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EMERGING RESEARCH

Nutrition Bulletin

Food insecurity in people living with obesity: Improving sustainable and healthier food choices in the retail food environment—the FIO Food project

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Abstract

At both UK and global level, dietary consumption patterns need to change to address environmental, health and inequality challenges. Despite considerable policy interventions, the prevalence of overweight and obesity in the United Kingdom has continued to rise with obesity now a leading cause of mortality and morbidity. Obesity prevalence is greater among those on lower incomes and the current UK food system, including government policy, does not effectively address this. Current behavioural approaches, without the support of structural changes in the system, may even widen the inequalities gap. Hence, using behavioural insights from those living with obesity and food insecurity, the project will explore potential avenues that can be applied in the food system to promote healthier choices in the food retail environment. The National Food Strategy report recommends that the UK food system should ensure "safe, healthy, affordable food; regardless of where people live or how much they earn". However, the association between food insecurity and the development of obesity is not well understood in relation to purchasing behaviours in the UK retail food environment, nor is the potential effectiveness of interventions that seek to prevent and reduce the impact of diet-induced health harms. The *FIO Food* (Food insecurity in people living with obesity – improving sustainable and healthier food choices in the retail food environment) project provides a novel and multi-disciplinary collaborative approach with co-development at the heart to address these challenges. Using four interlinked work packages, the *FIO Food* project will combine our knowledge of large-scale population data with an understanding of lived experiences of food shopping for people living with obesity and food insecurity, to develop solutions to support more sustainable and healthier food choices in the UK retail food environment.

KEYWORDS
diet inequality, food insecurity, food system, health inequality, obesity, sustainability

Professor Alexandra Johnstone is leading the FIO Food Strategic Priorities Fund UKRI grant team.

INTRODUCTION

The prevalence of obesity in the United Kingdom is a key public health issue. In England, around two-thirds of men and women are living with overweight or obesity (NHS Digital, 2019), with similar levels found throughout the United Kingdom (Department of Health, 2020; Public Health Wales, 2019; Scottish Government, 2020). These statistics are concerning since people living with obesity (PLWO) are at an increased risk of chronic health conditions such as type 2 diabetes, some types of cancer, cardiovascular disease, osteoporosis and poorer mental health (Bray, 2004; Roberts et al., 2003; Safaei et al., 2021). Despite being a public health priority in the United Kingdom since 1991, there has been no reduction in the number of PLWO (Theis & White, 2021). This is potentially due to the wide range of factors that influence bodyweight such as genetic, epigenetic, social-environmental and microenvironment factors (Lin & Li, 2021; Safaei et al., 2021; Theis & White, 2021).

One key challenge faced by people living on a low income is the ability to afford a healthy, balanced diet (Bai et al., 2021; Power et al., 2021). The current UK economic climate has led to a cost-of-living and energy crisis that has caused a significant reduction in people's 'real' disposable incomes (UK Parliament, 2022). This cost-of-living crisis is disproportionately affecting poorer households and is likely to be amplifying existing diet challenges, such as food insecurity (FI) (The Food Foundation, 2022b) which is defined as 'the state of being without reliable access to a sufficient quantity of affordable, nutritious food' (USDA, 2022). Indeed, FI is typically experienced by families on lower incomes. Paradoxically, research indicates that those experiencing FI in high-income countries are more likely to be living with obesity (Aggarwal et al., 2011; Drewnowski & Specter, 2004; Papan & Clow, 2015).

