholegrain food" (Ferruzzi, et al., 2014).

Ethical approval

The University of Leeds MEEC Faculty Research Ethics Committee approved the study protocol (MEEC 13-003). This study adhered to the guidelines laid down in the Declaration of Helsinki. Head teachers and all adolescent participants provided written informed consent along with parental/legal guardian assent.

Assistant researchers were postgraduate students, with experience in qualitative research, focus groups, and working with adolescents. Both the principal researcher and assistants were female with appropriate clearance for working with young people. The researchers had no prior contact with the participants. The aim of the research was presented on participant information sheets with researchers' academic affiliations. It was stated that the research was not influenced by any funders or third parties.

Recruitment

Participants were recruited using purposive sampling. Twenty schools were contacted by email. The schools were within the City of Leeds geographic area, coeducational, had a minimum of 20% ethnic minorities, and more than 1000 pupils aged above 11 years, to ensure maximum representativeness and diversity. Four out of the twenty schools responded; however, two out of the four withdrew during the course of the research, and the study was conducted with the remaining two schools.

Schools that indicated an interest in taking part received further information along with participant information sheets, which class teachers then delivered to pupils from years 7 to 11 (approximate age 11 – 16 years). Signed consent forms from the young persons and their parent/guardian were required for study participation. Recruitment of participants continued with transcription and analysis until saturation of data was reached (i.e. no new data emerged).

Procedure

The participants were grouped by age and gender into five one-hour focus groups (FGs), consisting of between 9 and 12 participants each. Same-sex groups were each held for 11-13 year old pupils (FG1(boys) n=9; FG2(girls) n=9) and for the 14-15 years old pupils (FG3(boys) n=9; FG4(girls) n =11). Due to practical constraints, participants aged 16-17 years took part in one mixed-gender group (FG5 n=12). Focus groups took place on school premises and within school hours for the 11-13 year olds, and after school for the remaining 14-17 year olds. Groups were led by the first author with assistance from a co-facilitator.

The focus groups were led with a combination of semi-structured questions and interactive activities (see Table 1), developed according to: focus group guidelines (Krueger, 2000; Ritchie & Lewis, 2003); focus group work with adolescents (Daley, 2013; Neumark-Sztainer, Story, Perry, & Casey, 1999; O'Dea, 2003; Stevenson, et al., 2007); previous qualitative studies with other age groups on whole

grain intake (Arvola, et al., 2007; Burgess-Champoux, et al., 2006; Chase, et al., 2003; Kuznesof, et al., 2012; Larson, et al., 2010; Muhihi, 2012) and with adolescents on other nutritional outcomes (Berg, Jonsson, Conner, & Lissner, 2003; Wind, Bobelijn, de Bourdeaudhuij, Klepp, & Brug, 2005; Zeinstra, Koelen, Kok, & De Graaf, 2007; Zoellner, et al., 2012) (due to scarcity of studies on whole grain intake with adolescents). The key study material was successfully piloted on a sample of university students (Kamar, 2012). Probes were only used where participants needed further support to generate discussion.

Table 1 Sample focus group questions. (Illustrated questions are meant to be representative of the focus script and do not represent all of the sections or questions within each section)

"Choose your meal" Game: From pictures of meals containing wholemeal bread and processed bread, which one would you choose and why?
What do you know about whole grains? What do you think wholegrain foods are?
Education about whole grains: participants given brief overview of wholegrain foods with a few examples to allow for a discussion based on some knowledge. Health benefits of whole grains were not cited here though. Further comments/discussion invited.
Can you think of other examples of wholegrain foods? From your culture?
How do you feel about/what do you think of wholegrain foods? (good/bad/why?)
Are there good things/health benefits in wholegrain foods? (Health benefits listed to participants after hearing their suggestions)
Have you ever tried wholegrain foods? How often do you consume them? What do you think are the factors that affect/influence your whole grain consumption? Probing questions: - Physical environment: availability at home, school, takeaways, eating-out, cost? - Social environment: school environment? Adults you live with? - Personal: lifestyle, your own preferences, image among peers? - Varieties available (wholemeal bread vs. wholewheat cookies)? - Appeal of the food? - Do you feel wholegrain foods are more or less expensive than refined grain foods? - Any physical annoyance like bloating etc?
What kinds of situations can you think of where the barriers to whole grain intake were different, or you felt different?
What does it mean for a grain-based food to taste (flavour), look (visual appeal), or feel good to you (texture)? What are the various qualities/things that make it good or bad? Do you think there are any

