

“If dietary fibre is important, why are we not consuming more?” Investigating consumption-related challenges in student, older adults and community cohorts

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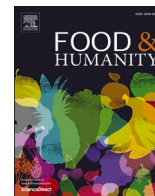
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“If dietary fibre is important, why are we not consuming more?” Investigating consumption-related challenges in student, older adults and community cohorts

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ABSTRACT

Dietary fibre intake is suboptimal in the UK population for all age-groups; hence, understanding relevant strategies to modulate consumption patterns in different targeted populations is key. Accordingly, this study explored dietary fibre derived knowledge gaps in three cohorts via a two-stage approach: (1) age-related differences in students ($n = 149$; 18–35 years) and older adults ($n = 150$; 65–87 years) quantifying nutritional factors, awareness and preferences; and (2) testing a quiz in a community cohort ($n = 171$; 7–86 years) at local events. Key factors modulating food choice varied by age: students cited price and convenience whereas older adults reported nutritional aspects (healthy, ingredients, food quality and environment). This trend was also reflected in strategies to encourage dietary fibre intake (students: sensory appeal, affordability and routine vs older adults: accessible information, health benefits, age-specific and examples). Overall, both age-groups lacked dietary fibre awareness; however, older adults were better at identifying recommendations, foods and benefits as well as more positive and cited less issues compared with students. The quiz demonstrated limited knowledge relating to dietary fibre in the community cohort with vegetables and fresh fruits as most commonly consumed dietary fibre sources. There was an overriding positivity to learn more and modulate future intake as well as emphasis on easy to prepare foods, examples, routine and affordable derived strategies using video and label formats to convey information. Next steps should capitalise on all cohort's willingness to drive an uptake in dietary fibre intake as well ensuring the “food environment” can support consumers in making such decisions.

1. Introduction

Dietary fibre is a nutrient of interest and is associated with a range of positive health benefits such as reducing cardiovascular disease, coronary events, stroke, type 2 diabetes and colorectal cancer risk (Scientific Advisory Committee on Nutrition, 2015). Accordingly, the Scientific Advisory Committee on Nutrition (SACN) recommend adults should consume 30 g/d of dietary fibre (Scientific Advisory Committee on Nutrition, 2015). However, despite this advice been in place for nearly 10 years, is it considered one of the most poorly adhered to recommendations in the UK population with only approximately 4% complying (Scientific Advisory Committee on Nutrition, 2015; Office for Health Improvement and Disparities, 2025). It is likely that insufficient uptake of fruits, vegetables, legumes and wholegrain may contribute to low intake (McKeown et al., 2022). In addition, key dietary fibre-related challenges include: cost, availability, unaware of health benefits or

recommendations, labelling misconceptions, identification of sources, not forefront of mind and low sensory appeal (Barrett et al., 2020; Buttriss, 2015; Hooper et al., 2015; Lockyer et al., 2016; Meynier et al., 2020; Norton et al., 2024a; Norton et al., 2024b; Robinson & Chambers, 2018). Hence, the growing interest in this topic and identifying relevant strategies to promote dietary fibre consumption (McKeown et al., 2022).

Dietary fibre intake is suboptimal for all age-groups in the UK (Office for Health Improvement and Disparities, 2025); therefore, exploring preferences in targeted populations is fundamental to help shift consumption patterns from a dietary fibre perspective. For example, university students are a unique cohort often experiencing independence for the first time in new environments which subsequently impact diet and/or lifestyle decisions (Deliens et al., 2014; Hafiz et al., 2023). Students may also face budget-related challenges, limited nutrition and/or cooking knowledge, food availability and/or accessibility issues and academic pressure, all impacting food choice (Deliens et al., 2014; Hafiz

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et al., 2023). In contrast, the ageing population (aged 65 years and over) is expanding rapidly and strategies to promote healthy ageing is key as well as a desire to maintain functional ability (Office for National Statistics, 2019; World Health Organisation, 2020). Issues affecting older adults to varying extents include changes in appetite, sensory sensitivity, preferences, oral processing and food accessibility, all negatively influencing the eating experience (Methven et al., 2012; Morley, 2001; Norton et al., 2021; Vandenberghe-Descamps et al., 2017; Whitelock & Ensaff, 2018).

Importantly, the role of nutrition should not be underestimated in this population since it can impact health and well-being outcomes (Volkert et al., 2019). Recently, a survey was developed to gain insights into dietary fibre-related knowledge, awareness, attitudes and behaviour as well as information preferences in an ageing population (Norton et al., 2024b). Overall, it was evident that older adults had knowledge gaps and associated misconceptions mainly centred about dietary fibre recommendations, benefits and foods (Norton et al., 2024b). However, further research is needed to test the same survey with additional cohorts to provide context and understand dietary fibre challenges from different perspectives. In addition, community events are a regular occurrence especially during the summer months; therefore, providing a valuable opportunity to conduct research in ecologically valid settings. Community cohorts may also enable a more representative sample if the activity is appropriate and of interest. This approach was used previously on sustainable practices utilising quizzes which was well-received (Norton & Lignou, 2023); accordingly, expanding this to different topics (such as dietary fibre) could be beneficial.