The link between obesity and food insecurity is evidence based and well documented in the literature. For instance, in the United States, income negatively correlates with BMI status (Bentley et al., 2018), with similar patterns observed in Europe. An analysis of the *Survey of Health, Ageing and Retirement* (*SHARE*) and the *English Longitudinal Study of Ageing* (*ELSA*) reported that older, poor individuals were from 10 to 20% points more likely to be obese than non-poor individuals (Salmasi & Celidoni, 2017). Dietary characteristics of those on lower incomes have been described as having an over-abundance of nutrient poor-energy dense foods, known as a 'substitution' effect, in which more expensive foods are replaced by cheaper options, often high in fat, salt and sugar (Morales & Berkowitz, 2016). In the United Kingdom, diets meeting national food and nutrient-based recommendations by the Scientific Advisory Committee on Nutrition (SACN) are associated with higher monetary costs, particularly for healthy diet indicators such as fruit and vegetables (by 17%) or fish (by 16%) (Jones et al., 2018). Therefore, the easy accessibility and widespread availability of nutritionally poor, often ultra-processed foods high in fat, sugar and salt (The Food Foundation, 2022a) makes the purchase of healthy, nutritious food more challenging (Dhurandhar, 2016).

However, such justifications fail to provide an explanation of the underlying mechanisms of this association (Dhurandhar, 2016; Nettle et al., 2017). To address this, the Insurance Hypothesis and the Resource Scarcity Hypothesis propose evolutionary decision-making mechanisms which are argued to bring about increased energy intake in times of food insecurity (Dhurandhar, 2016; Nettle et al., 2017). These hypotheses propose that perceived cues indicating an upcoming shortage of food, to which people living with financial insecurity are potentially more attuned compared to those who are financially secure, trigger an adaptive behavioural response of increased caloric intake which, in high-income countries, where there is an abundance of energy-dense foods, may lead to weight gain (Dhurandhar, 2016; Nettle et al., 2017). While such hypotheses may go some way in helping explain the association between food insecurity and obesity, on their own, they face limitations such as the presence of a stronger association between obesity and FI in women compared to men (Nettle et al., 2017). Irrespective of the potential underlying mechanisms, there is also evidence to suggest that weight loss programmes delivered in primary care may be less effective for those living with FI compared to individuals who are food secure (Myers et al., 2021). Indeed, individuals living with FI and obesity may need specific, tailored interventions (Myers et al., 2021). However, going beyond the individual level, taking a socio-ecological perspective, consideration must be paid to existing health inequities resulting from social, economic or political upstream determinants such as income, education, ethnicity or culture which have typically been ignored by many strategies aimed at tackling levels of obesity in the general public (Kumanyika, 2022; Theis & White, 2021). This lack of consideration around the wider determinants of health in interventions aimed at reducing obesity levels has failed to consider the limited agency and lack of resources available to individuals experiencing FI (Adams et al, 2016; Theis & White, 2021). Those living on a low income and experiencing FI face barriers around the type of food they can afford to purchase (The Food Foundation, 2022b). This suggests that it would be extremely challenging for these individuals to engage with interventions which require the purchase and consumption of healthier, more nutritious and often more expensive food items.

Apart from health impacts, the existing food system also negatively impacts the environment. The food system was estimated to contribute 35% of the UK total greenhouse gas (GHG) emissions in 2019 (WRAP, 2021), accounting for 70% of all human water

use, and is the leading cause of deforestation, pollution and biodiversity loss (Garnett et al., 2018). Food growing (e.g., farming methods, geographic location and conditions) and transportation methods all play a role in the environmental sustainability of the foods we consume (Macdiarmid, 2013); therefore, the environmental impact or 'sustainability footprint' of any healthy diet must also be considered within health promotion, policy and practice.

Sustainable healthy diets are "dietary patterns that promote all dimensions of individuals' health and well-being; have low environmental pressure and impact, taking into account factors including GHG emissions, water consumption, and land use; are accessible, affordable, safe and equitable; and are culturally acceptable" (WHO, 2019). In the United Kingdom, the government provides nutritional advice via the Eatwell Guide which depicts how much adults should consume of each food group to achieve a healthy, balanced diet (Scheelbeek et al., 2020). The Eatwell Guide has been reviewed to ascertain whether adherence is more environmentally sustainable (as well as healthier) than the current national diet (Carbon Trust, 2016; Cobiac et al., 2016). Findings indicated that adherence to the Eatwell Guide recommendations have a 32% lower environmental footprint than the current national diet (Carbon Trust, 2016). Therefore, supporting a diet in line with the Eatwell Guide is important for sustainability as well as health. The Net Zero report, from the UK Committee for Climate Change, recommended UK intakes of ruminant meat (beef and lamb) and dairy should be reduced by 20% (DBAIS, 2021). However, evidence on the ways to achieve behavioural change to attain such reductions is lacking.

