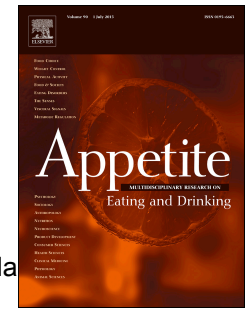
CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	A phenomenological exploration of change towards healthier food purchasing behaviour in women from a lower socioeconomic background using a health app
Authors	Flaherty, Sarah Jane;McCarthy, Mary;Collins, Alan M.;McCafferty, Claire;McAuliffe, Fionnuala M.
Publication date	2019-12-19
Original Citation	Flaherty, S. J., McCarthy, M. B., Collins, A. M., McCafferty, C. and McAuliffe, F. M. (2020) 'A phenomenological exploration of change towards healthier food purchasing behaviour in women from a lower socioeconomic background using a health app', Appetite, 147, 104566 (11 pp). doi: 10.1016/j.appet.2019.104566
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.sciencedirect.com/science/article/pii/S0195666319307937 - 10.1016/j.appet.2019.104566
Rights	© 2019 Elsevier Ltd. All rights reserved. This manuscript version is made available under the CC-BY-NC-ND 4.0 license http://creativecommons.org/licenses/by-nc-nd/4.0/ - https://creativecommons.org/licenses/by-nc-nd/4.0/
Download date	2026-11-16 11:47:42
Item downloaded from	https://hdl.handle.net/10468/11432

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Journal Pre-proof



A phenomenological exploration of change towards healthier food purchasing behaviour in women from a lower socioeconomic background using a health app.

Sarah Jane Flaherty, Mary B. McCarthy, Alan M. Collins, Claire McCafferty, Fionnuala M. McAuliffe

PII: S0195-6663(19)30793-7

DOI: https://doi.org/10.1016/j.appet.2019.104566

Reference: APPET 104566

To appear in: *Appetite*

Received Date: 19 June 2019

Revised Date: 16 December 2019

Accepted Date: 18 December 2019

Please cite this article as: Flaherty S.J., McCarthy M.B., Collins A.M., McCafferty C. & McAuliffe F.M., A phenomenological exploration of change towards healthier food purchasing behaviour in women from a lower socioeconomic background using a health app., *Appetite* (2020), doi: https://doi.org/10.1016/j.appet.2019.104566.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2019 Published by Elsevier Ltd.

Journal Pre-proof

Title: A phenomenological exploration of change towards healthier food purchasing behaviour in women from a lower socioeconomic background using a health app.

Authors

Sarah Jane Flaherty[1,2]*, Mary B. McCarthy[1,2], Alan M. Collins[1,2], Claire McCafferty[1,3], and Fionnuala M. McAuliffe[1,4].

1. HRB Centre for Health & Diet Research, University College Cork, Republic of Ireland.

2. Cork University Business School, University College Cork, Republic of Ireland.

3. School of Public Health, Physiotherapy and Sports Science, University College Dublin, Republic of Ireland.

4. UCD Perinatal Research Centre, School of Medicine, University College Dublin, National Maternity Hospital, Republic of Ireland.

*Corresponding author:

Address: Cork University Business School, University College Cork, Western Road, Cork, Republic of Ireland.

Email: sarahjane.flaherty@ucc.ie

Journal Pre-proof

Journal Pre-proof

Abstract

Food purchasing is dominated by routines and habits that may hamper the use of reflective decision-making and impede change. Disrupting existing behavioural patterns may address this challenge. Individuals from a lower socioeconomic background are more likely to report unhealthier purchasing and targeted initiatives are required. Health apps offer a potential approach although little evidence is available for this specific context. This research examines the individual's experience of changing food purchasing behaviour using an app focusing on women from a lower socioeconomic background. Multiple methods across different time-points explored the individual's experience over an 8-11 week period. An accompanied shop, incorporating think-aloud and researcher observations, was undertaken at baseline, followed by an in-depth interview and questionnaire. A reflective account of the individual's experience was recorded at four weeks and grocery receipts were shared for the duration. At follow-up, an accompanied shop, in-depth interview, and questionnaire were again used. Data were analysed using interpretative phenomenological analysis. The app appeared to disrupt existing behaviour by encouraging a more conscious approach to food purchasing. Self-monitoring, problem solving, and behavioural prompts were expressed as the most effective techniques. Due to the retail environment, self-control was necessary to create and maintain healthier behaviour. Individual higher-order goals appeared to influence behaviour change and the extent to which reflective cognition was employed. The role of retailers in directing behaviour was acknowledged but it appeared that change was still viewed as individual responsibility. In conclusion, apps may facilitate healthier purchasing via specific behaviour change techniques but personal and environmental factors may influence the change process. A range of strategies may be necessary to support sufficient and sustained change.