Currently, there are limited studies that have investigated dietary fibre knowledge in different cohorts of interest; hence, this warrants further investigation. Such insights will help support translation from cited benefits into consumption habits from a dietary fibre perspective by exploring the relevant design cues and establish how it varies by target population so that a more tailored/personalised approach can be used in the future. Accordingly, this study will investigate: (1) does dietary fibre-related knowledge and awareness vary by age (students vs older adults)? and; (2) does age impact dietary fibre-driven engagement levels and preferences? The insights captured then informed development of a new dietary-fibre based quiz for different age-groups for pilot testing to evaluate dietary fibre awareness in community settings using a more ecologically valid location than online surveys.

2. Methods

2.1. Study overview

Stage one focused on investigating dietary fibre from a broad perspective with two cohorts varying in age: students (aged 18–35 years; 22.0 ± 4.3 years; 23% male, 73% female and 3% other) enrolled in university degree-based programmes (e.g., undergraduate, masters or doctorate) and older adults defined as aged 65 years and over (range: 65–87 years; 72.0 ± 5.4 years; 45% male and 55% female) from the Fibre4Life project (Norton et al., 2024b). The recruitment process (March 2023 to May 2024) adhered to steps outlined in previous research (e.g., social media, University of Reading Department-based databases, etc.) (Norton et al., 2024b). Stage two mainly focused on developing a dietary fibre quiz (informed from stage one) and invited all ages (range: 7–86 years - under 18 s: 17.5%, 18–35: 38.6%, 36–64: 31.0% and 65+: 12.9%; 42% male and 58% female) to take part at local community-based events (May to July 2024). Children aged 7 years and upwards were asked to participate; this population are considered to have sufficient literacy skills as well as having performed quiz-based research tasks successfully previously (Laureati et al., 2015; Norton & Lignou, 2023). It was deemed that at least 100 individuals would be sufficient in each cohort utilising the Yamane's formula ($n = \frac{N}{1+Ne^2}$ n = sample size; N = population and e = precision) (Yamane, 1973).

Both stages received a favourable opinion for conduct by the School of Chemistry, Food and Pharmacy (University of Reading) Research Ethics Committee (study number: 15/2023). All cohorts reviewed the participant information sheet and provided written (online or in paper) informed consent prior to taking part in the surveys or quizzes. It should be noted that for children (aged under 18 years) written consent was provided by an appropriate adult (e.g., parent or guardian) prior to taking part in the activities.

2.2. Stage one: students and older adults

The survey captured nutritional factors, dietary fibre awareness, knowledge and preferences predominately utilising 5-point scales (agreement, willingness, liking, easiness to consume), check-all-that-apply (CATA) and ranking based questions. The survey had been previously developed (Norton et al., 2024b) and was adapted for this study to focus on key aspects considered relevant for age-related comparisons. In brief, section one quantified food choice drivers and diet-related interest as well as dietary fibre awareness/knowledge relating to recommendations, foods and benefits. Section two identified dominant sensory properties, liking and easiness to consume of various dietary fibre-rich foods and common issues associated with such foods. Section three recorded dissemination preferences for encouraging dietary fibre consumption such as willingness, drivers, topics of interest and trusted sources. The survey was deployed using the Compusense platform (Compusense Cloud Software, Ontario, Canada) and was also available in paper format (specifically for older adults).

2.3. Stage two: community quiz

This stage aimed to develop a short quiz (less than 5-min) to explore dietary fibre related knowledge for use in different settings by all age-groups. Quizzes can be a useful interactive tool to “test” learning in a more relaxed and fun format compared with surveys in ecologically valid settings (Norton & Lignou, 2023). The question selection focused on consumption habits (key dietary fibre-rich foods: wholemeal/grain bread, cereals, potatoes, dried fruits, fresh fruits, vegetables, pulses and nuts/seeds), knowledge (recommendations, foods and benefits) and future intake (willingness, encourage consumption, formats and key topics) derived using single selection, category scales (five-point; never to always and not willing to willing) and CATA. The rationale for this aimed to capture dominant dietary fibre derived foods, knowledge gaps and preferences (Norton et al., 2024b; Public Health England, 2020; Rijnaarts et al., 2021). The design of the quiz utilised infographics coupled with supporting text to ensure suitability for all ages. Consumers attending community-based events in Berkshire (South-East England) were invited to complete the quiz using either an iPad (Apple, UK) or in paper format.

2.4. Statistical analysis

The analysis consisted of a pre-defined plan by stage and utilised XLSTAT version 2023.3.1.1416 (version 2023.3.1.1416, New York, USA): (i) ANOVA (analysis of variance; Tukey's HSD test for pairwise comparisons) compared agreement, willingness, CATA, liking and easiness to consume questions within and between age-groups/cohorts; (ii) binomial distribution to identify differences between variables such as “yes vs no” or “incorrect vs correct” based outputs; and (iii) ranking data via the Friedman's test (Nemenyi's procedure) (Norton et al., 2024b). Category data such as willingness (not willing, neutral and willing) and agreement (disagree, neutral and agree) were grouped into three and reported in percentage format.