Obesity and climate change are cited as two major interwoven global issues that currently face global population (An et al., 2018; Trentinaglia et al., 2021). The *Food Insecurity in people living with Obesity* (*FIO Food*) project will combine insights from large-scale population data with an understanding of the lived experience of food shopping for PLWO and FI, to develop solutions that support more sustainable and healthier food choices in the UK retail food environment. Globally, supermarkets are the primary source for purchasing food and beverages, holding an 86% share of the market (Statista, 2021). For families on low incomes, 76% of monthly food budgets are spent in supermarkets (Guy's and St Thomas' Charity, 2019), so decisions that the retail food sector makes around advertising, promotions and in-store design have a huge impact on public health within this vulnerable group and they present an opportunity to encourage healthier and more sustainable dietary behaviours. This project provides a novel and multi-disciplinary collaborative approach with co-production at the heart to address these challenges in the UK food system, using four interlinked work packages (WPs).

Co-production is often used within applied health research to describe partnerships among industry, academia and public involvement (PI). Nabatchi et al. (2017) suggest that co-production is a concept that captures a wide variety of voluntary collaboration between stakeholders from different organisations or communities working together in any phase of the provision of public goods or services that produce benefits in the design of interventions to positively impact behaviour. The *FIO Food* project defines co-production

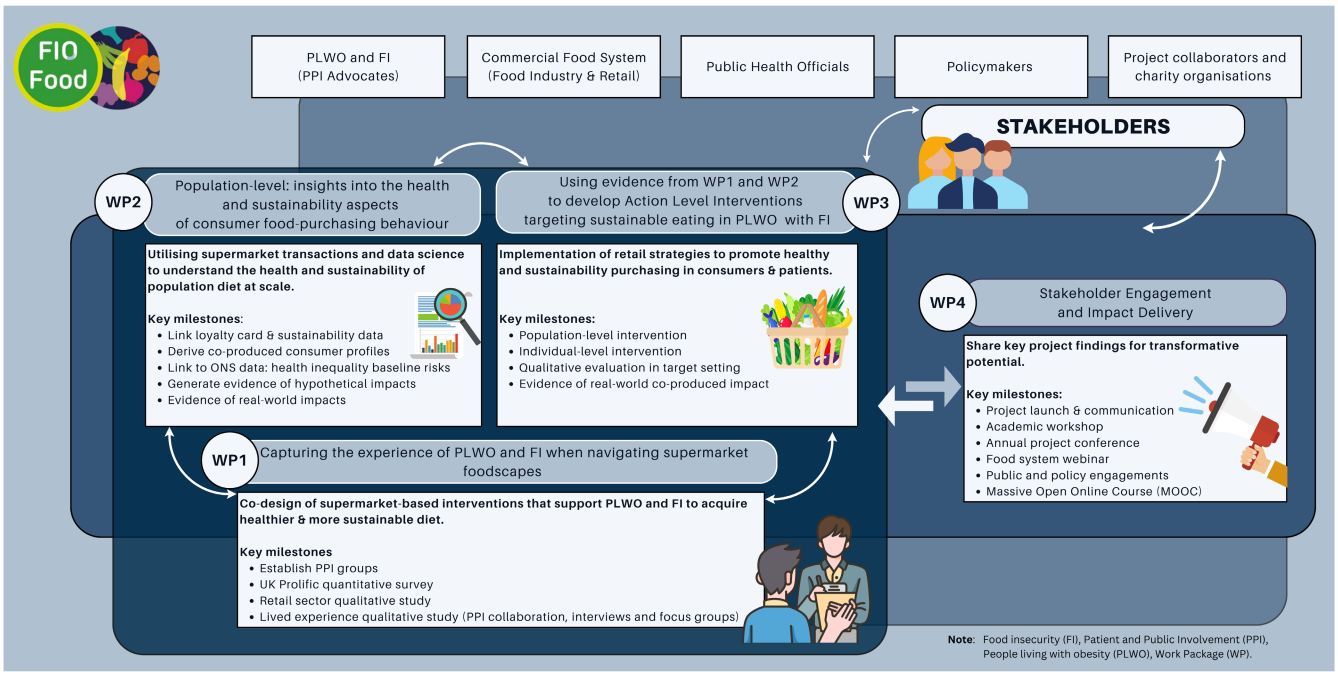

FIGURE 1 FIO Food project's structure reflecting the multidisciplinary approach.

as an umbrella concept, which captures a wide variety of activities that can occur throughout the four WPs where PLWO and FI, key stakeholders and academics work together (Nabatchi et al., 2017) in the co-design of relevant interventions that target purchasing behaviours (Figure 1).

Patient and Public Involvement (PPI) groups comprised individuals with lived experience of obesity, FI or both, are part of the project's Advisory Group. The input of PPI advocates is beneficial throughout the research process, for example, helping to ensure that the research addresses issues relevant to the target population, identifies lines of enquiry not previously considered by researchers and verifies that all study materials or interventions will be acceptable for participants (Brett et al., 2014). PPI in the analysis of research findings allows themes or trends to be interpreted from an insider perspective; these interpretations may differ from those of academics or clinicians (Brett et al., 2014). PPI can also help ensure that research findings are presented in a way that is easily understandable, with a focus on what is important for the target population (Brett et al., 2014). The *FIO Food* PPI group members will work alongside researchers and provide feedback on the development, delivery and dissemination of all work conducted within the *FIO Food* WPs; a practice in line with the citizens' participation model proposed by Arnstein (1969). Arnstein illustrated this concept as a ladder with eight rungs, each representing a level of participation in ascending order, starting from non-participation, through tokenism (PPI involvement solely to demonstrate that they were involved) all the way up to degrees of citizen participation (actual power). Although some find this model controversial, it provides useful guidance on good engagement practices, enabling PPIs to be involved in decision-making processes and attaining a truly collaborative relationship.