Keywords

Behavior change; healthy eating; food purchasing; health app; lower socioeconomic.

Journal Pre-proof

Journal Pre-proof

Acknowledgements

The authors wish to thank the women that participated, and the retail managers that facilitated recruitment and data collection. The authors are grateful to Jessica Finn for her support during data collection. This work was supported by the HRB Centre for Health & Diet Research, Grant Reference HRC/2014/13, and conducted as part of the SPHeRE Programme, Grant Number SPHeRE/2013/1. The funders had no role in the design, analysis, or writing of this article.

Journal Pre-proof

Introduction

The acquisition of food is an important step in the food choice process (Sobal *et al.*, 1998), with food purchased in the supermarket constituting the majority of food consumed (safefood, 2013). Changing food purchasing behaviour towards healthier options may support healthier consumption patterns. It may limit the availability or quantity of unhealthier foods at home which may reduce the likelihood of their consumption should competing goals arise. Food purchasing behaviour is driven by personal goals that are further influenced by individual, social, and environmental contexts (Story *et al.*, 2008). Figure 1 outlines the different contexts that can influence goal development in relation to food purchasing. It illustrates how the wider purchasing context may shape individual behaviour, and how particular personal contexts may result in differences in personal goals. As food purchasing is considered a "*contextualised act*" (Buttle, 1992), each context may influence behaviour differently depending on the specific purchasing context and the importance attributed by the individual to the particular context. This results in unique purchasing contexts for individuals as the combination of influencing factors may differ between and within individuals.

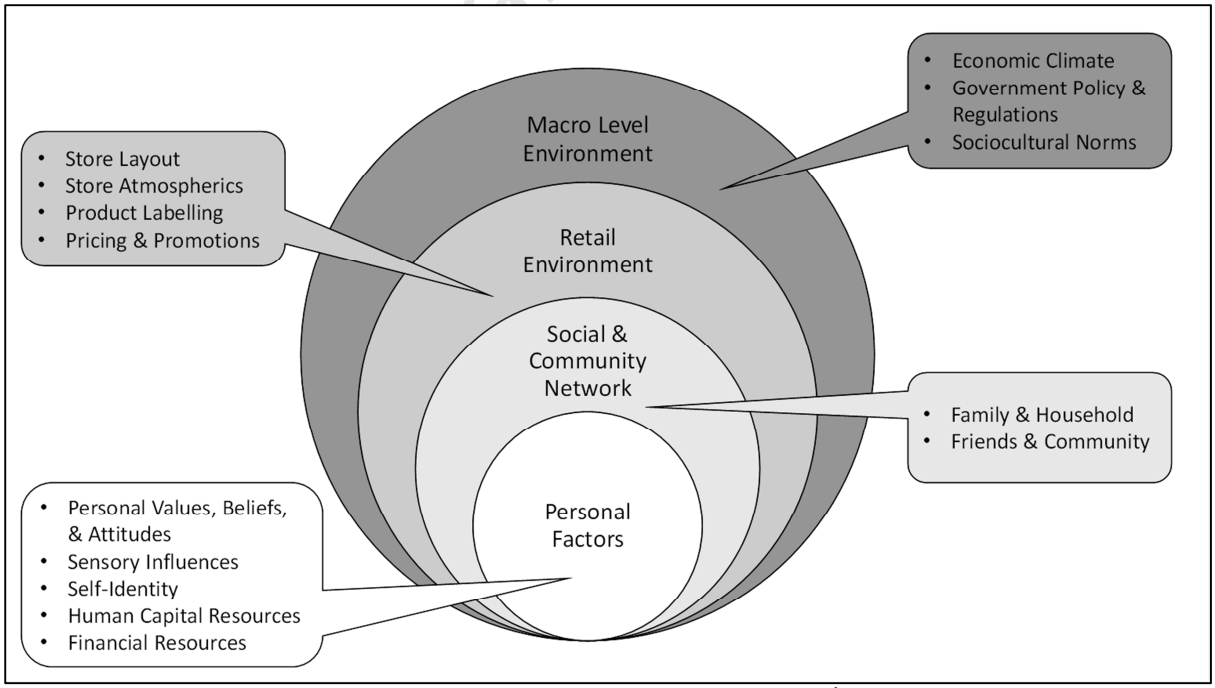


Figure 1. Socioecological Model of Food Purchasing Behaviour[1]

[1] This model was adapted from safefood (2012) and Story et al. (2008).