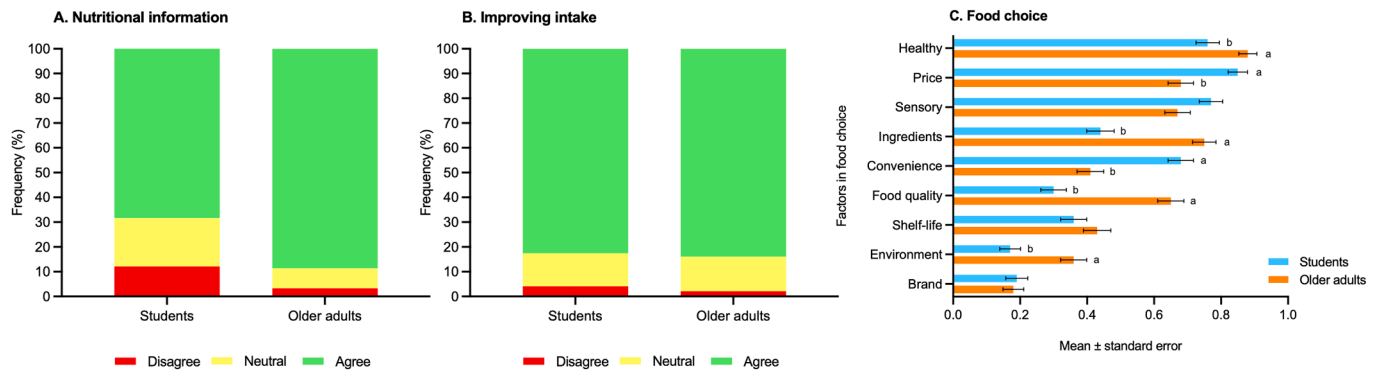


Fig. 1. Students (n = 149) and older adults (n = 150) perceived (A) importance of nutritional information; (B) interest in improving diet (data expressed as percentages); and (C) food choice factors (differing letters reflect significance from pairwise comparisons).

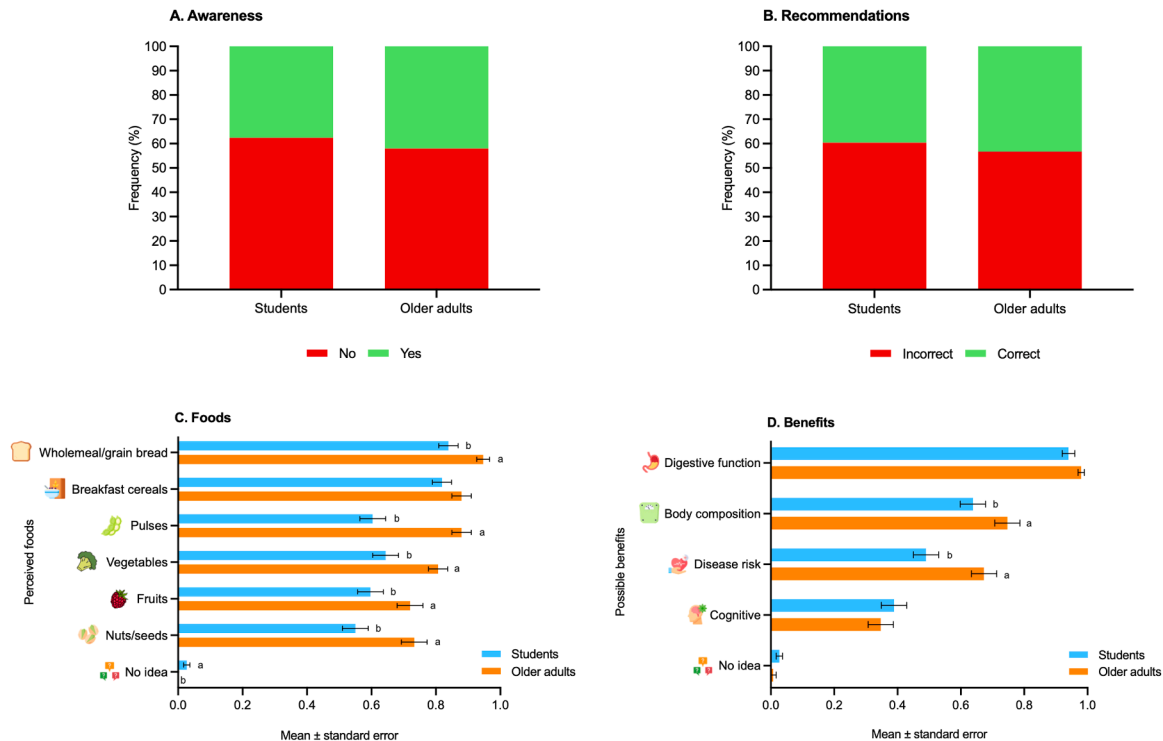


Fig. 2. Students (n = 149) and older adults (n = 150) dietary fibre knowledge-related questions by (A) awareness; (B) recommendations (data expressed as percentages); (C) dietary fibre-rich foods; and (D) possible dietary fibre benefits (differing letters reflect significance from pairwise comparisons).