This innovative project aims to improve environmentally sustainable and healthier food choices in the UK food system and provide actionable evidence for policy on retail strategies to address dietary inequalities in two vulnerable groups (PLWO and FI). The four WPs are described in the next section.

FIO FOOD WORK PACKAGES

WP1: Capturing the experience of people living with obesity and food insecurity when navigating supermarket foodscapes

Insight into the potential determinants of purchasing behaviour can be acquired through the exploration of peoples' lived experience (Puddephatt et al., 2020; Roudsari et al., 2017; Whitelock & Ensaff, 2018). Existing qualitative research has revealed that for people with FI, purchasing behaviour, including where consumers choose to shop and the products they buy, is predominantly determined by cost (Cannuscio et al., 2014; Pitt et al., 2017; Puddephatt et al., 2020). Individuals experiencing FI describe trips to multiple stores to acquire products at the best price (Cannuscio et al., 2014; Pitt et al., 2017) often prioritising cost over nutritional quality, despite reporting a preference for healthier foods (Puddephatt et al., 2020). However, there is a lack of research into the experiences of PLWO and FI when acquiring foods that might help them achieve their weight-loss or weight-maintenance goals. Similarly, there is little understanding of the extent to which the environmental footprint of food plays a role in purchasing behaviour, including that of PLWO and FI. Food purchasing is a key antecedent to consumption; therefore, the supermarket setting provides an excellent opportunity to improve diets and promote good health (Drewnowski & Rehm, 2013). A recent systematic review of grocery store interventions indicated that the retail food environment (e.g., the supermarket) can influence food purchasing behaviour (Hartmann-Boyce et al., 2018). Hartmann-Boyce and colleagues found economic interventions, such as reducing the price of healthy foods, or providing financial rewards for healthy purchases, helped to increase the purchase of healthier food items, regardless of income or budget. Swap-based interventions, such as offering the consumer the chance to replace their usual food items with healthier alternatives, or food labelling interventions appeared less effective for those in low SES groups (Hartmann-Boyce et al., 2018); however, more research is needed to understand the role that supermarkets play in determining food purchasing for various populations, such as PLWO and FI. WP1, informed by co-production, aims to collect data to assist key stakeholders (food industry, policymakers, charities, public health officials, PLWO and FI), in the co-design of a supermarket-based intervention (WP3), which supports PLWO and FI to achieve better health quality.