wholegrain foods out there that suit your taste?
Do you think media is important and does it affect what you eat? If wholegrain foods were made "cool" for teenagers by media would that affect how much you eat whole grains? How could they make whole grains cool?
Identification Game: how do we identify a wholegrain food product? Participants assigned to teams and competed to correctly identify wholegrain food products Examples of WG products used: Quakers Oat So Simple Fruit Muesli Morning Bars, McVitie's Hobnobs, Uncle Ben's Brown Basmati Rice, Hovis Wholemeal Medium Bread, Kellogg's Fruit n Fibre Breakfast Cereals, Butterkist Salted Microwave Popcorns, Belvita Crunchy Oats Breakfast Biscuits Examples of non-WG products used: Warburtons Seeded Batch Bread, Kellogg's Special K Cereal bars (old formulation), McVitie's The Original Digestives
Do you think you will start eating or increase your whole grain intake in the future? Why or why not? Would you eat differently if you had more time or the wholegrain option was conveniently available? If a wholegrain food was set out on the table in the morning, would you eat it? Why or why not? If a wholegrain option was available at an eat-out (example Subway, Mc Donald's, pizza places), would you choose it? Why or why not? If you ate more meals with your family, do you think you would eat more wholegrain foods? Would you choose wholegrain foods for their health benefits even if they are not that tasty?
Have you changed any specific type of food you ate over the past year or two (habitually)? Why has that happened? What caused the change?
Design an Intervention Game: participants asked to imagine their future job was to increase young people's health and whole grain intake. Asked to work in groups and post ideas on sticky notes on boards.

Data preparation and analysis

This study addressed the need to understand the usefulness of the RAA in explaining and exploring adolescent whole grain intake. We elicited UK adolescents' accounts of whole grain awareness and intake and adopted both a deductive and inductive analytic strategy by (a) exploring the extent to which RAA constructs were represented in young people's accounts of whole grain intake and (b) attempting to identify additional determinants of behaviour, as reported by adolescents, but which were not captured or adequately represented in the RAA.

All focus groups (discussion and activities) were audio-recorded and transcribed by the first author to playscript standard, with all identifying information removed. Data were analysed using thematic analysis as described by Braun & Clarke (Braun & Clarke, 2006). First, the data were read carefully to identify and descriptively label meaningful units of text relevant to the research topic. Second, units of text relating to the same issue were assigned to provisional themes and the same unit of text could be included in more than one theme. These included themes relating directly to the constructs in the RAA model, as well as themes capturing data which did not appear to be represented in the RAA model. Analysis was lead by the first author. Emergent themes were discussed with the second and third authors and credibility checks conducted (i.e. that the interpretation of the data were credible for their assignment to a theme and that there was sufficient evidence to support the generation of a theme). The third and final stage of analysis involved review and refinement of the themes. The analytic outcomes are reported as RAA constructs and non-RAA constructs, if any, to distinguish between data represented by constructs in the model and those which appear additional to the framework.

RESULTS

Participants

Fifty-two participants were recruited (n= 25 boys and 27 girls). Two male participants did not complete the study (one was absent for data collection and the other unavailable). The final sample included 50 adolescents (n= 23 boys and 27 girls) aged 11 to 17 years, of mixed ethnicities and socioeconomic backgrounds. No pupils were excluded from recruitment or participation. Saturation of data was reached after five focus groups.