3. Results

3.1. Stage one

Older adults considered nutritional information more often in food choice compared with students (Fig. 1; $p < 0.0001$). However, there were no differences relating to improving nutrition intake between cohorts (Fig. 1; $p = 0.25$). Key factors modulating food choice varied by age: students cited price and convenience whereas older adults reported healthy, ingredients, food quality and environment (Fig. 1).

Both cohorts lacked awareness relating to dietary fibre (students: $p = 0.002$ and older adults: $p = 0.03$) (Fig. 2). However, older adults were marginally better at correctly interpreting dietary fibre recommendations (students: $p = 0.007$ and older adults: $p = 0.06$) (Fig. 2). Older adults were better at identifying dietary fibre-rich foods (wholemeal/grain breads, fruits, vegetables, nuts/seeds and pulses) compared with students (Fig. 2). This effect was also demonstrated in terms of citing possible dietary fibre benefits especially for body composition and

disease risk (Fig. 2).

There were also differences in perceived importance of sensory properties of dietary fibre-rich foods. For example, taste+flavour was dominant in both cohorts; however, there were ranking differences in appearance, mouthfeel and aftertaste depending on age (Table 1). Older adults reported higher liking and easiness to consume scores for wholemeal/grain bread, breakfast cereals, fruits, vegetables, nuts/seeds and pulses compared with students (Fig. 3). Students cited more dietary fibre issues such as lack of sensory appeal, limited choice, expensive, unsure of health benefits and cooking challenges than older adults (Table 1). Strategies to encourage consumption of dietary fibre-rich foods were also impacted by age: students noted low sensory appeal, affordability and daily routine whereas older adults highlighted accessible information, health benefits, food-based examples and age-specific information (Table 1). Key topics of interest were recipes in both cohort as well as recommendations, examples and health benefits were dominant in the ageing population (Table 1). Trusted sources were similar between cohorts apart from independent consumer organisations, social

Table 1
Students (n = 149) and older adults (n = 150) dietary fibre related preferences.

Preferences	Students	Older adults	p-value
Sensory properties[^]			
Appearance	3.46 ± 0.12 [3]	2.75 ± 0.10 [2]	< 0.0001
Aroma	3.54 ± 0.09 [4]	3.32 ± 0.09 [3]	0.08
Taste + flavour	1.39 ± 0.06 [1]	1.35 ± 0.06 [1]	0.61
Mouthfeel	2.91 ± 0.10 [2]	3.38 ± 0.10 [4]	0.001
Aftertaste	3.70 ± 0.09 [5]	4.21 ± 0.08 [5]	< 0.0001
Issues			
Sensory	0.41 ± 0.04	0.13 ± 0.03	< 0.0001
Side effects	0.32 ± 0.04	0.22 ± 0.03	0.06
No information	0.20 ± 0.03	0.17 ± 0.03	0.54
Limited choice	0.19 ± 0.03	0.09 ± 0.02	0.01
Expensive	0.28 ± 0.04	0.11 ± 0.03	< 0.0001
Unsure of health benefits	0.11 ± 0.03	0.03 ± 0.01	0.01
Preparation/cooking difficulties	0.18 ± 0.03	0.05 ± 0.02	< 0.0001
No issues	0.23 ± 0.03	0.63 ± 0.04	< 0.0001
Encourage consumption			
Improved sensory appeal	0.40 ± 0.04	0.25 ± 0.04	0.008
More affordable	0.56 ± 0.04	0.29 ± 0.04	< 0.0001
Accessible information	0.40 ± 0.04	0.53 ± 0.04	0.02
Health benefits	0.41 ± 0.04	0.63 ± 0.04	< 0.0001
Examples	0.51 ± 0.04	0.64 ± 0.04	0.02
Variety	0.36 ± 0.04	0.36 ± 0.04	0.94
Daily routine	0.65 ± 0.04	0.46 ± 0.04	0.001
Age-suitable	0.11 ± 0.03	0.21 ± 0.03	0.02
Targeted education	0.12 ± 0.03	0.07 ± 0.02	0.17
Nothing	0.01 ± 0.01	0.01 ± 0.01	0.99
Information			
Recommendations	0.36 ± 0.04	0.67 ± 0.04	< 0.0001
Examples	0.26 ± 0.04	0.48 ± 0.04	< 0.0001
Recipes	0.69 ± 0.04	0.63 ± 0.04	0.24
Long shelf life	0.28 ± 0.04	0.32 ± 0.04	0.47
Health benefits	0.50 ± 0.04	0.76 ± 0.03	< 0.0001
Trusted sources			
Scientists	0.78 ± 0.03	0.78 ± 0.03	0.98
Government	0.49 ± 0.04	0.47 ± 0.04	0.69
Evidence based organisations	0.88 ± 0.03	0.88 ± 0.03	0.98
Independent consumer organisations	0.12 ± 0.03	0.57 ± 0.04	< 0.0001
Journalists	0.04 ± 0.02	0.03 ± 0.01	0.51
Social media	0.06 ± 0.02	0.01 ± 0.01	0.01
Friends/family	0.21 ± 0.03	0.20 ± 0.03	0.75
Health professionals	0.84 ± 0.03	0.87 ± 0.03	0.50
Food companies	0.10 ± 0.02	0.01 ± 0.01	< 0.0001
No one	0.01 ± 0.01	0.01 ± 0.01	1.00

Data reported as mean ± standard error. [^]sensory properties: reflects ranking data where lower values denotes more commonly selected – the number reflect ranked order within a cohort.

media and food companies with the latter two more dominant in students (Table 1). Older adults were more willing to read information on dietary fibre compared with students ($p < 0.0001$; students: 77.9% vs older adults: 87.3%).