To achieve this aim, after seeking all necessary ethical approvals from RGU School Ethics Review Panel and Institute of Population Health Research Ethics Committee, WP1 will first conduct a large, representative online survey ($n = 600$) with PLWO and FI to identify the main barriers and facilitators that may be encountered when shopping for healthier, more sustainable foods. Participants will be recruited via several routes, including using an online recruitment website known as Prolific (www.prolific.com), through paid targeted advertisements on Facebook, through charity organisations (e.g., Obesity UK, Food Foundation), and from a weight management service in the United Kingdom—MoreLife, utilising their existing contract with non-NHS users. Data will be analysed using structural equation modelling to assess whether the relationship between FI and a less healthy and sustainable diet is accounted for by barriers from the food environment and personal factors. Descriptive analyses will also be conducted to

identify intervention recommendations relating to the facilitators to acquiring healthier, more sustainable food. Findings from the survey will be used, in part, to inform topic guides for interviews ($n = 30$) and focus groups ($n = 5$) exploring the lived experience of PLWO and FI when food shopping in greater detail than is possible using quantitative methods. Participants completing the survey will be offered the opportunity to take part in the interviews and focus groups to further discuss their experiences of shopping for healthy, environmentally sustainable foods in the supermarket with *FIO Food* researchers. Additionally, participants for the interviews will be recruited from posters displayed in local communities and relevant social media pages. Within the interviews, we will encourage discussions around the drivers of purchasing behaviours from the individual level (preferences, tastes, habits) to the level of the supermarket (price, promotion, availability of produce) as well as at the policy level (benefit payments, legislation for retailers). Ethnographic work with a small subsample of interview and focus group participants ($n = 10$) is also planned. Ethnography involves the researcher being immersed into the real-world context of the participant, allowing insight into the complexities occurring within the setting under investigation (Jones & Smith, 2017). This approach will allow a thorough exploration and analysis of shopping experiences and determinants of food purchases in the supermarket environment to produce rich, detailed data (Draper, 2015). As well as the qualitative work with PLWO and FI, interviews will also be conducted with senior nutritionists of leading UK-based supermarkets who are members of the Industry Nutrition Strategy Group (INSG). The aim of these interviews is to understand their perspectives and views on the adoption or integration of some or all the key recommendations from the survey. It is anticipated that between 5 and 10 senior nutritionists will participate, although this depends on the availability of participants balanced with the need for data saturation. Data will be analysed using thematic analysis and the themes generated will inform intervention development during WP3.

In keeping with the collaborative ethos of the *FIO Food* project, as part of WP1, study documents including the interview and focus group topic guides, screening questionnaires and recruitment procedures will be co-produced with our *FIO Food* PPI groups. Furthermore, our PPI groups will co-produce the findings of WP1 through their interpretation of the data generated.