Journal Pre-proof

Individual behaviour is guided by two cognitive networks (Kahneman, 2011). The first is a less conscious, automatic network that encompasses practices and associations that are learned over time, stored in memory, and accessed without effort (Kahneman, 2011). Heuristics, routines, and habits comprise some of these cognitive processes and are used as a means of simplifying the purchasing process (Bettman *et al*., 1991). The second network is conscious and reflective and involves a more effortful and slower cognitive response (Kahneman, 2011). Contextual influences dictate which cognitive system is drawn upon (Rothman *et al*., 2009). Given the changing contexts in which food purchasing takes place, consumers are likely to draw on both cognitive systems, although the influence of each may vary. There is, however, a dominance of routines and habits in food purchasing which hinders the use of reflective decision-making. This results in traditional measures of behaviour change, such as goal-setting and information provision, being less effective (van't Riet *et al*., 2011).

Consequently, a different approach is necessary to achieve sufficient and sustained change. A greater incorporation of techniques that disrupt existing routines and habits, and prompt a greater employment of conscious reflection, is required (van't Riet *et al*., 2011, Yang et al., 2012). Disrupting existing purchasing patterns can encourage a re-evaluation of behaviour and an openness to available information and new goals (Wood *et al*., 2005). Combining such an approach with information provision and goal-setting is likely to be most effective at facilitating change (van't Riet *et al*., 2011). Employing self-control, modifying the behavioural context, and re-framing behavioural outcomes offer opportunities to disrupt existing behaviour (van't Riet *et al.*, 2011). Little is known on their potential effectiveness in the context of food purchasing and further exploration is needed.

Furthermore, clear disparities exist with individuals from a lower socioeconomic background less likely to purchase and consume healthier foods (McCartney *et al*., 2013; Turrell and Kavanagh, 2006), illustrating the need for specifically targeted initiatives. Health apps may offer a means of supporting behaviour change in this population group given the high ownership of smartphones across all social groups (Anderson, 2015) and the apparent acceptance of apps as a tool for change (Ball *et al*., 2014). Consumers are typically within reach of their mobiles (Dey *et al*., 2011) which allows interaction in contexts of personal relevance which is proposed as efficacious for supporting healthier behaviour (Heron and Smyth, 2011).

Journal Pre-proof

Drawing on these literatures, health apps that incorporate relevant behaviour change techniques may offer a means of facilitating change in food purchasing behaviour in those from a lower socioeconomic background. A lack of evidence examining this process of behaviour change, however, may limit their use in dietary interventions. An initial step in addressing this gap is to capture an in-depth account of behaviour change across time. Given the importance of the individual context for food purchasing behaviour, it is important that the individual's experience of behaviour change is understood to best support future intervention design. Consequently, the present research aims to examine the individual experience of changing food purchasing behaviour using a health app with a particular focus on women from a lower socioeconomic background.

Methods

A qualitative approach, drawing upon phenomenological and experience-centred design perspectives (Patton, 2002, Wright and McCarthy, 2010), was adopted to explore the lived experience of changing food purchasing behaviour using an app. A phenomenological approach allows in-depth insight into the individual's experience (Gray, 2014), which in this research is the experience of behaviour change across time. Critical interpretation of these experiences can give insight into the "essence" of an experience (Goulding, 2005, Patton, 2002). Retrospective reflection, and the individual's interpretation of their experience, is a core element (Goulding, 2005, Patton, 2002) and in-depth interviews constituted a central component. It is also apparent that certain aspects of purchasing behaviour are routine and habitual, and may be less accessible to introspection. Employing a pragmatic perspective, additional data collection measures, including questionnaires and grocery receipts, were introduced. Such measures capture additional aspects of behaviour change that can be critically interpreted to complement the core interview dataset. An experience-centred design perspective emphasises the context-specific nature of technology use where users are "*active in defining the nature of the roles they construct…and the relationships they enter into*" (Wright and McCarthy, 2010). Understanding app use in everyday life is considered important to identify those factors that may influence the individual's experience.