3.2. Stage two

Consumers most commonly consumed vegetables and fresh fruits as dietary fibre-rich sources in the past two weeks ($p < 0.0001$; Fig. 4). There was a lack of awareness of dietary fibre recommendations and difficulty in correctly interpreting the exact value (yes: 32.2% vs no: 67.8%; $p < 0.0001$). Consumers cited wholemeal/grain bread, breakfast cereals, vegetables and digestion function as key dietary fibre-rich foods/benefits ($p < 0.0001$; Fig. 4). Overall, consumers (71.9%) were willing to read information on dietary fibre and cited easy to prepare foods, food-based examples, fits into routine and affordable would help to encourage dietary fibre consumption ($p < 0.0001$; Figure S1).

Consumers most preferred formats to learn more on dietary fibre were videos and labels ($p < 0.0001$; Figure S1). There was also a strong interest in modulating future dietary fibre intake (yes: 82.5% vs no: 17.5%; $p < 0.0001$).

4. Discussion

4.1. Stage one: age-related differences

Positively, nutritional information was considered in food choice and this was to a greater extent in the ageing population; however, key drivers were modulated by age. For example, price and convenience were dominant in the student cohort; in contrast, nutritional aspects (healthy, ingredients, food quality and environment) were particularly present in older adults. Despite the differences there was still a strong interest (students: 82.6% and older adults: 84.0%) in improving food intake in both cohorts. This reflects current market research and the emphasis on individuals trying to eat healthily (mostly or always); yet, the challenge in adhering to such practices should not be underestimated as approximately 64% of adults in England are overweight or obese (Finnegan, 2024; Office for Health Improvement & Disparities, 2024). Similar findings (convenience vs health) in decision making being modulated by age have also been cited in the literature (Chambers et al., 2008). This suggests the role of “lived experience” may help older adults to potentially make healthier and/or time-efficient decisions than students to some extent. Moreover, it should be noted that older adults are typically unaware of nutritional requirements with increasing age and tend to have some diet-related misconceptions; hence, the need to provide relevant advice to ensure appropriate understanding of key nutritional concepts (Castro et al., 2021; Doma et al., 2019; Norton et al., 2022; Norton et al., 2024b). Future research should investigate at what point such changes occur; for example, the switch from convenience to nutritional derived choices and how this explains dietary fibre consumption habits. In addition, especially in the context of the student cohort understand if perceptions are modulated by gender and to what extent this impacts eating behaviour and future targeted dietary-fibre strategies.

Overall, both cohorts lacked dietary fibre awareness; however, older adults were better at identifying recommendations, foods and benefits compared with students. This implies regardless of age-group areas for improvements include: (i) clarifying dietary fibre recommendations; (ii) highlighting the variety of dietary fibre sources; and (iii) benefits beyond digestive function. The overriding themes are in line with previous research and demonstrate the importance of overcoming the associated knowledge gaps to ensure dietary fibre is forefront of mind and regularly incorporated in the diet (Barrett et al., 2020; Kissock et al., 2022; McMackin et al., 2012; Meynier et al., 2020; Norton et al., 2024a; Norton et al., 2024b). Interestingly, older adults were more positive than students in terms of reporting liking and easiness to consume of various dietary fibre foods and cited less issues. This may relate to the “positivity effect” with increasing age (e.g., potential to retain more positive than negative information) and/or students may be willing to give their honest opinions especially with the increasing emphasis on the student voice at universities (Bundy, 2021; Carstensen & DeLiema, 2018). Therefore, understanding current barriers and strategies to promote dietary fibre consumption is key. It is likely that improving sensory appeal (e.g., making dietary fibre foods tasty), increased product variety, ensuring affordability and easy to prepare foods could entice students to consume more dietary fibre. Moreover, clarifying health benefits is vital regardless of cohort; older adults would also like accessible information and food-based examples. For example, consumers find it difficult to visualise what is 30 g/d of dietary fibre; therefore, breaking down the information into visual and digestible chunks may help with compliance as well as easy strategies to measure intake so that consumers can quickly check consumption without a considerable time burden.