WP2: Population-level insights into the health and sustainability aspects of consumer food-purchasing behaviour

This work package will use data on food products and loyalty-card transaction records from a large high-street supermarket in the United Kingdom. Baseline metrics will be generated for (i) shoppers' sustainability footprints estimated through linkage to published data on the environmental footprint of food product ingredients (e.g., GHG emissions, biodiversity loss, water use) (Clune et al., 2017; Mekonnen & Hoekstra, 2011, 2012; Poore & Nemecek, 2018) and (ii) healthiness of customer food purchases (e.g., using high in fat, salt and sugar [HFSS] metrics, the UK Eatwell Guide and national nutrition recommendations [DHSC, 2022; PHE, 2016]). Population socio-demographic and economic data at output-area level from the UK Census (ONS, 2021) will also be linked to the transaction records; these data will be used to generate population weights (i.e., values assigned to each individual/household in the sample to indicate their representativeness in the analyses). The generated population weights will then be used to account for the differences in the selection probability of individuals/households in the sample of supermarket shoppers considering the background of the UK population and transform the estimates from the high-street supermarket so that they are more generalisable to the UK population.

In the United Kingdom, nationally representative data on food consumption are provided by the *National Diet and Nutrition Survey* (data on 1000 people per year) (PHE, 2021) and household purchasing data are available from the Family Food module of the *UK Living Costs and Food Survey* (data on around 5000 households per year) (DEFRA, 2023). However, considering the disadvantages of dietary surveys (e.g., reliance on self-reporting) and the relatively low sample sizes, particularly for analysis of subgroups or spatial patterns, the novel source of food purchasing data that will be used in WP2 on over a million individuals/households is useful for studying dietary patterns (Green et al., 2020). The findings from this WP will, therefore, produce the most comprehensive description of food-purchasing patterns in the United Kingdom at a scale not seen before, by examining the intersection between the healthiness and sustainability of current diets, and how these vary across social inequalities. The data from this work package will be imperative for identifying target areas for interventions.

Consumer 'profiles' will be created based on the loyalty card-holder food-purchasing patterns, socio-demographic characteristics and sustainability footprint using latent class profiling (an analytic approach that identifies latent subpopulations/subgroups within a population based on a defined set of variables; i.e., individuals are placed into mutually exclusive subgroups with specific shared characteristics) (Williams & Kibowski, 2016). Using loyalty card-holder subgroups (i.e., consumer 'profiles') that are optimised according to multiple items of information (e.g., age–sex profile, estimated household income, area type of residence, as well as food-purchasing patterns

that likely reflect health aspects of diet and potential FI) avoids relying on any single household feature (e.g., income estimates) or area attribute (e.g., index of multiple deprivation based on postcode of residence). This makes the classification more complex and fine-grained in profiling households in relation to health and sustainability, moving beyond simply describing patterns. The data-driven consumer 'profiles' identified in WP2 analyses will be discussed with stakeholders (e.g., PLWO and FI, policymakers, food industry and retailers). The findings about consumer food-purchasing behaviours in WP2 will then be applied to inform the development and examine the impacts of in-store interventions (designed in WP3). WP2 will examine the impact of potential shifts in consumer purchasing patterns (e.g., reducing meat purchasing or food swaps using data modelling of different scenarios), as well as of real-world interventions, such as healthy start voucher top-up coupons (Thomas et al., 2022), 60p value on selected fruit and vegetables (IGD, 2022), sustainability labelling (Potter et al., 2022). This WP will focus on how interventions could theoretically influence purchasing of healthier and environmentally sustainable foods, both independently and combined. WP2 will then investigate if these dietary shifts and the subsequent knock-on impacts differ across the generated consumer 'profiles', population subgroups (e.g., age, ethnicity) and socioeconomic measures (e.g., neighbourhood deprivation). This will help to identify how consumers can be nudged towards purchasing healthier and more environmentally sustainable foods. Although WP2 focuses on exploring nudges that place responsibility on the behaviour of individuals, it is important to note that businesses, local and national governments also play a key role in driving positive change.

WP2 will generate, for the first time, important population-level insights into health and sustainability aspects of consumer food-purchasing behaviours at a scale not yet seen. This research aligns with recent legislation to slow obesity (Department of Health & Social Care, 2022) and Carbon Net Zero ambitions in the United Kingdom (UK Parliament, 2021), and it will impact the public, businesses and policymakers.