Research Team and Reflexivity Statement

As critical interpretation is a key element of phenomenology, it is essential that the researcher(s) reflects on their background and how this may frame the interpretative process

Journal Pre-proof

(Malterud, 2001). A statement of reflexivity is provided to clarify such experience and its influence on the research process. The interdisciplinary research team combined expertise in public health nutrition, consumer behaviour, social psychology, and women's health. This combination was invaluable in appropriately designing the research study for the population group of interest. A key aspect was acknowledging the need for reflexivity at all stages to recognise assumptions of the research team that may shape participant interaction and interpretation of findings. This was achieved through personal and group reflection at different stages. In order to ensure participants felt comfortable sharing their experiences, empathy and a lack of judgement was important. A friendly, informal, and open manner was expressed at all times to minimise any perceived power imbalance between the researcher and the participant. The importance of the individual's experience, even perceived negative experiences, was emphasised during each interaction to build a trusting relationship. Employing a critical and reflective approach allowed relevant experience to be drawn upon during the research process while also ensuring that in-depth insight of the individual's experience was obtained.

Ethical Considerations

Ethical approval was granted by University College Cork's Ethics Committee. Individuals from a lower socioeconomic background may have lower literacy levels which may influence their understanding of the research process and capacity to fully participate (Schnirer and Stack-Cutler, 2012). This was addressed by providing information orally, incorporating non-written measures, and ensuring the use of simple and inclusive language (Schnirer and Stack-Cutler, 2012). Participants received a voucher for participation to acknowledge the commitment required but this was not reliant on the degree of participation. Participants received a voucher even if particular data were not shared. This was communicated to participants during the consent procedure and aimed to ensure that participants did not feel unduly pressured to participate in all aspects if not desired. Collecting data in a public supermarket required additional consideration as it was possible that data from non-participants could be captured. Existing data protection guidelines designate supermarkets as public spaces, and it is considered unfeasible and unnecessary to obtain consent from all customers in the supermarket at the time of data collection. Nevertheless, the research team minimised the potential that data would be captured from non-participants, such as retail staff, and provided study information to those where it was unavoidable. No identifying details were captured for these individuals.

Journal Pre-proof

Sample

A purposive sample of 10 women aged between 30-45 years participated (Table 1). Pseudonyms have been used to protect identity. All participants lived in two different suburban areas of Cork City, Ireland, which were designated areas of disadvantage (CESCA, 2015). Women under the age of 45 were chosen as they were considered most likely to use a health app (Bhuyan *et al*., 2016, Bol *et al*., 2018). Socioeconomic status was determined by the occupation and employment status of the household's primary income earner (Central Statistics Office, 2012)[2].

Participants were required to hold primary or equal responsibility for food purchasing. As women typically hold primary responsibility for food acquisition (Ball *et al*., 2011, Checkout, 2017), they were chosen as the population of interest. Participants were required to own a smartphone capable of downloading an app, and had previously downloaded or used an app but not either of the study apps. As clinical support was not available, pregnant women or those with restricted diets were ineligible. Participants were required to be in a motivational state that is considered open to change, according to the transtheoretical model of change, and needed to be contemplating, preparing, or have made a change to their healthy eating behavior in the previous six months (Prochaska *et al*., 2008). This was assessed by asking individuals to place themselves in one of five categories that best reflected their current stage of change in relation to healthy eating (Armitage, 2006). All participants were in relationships at the time of data collection, and participants with children lived in a two-parent household.

[2] Examples of occupations included in the eligible socioeconomic categories - Non-manual: waitress, beautician, administration assistant; Manual skilled: electrician, plasterer, butcher; Semi-skilled: security guard, scaffolder, care assistant; Unskilled: labourer, refuse collector, cleaner.