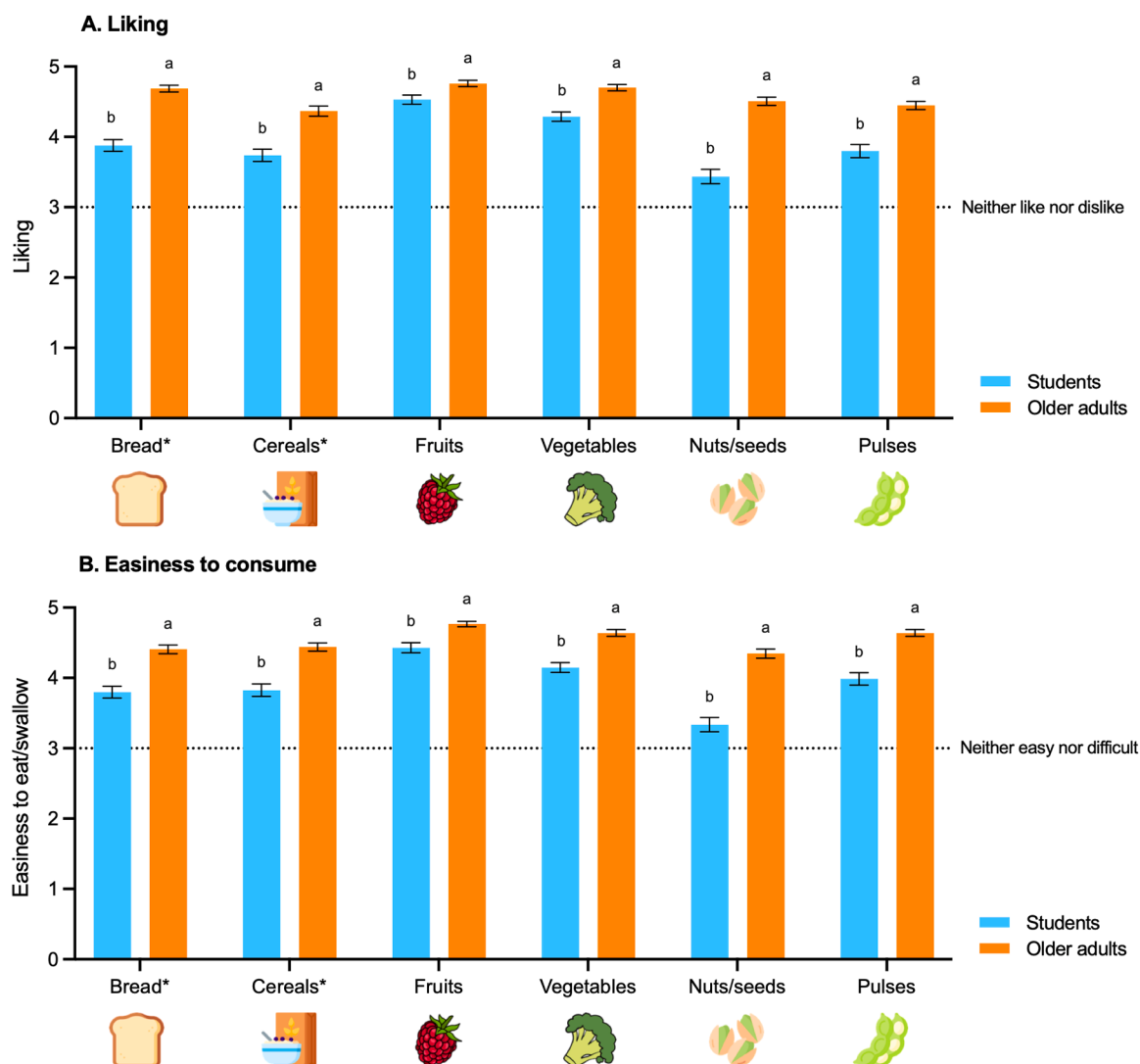


Fig. 3. Mean \pm standard error liking and easiness to consume scores of dietary fibre-rich foods (*wholemeal/grain bread and breakfast cereals) by cohort (students: $n = 149$ and older adults: $n = 150$). Differing letters reflect significance from pairwise comparisons.

4.2. Stage two: community

Community settings provide an ideal opportunity to conduct research with cohorts who are not usually involved. It is important to utilise measures that are appropriate; therefore, a short quiz combining infographics and text was developed reflecting key themes from the survey. The survey used in stage one did not capture consumption habits; thus, nine key contributing dietary fibre groups (with relevant examples and infographics) were evaluated via a category scale which can be easily administrated in field settings. This insight provided noteworthy trends and areas for improvement such as consuming a greater variety of dietary fibre-rich foods (e.g., wholegrains pasta/rice, potatoes, pulses, dried fruits, nuts/seeds). Next steps will involve validating this tool with a food frequency questionnaire to enable quantification of intake.

As expected, the community cohort lacked dietary fibre awareness and the magnitude of the effect was greater than in stage one. Therefore, this suggests the benefits of conducting research “in the wild” and findings may reflect more accurate interpretation of knowledge levels. However, the areas of future focus are the same (e.g., what are the dietary fibre recommendations, common foods sources and associated benefits). Positively, the community cohort were willing and interested in modulating future dietary fibre intake; therefore, capitalising on such

findings is fundamental to help shift consumption patterns. Interestingly, strategies to modulate future intake were similar in the student and older adults cohorts such as easy to prepare foods, food-based examples, affordable and fits into routine. The community cohort also noted videos and labels on pack as preferred formats to learn more about dietary fibre; videos can enable complex information to be communicated visually, are easily shareable and suitable for a range of ages with access to a digital device. In contrast, labels especially in the dietary fibre context are confusing as they are not typically present on front-of-pack unless the product is a source of fibre (3 g per 100 g) or high fibre (6 g per 100 g) (European Commission, 2022). Therefore, consumers need sufficient knowledge to interpret back-of-pack and ingredient lists to identify the amount of dietary fibre in a specific food. There are also accessibility concerns with small font size, challenges with interpreting what is a portion size and consumers not typically checking for dietary fibre (Norton et al., 2024a; Norton et al., 2024b). This suggests the importance of food packaging in communicating information to consumers and subsequent decision making (Marsh & Bugusu, 2007); thus, co-design with consumers could be relevant to understanding labelling preferences for dietary fibre. Hence, improved marketing of dietary fibre-rich foods coupled with increased awareness could help consumers become more familiar and subsequently shift consumption patterns. In summary, any strategy needs to reflect the target populations dietary