WP3: Using evidence from WP1 and WP2 to develop action level interventions targeting sustainable eating in PLWO with FI

This WP recognises the requirement for action-level interventions. Intervention studies are a crucial component of *FIO Food* research because they evaluate the effectiveness of sustainable eating strategies targeted at people living with obesity and food insecurity. The interventions in WP3 will be co-designed with and informed by stakeholders involved in WP1 and WP4 activities (e.g., policymakers, public health officials, food retailers, food industry, PLWO and FI) to ensure research activities remain impactful and valid. Due to the nature and co-production of methods applied as part of the project, WP3 can only be fully articulated following the integration/completion of WP1 and WP2. Using the findings from these WPs, as well as insights from the retail partner, WP3 will aim to co-design and review intervention strategies to increase healthy and sustainable food purchasing in PLWO and FI. Using either in-store, a retail online shopping website or supermarket loyalty-card app, the co-produced interventions will aim to promote healthier and sustainable food purchasing behaviours, at a population level via a retail project partner, who has established links and worked with the academic team in securing funding for the *FIO Food* project. Retail interventions will use learnings from previous piloted interventions and consider (i) economic incentives, (ii) store environment changes, (iii) swaps to a healthier alternative, (iv) labelling and/or educational interventions (Hartmann-Boyce et al., 2018). Public health impact is dependent on the extent to which efficacious interventions are both robust and agile, so they are disseminated with fidelity into real-world settings, then maintained and institutionalised (Hasson, 2010). WP3 will evaluate the efficacy and effectiveness of the retail intervention to assess its impact on PLWO and FI.

Beyond a population-level intervention, the use of co-production can help to address concepts at other socio-ecological levels, including interventions that target the individual and their support network. MoreLife UK provide programmes and services to PLWO that aims to help them change their behaviours, for example, diet, physical activity, smoking cessation and make a difference to their overall health and wellbeing (MoreLife, 2023). MoreLifeUK has established links with the research team, and with its large group of clients, (people living with obesity) they are able to provide insights around the key focus of the project (i.e., food sustainability and insecurity), which will enable the research team to develop a logic model to inform intervention designs for future implementation. Currently, 60% of MoreLife UK service users accessing weight management services are from 40% most deprived communities.

Using findings from previous WPs, WP3 will also co-design a more individual targeted intervention, using a patient cohort from MoreLife UK (approximately 55 000 patients). The intervention design will be a dynamic process, supported by The National Institute of Health's (NIH) Behaviour Change Consortium (BCC) five domains of treatment fidelity (Study Design, Training, Delivery, Receipt and Enactment) (Ory et al., 2002). The effectiveness evaluation of the study aims to evaluate whether the intervention achieves its intended outcomes, for example, more sustainable food purchasing

behaviour. Essentially, given that sustainable eating in PLWO and FI will depend on the MoreLife UK client's acceptance of a change to their current curriculum, there is also a need to co-create and evaluate with clients any solutions designed to facilitate uptake of healthy, sustainable diets, which *FIO Food* will address.

Co-designed, qualitative semi-structured focus groups will be adopted with a sub-sample of participants (PLWO and FI) to develop treatment fidelity parameters. Treatment fidelity is the ongoing assessment, monitoring and enhancement of the reliability and internal validity of a study (Borrelli et al., 2005). Treatment fidelity is particularly important for health interventions given the inherent complexity of changing behaviours. The focus groups will enable continued insights of PLWO and FI regarding acceptability, engagement behaviour change and mechanisms of action, for the interventions. WP3 will analyse the focus group data using content analysis, by systematically reviewing and interpreting the discussions, and then presenting them using a pen profile technique. Pen-profiling allows data from content analysis to be organised schematically via a diagram of composite emergent major and minor themes (Sanders et al., 2022). Emergent themes will be organised to illustrate the perspectives held by participants and provide transferrable information to continually develop strategies for the effective delivery of a co-designed, combined retail and weight management intervention conducted in the 'real world'. These findings will feed into WP4 and ongoing engagement with key stakeholders.