The results of the focus groups are presented under RAA construct themes (i.e. themes falling under background factors, behavioural/attitudinal beliefs, normative beliefs, and/or control beliefs). All of the data were capturable by the RAA model.

RAA constructs

(i) Background factors: knowledge/awareness of wholegrain products

When asked what they knew about whole grains, most participants cited breakfast cereal followed by brown bread and oats/oatmeal products. Oatmeal products included porridge, which was mentioned by two participants. Certain brands of breakfast cereals stood out markedly, such as *Weetabix* and *Cheerios*, whereas cereal bars were mentioned less often. With regards to breakfast cereals, participants could list wholegrain varieties as well as their favourite brands, whereas in the case of bread, responses were a mixture of: bread, brown bread, 50-50 bread, and other guesses like croissants and white bread with added fibre. Three of the fifty participants had never heard the word "whole grains" before. Some participants also thought of "healthy/healthiness" or simply "carbohydrates" as an initial answer and some mentioned "flour" or "wheat/shredded wheat". One participant asked if whole grains meant "seeds". Other responses included "farm" and "breakfast". One of the participants said that "big brands try to use this [label] to market their products", and another said "I've heard it in some ads on the T.V." Then a participant added: "but I heard we can't digest brown bread easily".

Other individual comments were made such as assumptions that whole grain must mean it is organic, or that it is food that is "pure with no artificial additives", as well as questioning whether it was actually "food for diabetes".

After explaining what whole grain meant, some participants were then able to give some examples of what they perceived to be wholegrain foods. When asked to list those examples, and encouraged to add some cultural varieties, some previously mentioned as well as new varieties emerged in the discussion. Previously suggested varieties included brown bread, wholemeal bread, 50-50 bread, porridge, brown rice, and brown pasta. Cited cultural varieties were fufu, an Afro-Caribbean dough-like "bread" made of various grain and starchy crops, and roti, an Indian Subcontinent flat bread, made from unleavened stone-ground wholemeal flour.

Some participants thought that wholegrain foods were more expensive, as "the most [healthy] food would be more expensive, just like organic food." However, participants in two separate sessions started discussions on how it should be cheaper, according to the assumed logic of: "isn't it cheaper to make?" This exchange was interesting, as it depicted varying attitudes towards product pricing; some adolescents linked higher prices with healthiness, while others associated it with levels of product processing and its costs.

In the identification game (after being taught what whole grain broadly meant), participants were able to correctly identify slightly less than half of the game products as either whole grain or non whole grain. They named the following (in order of frequency): pasta, rice, bread, porridge, popcorn, breakfast cereals, cereal bars, biscuits.

Misconceptions that arose within the identification game were that: wholegrain food products had no or minimum additives or preservatives; "oat" may not mean whole grain as "it does not say wholeoats"; multigrain equals whole grain; "made with whole grains" means whole grain; product is not whole grain as "product does not seem heathy and has lots of sugar"; popcorn does not have health claims so must be non whole grain; bread is brown and has seeds thus must mean it is whole grain; or that a product is overly-advertised and that must mean the company is making up for the fact that it is not whole grain.

Knowledge of wholegrain products varied considerably between participants with many of the participants not able to correctly identify wholegrain foods and products. As well as large differences in knowledge, many of the adolescents had misconceptions about wholegrain foods identifying a need for more education on wholegrain foods.

(ii) Background factors: past behaviour

When asked whether they have previously tried wholegrain foods, 43 (86%) out of 50 responded positively. However, when asked about regular whole grain consumption (measured as daily or at least three times a week), only 8 out of 50 (16%) responded positively. A few indicated they were occasional whole grain consumers, mainly due to enjoying wholegrain breakfast cereals now and again such as *Weetabix*, *Cheerios* and *Belvita* brands consumed as snacks or a quick breakfast.