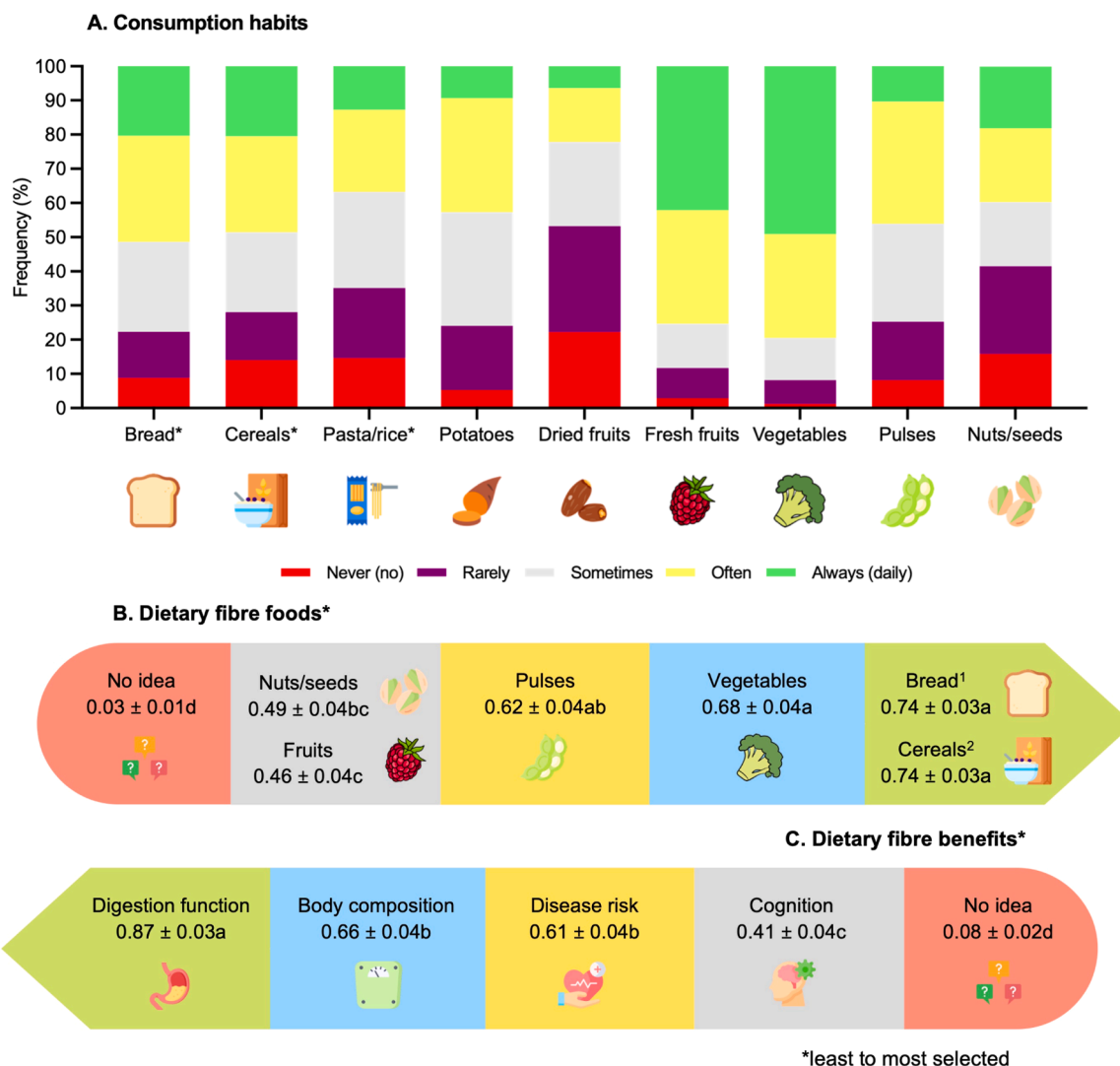


Fig. 4. Community cohort (n = 171) dietary fibre by (A) consumption habits (*wholemeal/grain bread, breakfast cereals & wholegrain pasta/rice) in the past two weeks (data expressed as percentages); (B) perceived foods (¹wholemeal/grain bread & ²breakfast cereals); and (C) benefits (data repeated as mean ± standard error and differing letters reflect significance from pairwise comparisons).

fibre challenges; accordingly, Fig. 5 summarises relevant considerations by cohort.