WP4: Stakeholder engagement and impact delivery

The aim of WP4 is to share key project findings for the transformative potential of the UK food system with key stakeholders using engagement and impact delivery, throughout the duration of the grant.

In the past, research was disseminated using mainly written formats, (e.g., reports and/or publications in peer-reviewed journals) targeting specialist audiences. This passive way of disseminating science was found not only ineffective in transforming policy (Bero et al., 1998; Reynolds et al., 2020) but also excluded the groups that were supposed to benefit from the research findings. Hence, in modern research, well-designed communication strategies gained more importance and many funders have included the strategic communication plan as a compulsory component of research proposals to encourage the successful uptake of research evidence by stakeholders (Adolph et al., 2009; European Union, 2010).

Academic collaboration with stakeholders is key to ensuring that the project remains focused, feasible and impactful, which means it will make a demonstrable contribution to the transformation of the food system and consumers' shopping behaviours. Apart from these impacts, the process of so-called 'knowledge mobilisation' is also required to catalyse change (NIHR, 2019). This process can be extremely creative, innovative and tailored to the specifics of the project. In the *FIO Food* project, it includes not only passive but also participatory dissemination, including public engagement and co-design described earlier.

The *FIO Food* team's communication plan aims to close the gap between knowledge and practice and is based on the principles of dissemination science defined as the *study of communication strategies that are designed to increase awareness and understanding of innovative, effective policies and practices to facilitate their widespread adoption* (Greenhalgh et al., 2004). The communication strategy of the *FIO Food* project involves regular sharing of the findings as well as an active and consistent online presence. Partial findings are shared with key stakeholders (representatives of Steering, Advisory and Stakeholder Impact groups, including the PPI groups) before peer-reviewed publications are completed, in order to gather feedback and help with data interpretation. In terms of online presence, so far, the project's website (https://www.abdn.ac.uk/rowett/research/fio-food/index.php) and Twitter profile (https://twitter.com/FIOFood) have been launched to reach the general public, provide information about the project and identify potential collaborators. Social media networking can enhance public engagement and spark insightful discussions in reflecting on the lived experience, policy limitations and retail challenges. This, in turn, can promote the project to evolve in real time and facilitate required adjustments.

The participatory aspect is further facilitated through continued knowledge exchange by organising workshops (e.g., online workshops for Early Career Researchers or in-person, interactive sessions with pupils, families and teachers during Science Week), scientific conferences, bi-annual meetings and designing a massive open online course (MOOC) for the public. This course, being a synthesis of the most recent evidence on food insecurity and obesity in the United Kingdom, along with experts' insights provided in interview format, will help close the theory–practice gap and can be a valuable tool for healthcare professionals, policymakers, retail representatives and anyone involved in the UK food system. Sharing insights openly with stakeholders and other retailers throughout the project acts as a pipeline to raise awareness of the ethical, moral and fiscal challenges of addressing healthier and environmentally sustainable diets in PLWO and FI. Furthermore, conducting briefings and workshops builds on stakeholder engagement and strengthens the capacity for effective communication with the non-academic community.

Conveying scientific messages to the public has proven to be challenging in previous health research. To maximise the full potential of the project to impact policy and the UK retail food environment, various formats of communication are explored that are tailored specifically for the target group. The *FIO Food* team is seeking the PPI members' feedback on dissemination materials which helps to craft the messaging so that it remains engaging and at the same time easy to understand for the layperson audience. To date, the PPI groups were consulted on the surveys used in the study, informative brochures, animated materials etc. The *FIO Food* team will explore other audio-visual dissemination methods to amplify the impact and increase study visibility, such as infographics, podcasts and video abstracts.

CONCLUSIONS

Using a co-production ethos, the *FIO Food* project brings together researchers from across the United Kingdom to explore how we might support sustainable and healthier food choices in the UK retail food environment. Our project fully embraces the UKRI call remit to transform the UK food system for health and the environment. It is both novel and synergistic to current UK academic activities and we strongly believe that it has the capacity to evaluate planned policy recommendations for the retail sector, over the next 3 years.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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