(iii) Background factors: knowledge of whole grain health benefits

When asked what they thought the benefits of wholegrain food consumption were, the top responses were that wholegrain foods contained fibre and that they were good for the digestive system, followed by the fact that they gave energy or long-lasting energy. The least identified were the cancer-preventative properties of wholegrain foods. **Fig. 2** lists the participant response rates in descending order.

There was a range of random guesses of whole grain health benefits across the sessions (marked in Fig. 2 as "Other"). Some examples of these were: "[Does eating whole grain] help in old-people sickness like keeps people living longer – antioxidant?"; "does it like calm the nervous system?";"feeds the immune system?"; and "in the advert it says [whole grain is] fuel for the brain."

Although most adolescents were aware that whole grains are healthy they were not knowledgeable about the specific reasons why whole grains improve health.

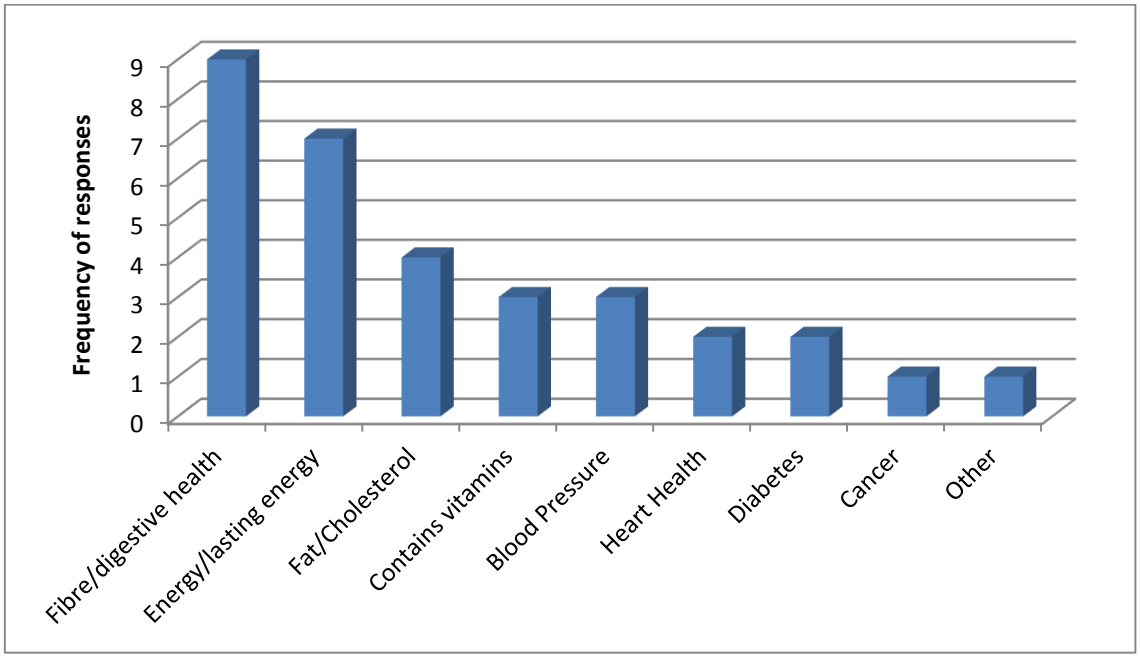

Fig. 2: Participant response rates identifying health benefits of wholegrain foods (in descending frequency of response).

(iv) Behavioural/attitudinal beliefs: feelings about wholegrain foods

The participants were asked about their perceptions of, and feelings towards, wholegrain foods. They talked about this in answer to this question and also in response to questions about the health benefits of whole grain. Thus, responses to both questions are listed separately here.