Insights from this research could be strengthened by capturing a broader range of demographics (including balance gender quotas, income, food intake) and target primary/secondary schools in varying locations across the UK to explore knowledge/awareness levels. Using a survey platform (such as Prolific) could have ensured more diverse cohorts; however, all surveys are prone to self-report bias. Practically, this research gained useful feedback from a dietary fibre perspective from three cohorts to inform future research.

5. Conclusion

This research provided novel insights by exploring age-related dietary fibre knowledge coupled with developing a new quiz and identified key areas for improvements: (i) clarifying dietary fibre recommendations; (ii) highlighting the variety of dietary fibre sources; and (iii) benefits beyond digestive function. Interestingly, older adults valued nutritional aspects to a greater extent than students as well as being more aware and positive relating to dietary fibre. Therefore, capturing food intake coupled with knowledge levels could help to explain the role of “lived experience” in a dietary fibre context. In

addition, the quiz was an effective approach to quantifying dietary fibre related challenges in more ecologically valid settings and provided similar insights as the survey data obtained in stage one. Future work in collaboration with key stakeholders (such as supermarkets and food companies) should include: larger sample sizes across the life-course, test cited strategies in different environments and track consumption habits over the short and long term. Gaining such insights will ensure relevant design cues can be incorporated into any proposed policies as well as reflecting the target population needs so that a more “personalised” approach can be used in the future. The impact of increasing dietary fibre consumption in the diet could lead to widespread societal, health and economic benefits; however, a collective shift in the food environment is much needed in order to help drive a sustained change in everyday eating patterns.

CRedit authorship contribution statement

Victoria Norton: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Stella Lignou:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project

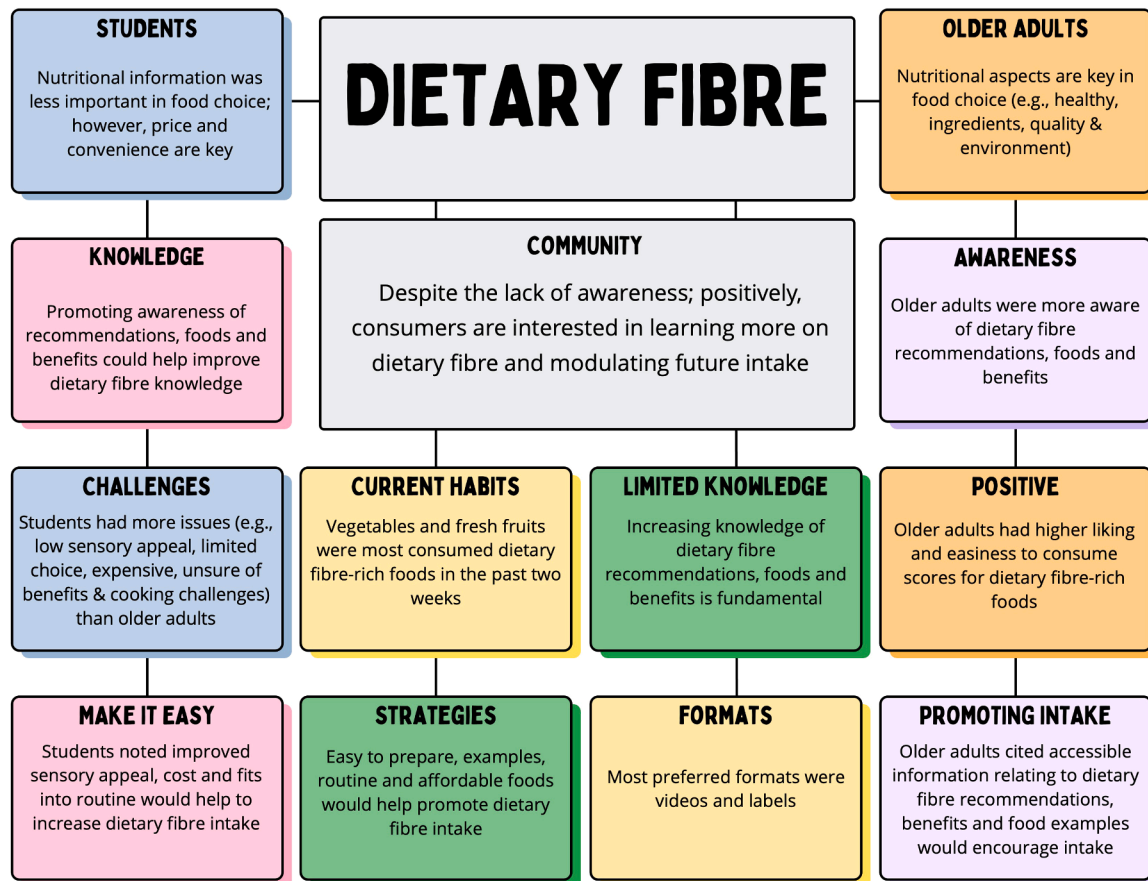


Fig. 5. Summary of stage one (students: blue and pink and older adults: lilac and orange boxes) and stage two (yellow and green boxes) key findings.

administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.foohum.2026.101205](https://doi.org/10.1016/j.foohum.2026.101205).

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