The most prevalent perception among adolescents is that wholegrain foods are healthy or related to healthiness "somehow", or that they are at least "better than white bread". Expressions of dislike for whole grain taste, appearance and texture were prominent, with slightly more emphasis on the latter: "I like some of it, like porridge, but not brown bread – sometimes it's like really dry you have to have something to drink with it."; "It does not look inviting to eat" and "white bread is [softer]."; "I would prefer to buy a *nutri-grain* rather than [a wholegrain cereal bar], because I wouldn't want to walk around the school with things sticking out from my teeth." The prevalence of such comments raise

questions about whether food appearance and texture may be of even higher importance to adolescents compared to adults.

On the other hand, the third most prevalent attitude was liking the taste of wholegrain food: "for me I think brown bread tastes richer" and "*Belvita* biscuits are the best thing I've ever tasted!"

In summary, a variety of beliefs about whole grains were expressed by participants, and these included health outcomes. However, taste and acceptability were reported as possibly more influential in determining behaviour.

(v) Normative beliefs

Some aspects of normative beliefs emerged in the discussions – mainly the concept of the "norm" and parental modelling as barriers to whole grain intake (*barriers* are discussed below). Some participants reported that wholegrain foods were uncommon or unfamiliar in their everyday lives. For example, one participant stated that "I will not just go for whole grain because I am not used to it. It never comes to my mind even" – suggesting that dietary choices are habit driven and that whole grain had never been part of their repertoire of choices. Another participant stated that "It is not like something you find at home or anywhere, why should I go and eat it myself? I only shop for my snacks.", indicating the importance of access and availability in shaping intake alongside the perception of what others are consuming.

Parental influence was remarked upon in discussions of availability and habit as barriers to whole grain intake, and was present in nearly half of total discussions of barriers. For example, here the participant suggests that parents' introduction of foods from an early stage is fundamental to later acceptance by children: "When kids are introduced to bread and stuff the parents normally give them white bread, but if kids at first get introduced to brown bread then they'll probably get more used to it and like it." On the other hand, one participant said "My mum said if I eat whole grain I'd grow up but I know she's

292 lying to me." Thus, many parents may make efforts to encourage their children's whole grain intake,
293 even though they are not clear about the exact health benefits and have to deal with resistance from
294 their adolescent child.

295 (vi) Control beliefs/actual control: barriers and facilitators to wholegrain food consumption

296 The predominant barriers to whole grain consumption in general were reported to be sensory properties
297 and taste, followed by lack of awareness of health benefits, and availability in shops and schools.
298 Sensory property barriers were just as much due to appearance and packaging, as due to taste, with one
299 participant citing wholegrain food products were "serious and boring". This indicated that improving
300 whole grain consumption is not just about changing the flavour of the product but the way it is
301 marketed and packaged.

302 When probed further about the issue of availability, one of the participants mentioned that "it's not
303 accessible as well because you can't just get it, say, when you go to the corner shop; it won't be there".
304 A question about whole grain availability in school started a discussion in one of the groups, where one
305 of the participants argued that "the school did [provide] wholegrain toast." However, another
306 participant disagreed, saying "yeah but that's just for breakfast, and just the dry ones with boiled egg
307 which no one eats! The better cheese toasties and the good ones are all white bread." This raises the
308 issue of quantity as well as appealing foods that should accompany the wholegrain food options for
309 adolescents. In another group, one girl stated that in her school "they just sell *Nutrigrains*, but bread
310 and everything, it's all just white. And *Nutrigrains* are more expensive than the other snacks." Thus,
311 accessibility is affected by price and what other apparently comparable products are available in that
312 space. The cost of wholegrain foods was mentioned by some participants although this age group were
313 generally buying snacks rather than being in charge of shopping for the household.

Habit was also mentioned as a barrier of whole grain consumption, which appeared to be driven by many different factors. Parental modelling and provision (see *normative beliefs above*) were mentioned and participants also cited time and convenience as barriers. Only a few participants reported that they liked wholegrain foods and did not find themselves facing any barriers other than availability, especially when "eating out". Two participants spoke of brand loyalty as a barrier, as they were used to consuming a certain brand and type of cereal or bread from their childhood.

Facilitators to eating wholegrain foods were not naturally mentioned by the participants as part of the discussions, and the moderator had to specifically ask questions to prompt this topic. This pointed to the fact that this age group found it difficult to eat high intakes of sufficient whole-grain. However, when asked to imagine that they were in some position of authority and could do anything to facilitate or increase adolescent whole grain intake in the UK, they had many ideas. The main suggestions included; advertisements and educational campaigns to both raise awareness of wholegrain products and market them as a contemporary food; (e.g. "Get children's role models to eat it and tweet it – get it? That's like a campaign, eat and tweet! I think that's the best thing to do." and "Use a catch-phrase to make people remember whole grain. Make it rhyme and stick in their head"); improved sensory appeal; (e.g ."Why can't wholegrain products be colourful and fun like chocolate? Why does it have to look so boring?"); and increased availability and varieties of wholegrain food products and tailoring products for young people (e.g. "It's like all wholegrain food is bread and stuff, why don't they make more snacks like chocolates with wholegrain bits in them or, say, ice cream made with a wholegrain cone?").

Reduced cost was also raised as a potential facilitator for increased adolescent whole grain intake, although it was mentioned along with availability in schools: "Put whole grain in schools, and make them cheap. They are not the cheaper thing to buy in school here". Other suggestions included those of making wholegrain products easier to identify, along with other points related to shelving strategies:

"On the front of the product, it should say WHOLE GRAIN." "I would put white bread at the back of the shelf."

Thus, these young people targeted education, marketing, cost and availability as key strategies to promote intake for the age group alongside more creative and attractive ways of incorporating whole grains in habitually consumed foods and snacks.

DISCUSSION

This study found that many adolescents are aware of health benefits of consuming wholegrain foods even if they do not know which specific diseases are associated with low whole grain consumption. However, the adolescents found it difficult to identify wholegrain products and often perceived wholegrain foods as boring and lacking in taste. They identified a wide range of barriers to eating wholegrain foods including habits, availability, parental controls and cost. Adolescents made suggestions to increase whole grain consumption in their age group including education, marketing and increased availability in schools and shops as well as formulation of new foods and snacks higher in fibre aimed at this age group.

This study also reported that the Reasoned Action Approach is largely effective in representing adolescents' subjective accounts of determinants of whole grain intake.

Most participants reported having tried wholegrain products in the past; however few reported regularly eating wholegrain foods and therefore habitual consumption. This could be due to many reasons and a wide range of beliefs and barriers were identified. Expressions of like and dislike for whole grain taste were reported by different participants in the focus groups and is likely to be related to habitual consumption and whether they were familiar with the foods. Although many participants

mentioned healthiness in relation to consumption of wholegrain foods, few were able to provide details.

These findings are in line with those of other studies in different populations. Bread and breakfast cereals were reported as the most popular wholegrain food sources in various studies (Marquart, Pham, Lautenschlager, Croy, & Sobal, 2006; Smith, 2001; Smith, et al., 2003; Thane, Jones, Stephen, Seal, & Jebb, 2007). Previous research has also shown that whole grain intake is increased as people are educated about health benefits (Ellis, et al., 2005; Jones, 2010; Smith, 2001). However, with child and adolescent populations, where they are not the purchasers of food for the household, it could potentially be that the education of parents and carers is more important.

Many participants were not able to correctly identify wholegrain products, which has also been identified as a problem with adult populations. The word "brown bread" was used by participants to refer to wholemeal bread, and this incorrect use of terms points to the need for education regarding wholegrain products. Despite the fact that the mentioned difference was explained to them during the focus groups, it is likely that correct use of the terms might take some time. The problems with identifying wholegrain foods may be partially due to the terms used to advertise products, which may confuse consumers. Some descriptions such as “brown”, “seeded”, “wheat”, “whole”, “enriched” may mislead consumers into believing the product is whole grain (Jones, 2010). Most of the participants in the present study were not aware that products must have at least 30% whole grain content to qualify for classification as whole grain (Ferruzzi, et al., 2014). Perhaps these findings are to be expected, as an official whole grain definition, guidelines and recommendations have yet to be established in the UK.

Barriers and facilitating factors to whole grain consumption

A number of important barriers for whole grain consumption were identified in this study. These findings generally agree with, and add to existing studies of whole grain in different age groups.

Factors included: sensory properties and taste of wholegrain products(Arvola, et al., 2007; Chase, et al., 2003; McMackin, et al., 2012) followed by lack of awareness of health benefits,(Arvola, et al., 2007; Chase, et al., 2003; McMackin, et al., 2012) and lack of varieties and convenient availability (Kuznesof, et al., 2012; Larson, et al., 2010; McMackin, et al., 2012; Muhihi, 2012; Smith, 2001).

In this study, habit was mentioned as an important barrier to wholegrain food consumption. Generally, as people are exposed to certain foods, they get used to the taste over time and a habitual taste preference occurs (Cooke, 2007). Such acceptability trends have also been observed for wholegrain foods in recent studies (Brownlee, Kuznesof, Moore, Jebb, & Seal, 2013; Kuznesof, et al., 2012) and participants of this study made such comments in the focus groups before and after trying some wholegrain product samples.

Our study's results were also in agreement with some of the barriers reported by Adams and Engstrom,(Adams & Engstrom, 2000) such as awareness, identification, taste, texture, cost, ease of preparation/skills required, and availability in stores. However, identification and preparation skills (also mentioned in some of the above studies)(Chase, et al., 2003; Kuznesof, et al., 2012; McMackin, et al., 2012) were not verbally highlighted in the current study.

A small intervention study by Smith et al. (Smith, 2001) found similar barriers but also included intestinal discomfort. However, the latter may have arisen since the participants consumed a large amount of wholegrain foods (5 portions) per day. Taking household members' taste into consideration was also mentioned, which was also one of the barriers of The WHOLEheart study participants(Kuznesof, et al., 2012) and with McMackin et al.(McMackin, et al., 2012). Those two studies also included a lack of cooking/preparation skills, a barrier mentioned in a Tanzanian study by Muhihi et al(Muhihi, 2012) as well. The lack of such factors in our study may be expected, given the sample age group and the corresponding lifestyles.

A number of potential key facilitators to whole grain consumption were cited in this study. The facilitators generally agreed with existing studies in different populations and included: (1) increased awareness through advertisements and educational campaigns (Kuznesof, et al., 2012); (2) improved sensory appeal (McMackin, et al., 2012; Muhihi, 2012) and (3) increased availability and varieties (Kuznesof, et al., 2012; Larson, et al., 2010; Muhihi, 2012). In our study, participants also highlighted a need for tailoring of products for young people.

Studies in the literature such as McMackin et al. (McMackin, et al., 2012) and Muhihi et al. (Muhihi, 2012) listed similar facilitating factors. The WHOLEheart study (Kuznesof, et al., 2012) participants also considered preparation techniques to be important, perceived health benefits, and "substitutability of whole grains with existing ingredients and meal patterns"(Kuznesof, et al., 2012). An American study on young adults and adolescents (project EAT) found sensory appeal, self-efficacy, and home availability to be related to increased whole grain consumption (Larson, et al., 2010).

Findings in relation to the RAA

Most of the data produced in discussions could be mapped to constructs in the RAA, although the data did not permit any kind of test of the causal pathways proposed by the model. A recent intervention study with South African adolescents targeting HIV reduction strategies, similarly showed the usefulness of the RAA in informing the intervention targets (Jemmott, 2012).

Some themes identified in the present study seemed to cross two different RAA constructs and were difficult to separate, such as general knowledge of whole grain, identification abilities, and knowledge of health benefits (a combination of background factors as well as attitudinal ones). In addition, parental provision and influence could arguably fall between background factors and normative beliefs. Habit features independently as a factor in the RAA model, whereas it was mentioned in the focused groups mainly in conjunction with parental influence.

Some RAA constructs were not particularly dominant in the data, For example, intention to perform the behaviour of whole grain intake was not easy to capture completely. This could be due to the exploratory rather than hypothesis-testing nature of the study. Some elements within *Background factors* were also not present; namely the influence of mood/emotions, stereotypes, stigma, and possible health-promoting interventions. It may be that were these directly asked about, that adolescents may have indicated how they influenced their whole grain intake. *Normative beliefs* also had minimal presence in the discussions, despite the common assumption that social norms and influences play a key role in shaping adolescence behaviour (Contento, Williams, Michela, & Franklin, 2006). Participants avoided responding to direct questions as well as probes around such themes, and merely hinted at the various social/normative influences within discussions of other whole grain intake correlates.

Some components of the model we present in varying potency from that suggested in the model. For example, *background factors* appeared to have a stronger influence on whole grain consumption in this age than proposed by the model. Further studies using the RAA with this age group may enhance the understanding of the representativeness of this model in its current form to explain determinants of dietary behaviour in adolescents.

Strengths and limitations

This study adds to our understanding of the factors influencing food choice in adolescents, who are at the lower end of whole grain intake in studies at the national level (Mann, et al., 2015; Nelson, 2007). This study is among the few which adopt a theory led approach to the study of whole grain intake, (Kuznesof, et al., 2012; McMackin, et al., 2012; Smith, 2001) and the first to explore adolescent whole grain intake among adolescents in the UK. In addition, the theoretical and research literature on TPB and its extended models is often confusing and includes diverse approaches on how to operationalise those theories (Francis, et al., 2004). Therefore, there is a need to account for such practical issues that

arise when attempting to apply the theory, which may be relevant to those working with the RAA for the first time. A further strength of the study was the inclusion of a socially and ethnically diverse sample of young people, and the use of participant-centered methods.

However, the use of focus groups with young people - with the overall intention of using data to inform questionnaire design - posed some challenges. Much probing was required as the groups were sometimes reluctant to engage in discussion. This was especially evident when it came to talking about normative influencing factors, where it is likely to have been unconformable to suggest that one is influenced by peer behaviour or other norms. It may be that one-to-one work would be an important source of complementary data to for this demographic. In addition, the reported ability of the participants to correctly identify wholegrain food products may have been overestimated by them, as the comments they wrote to justify their guesses contradicted strongly in some instances with their choices of answer (wholegrain vs. non-wholegrain food product). Moreover, the representativeness of the focus group population studied may have been reduced due to the limited sample size as well as the fact that the participants were only recruited from two schools in one city. This is a practical limitation that arises when working with schools within a time and budget limit, and the results of this research would not be considered representative, but rather exploratory and descriptive. A similar note should be made about whole grain consumption levels in this study, which were self-reported and discussed in a general way. The research does not attempt to quantify whole grain intake in this age group. Finally, the mixed gender session, in the case of the older participants, may have influenced the resulting discussions if the adolescents felt awkward.

CONCLUSION

This study identified whole grain awareness, consumption, barriers and facilitators of intake in a sample of UK adolescents, employing a theoretical framework. The RAA was useful in representing factors influencing self-reported adolescent whole grain intake, and has demonstrated similar utility in recent non-dietary studies in the literature on this age group. The results of this study highlight the need for raising awareness of the specific health benefits of whole grain consumption among adolescents to motivate consumption. Moreover, they revealed a unique need to address issues of product appeal and the targeted tailoring of products for young people. This study has the potential to inform further research on whole grain consumption, and acts as a basis to guide public health nutritionists involved in development of programmes and strategies to improve whole grain intake in this age group.

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