Journal Pre-proof

Pseudonym	Children	Nutrition Literacy (Baseline)[3]	Employment Status	Perceived Financial Pressure[4]	App Used
Aisling	No Children	Adequate	Full-time Employment	Coping on present income	A
Christine	One Child	Adequate	Full-time Employment (Primary Earner)	Coping on present income	A
Claire	Two Children	Adequate	Student	Living comfortably on present income	B
Ellen	No Children	Adequate	Full-time Employment (Primary Earner)	Coping on present income	B
Faye	Two Children	Marginal	Full-time Employment	Coping on present income	B
Isabel	One Child	Adequate	Full-time Employment (Primary Earner)	Living comfortably on present income	B
Julie	No Children	Adequate	Full-time Employment (Primary Earner)	Living comfortably on present income	A
June	Three Children	Adequate	Part-time Employment	Living comfortably on present income	B
Laura	Four Children	Marginal	Engaged in the Home	Coping on present income	A
Teresa	No Children	Adequate	Full-time Employment (Primary Earner)	Coping on present income	B

Table 1. Participant Characteristics (n=10)

Recruitment

As recruitment of individuals from a lower socioeconomic background can be challenging (Bonevski *et al.*, 2014), two different methods were chosen: in-store face-to-face recruitment and snowball sampling. The primary method was in-store face-to-face recruitment (Ni Mhurchu *et al.*, 2009). Screening took place in two supermarkets over a four-week period, in total. Supermarkets were located in two different suburban areas of Cork City, Ireland, which were designated areas of disadvantage (CESCA, 2015). All female customers, aged over 18, were invited to complete a screening questionnaire. This questionnaire assessed their eligibility according to the criteria outlined in the previous section. Upon questionnaire completion, women were asked to provide contact details if they were interested in partaking in future studies. Eligible respondents were contacted and provided with information on the study before being invited to participate. Snowball sampling was subsequently employed (Atkinson and Flint, 2001) where, upon completion, participants were asked to share study

[3] Nutrition literacy was assessed using the measure developed by Gibbs and Chapman-Novakofski (2013) which was adapted for an Irish population.

[4] Perceived financial pressure was examined using a question drawn from the European Social Survey (2016).

Journal Pre-proof

information with their contacts. Interested individuals directly contacted the research team and were asked to complete a screening questionnaire.

Recruitment took place between May and October 2017. It was terminated at this point as the follow-up period would coincide with Christmas which does not typically represent usual purchasing behavior. Data were analysed throughout this period and saturation was deemed to have been achieved as no new themes emerged with the final participant (Bowen, 2008) and the depth and breadth of data gathered for each individual ensured data adequacy (Morrow, 2005). The homogeneity of the sample, due to the strict eligibility criteria, means that saturation can be achieved with a lower participant number and allows for theme generation (Braun and Clarke, 2013). If saturation had not been achieved, recruitment would have recommenced. In total, 280 women completed the screening questionnaire and 50 were eligible to participate. 19 could not be contacted and 21 were not interested in taking part. One participant was recruited via snowballing with the majority recruited in-store.

Procedure

An independent observation of each retail store was undertaken to assess the environment, capture factors that may influence (un)healthy food purchasing behaviour, and gain insight into the shopper experience. A predefined topic guide directed this observation. The apps used were drawn from previous research undertaken by the authors (Flaherty *et al*., 2018) and were considered potentially effective at supporting healthier purchasing behaviour as they met pre-defined criteria. They provided appropriate nutrition information (Franco *et al.*, 2016; Lieffers *et al.*, 2014), had good overall user quality (Stoyanov *et al.*, 2015), and integrated relevant behaviour change techniques (Michie *et al.*, 2013; van't Riet *et al.*, 2011). Table 2 provides further details on the apps. Both apps were free and publicly available on the iTunes and GooglePlay app stores.

Journal Pre-proof

App A	**App Description** The primary goal is weight loss with users able to choose their own goal. Users can choose different weekly meal plans (calorie-controlled). A daily menu, including pictures, and a weekly shopping list are provided which can be tailored, including taste preferences and shopping frequency. Recipes are provided. Users are prompted to monitor their weight-loss goal on a weekly basis. Advice is provided on foods that should be consumed as part of a healthy diet and foods that should be avoided or consumed in reduced amounts. Healthier meal options are offered for eating out occasions. Users can access a community forum that is facilitated by a nutritionist where they can share advice with other users or obtain advice from the facilitator. Reminders, via push notifications, are sent to the user relating to meal times and goals and can be tailored. Examples of prompts include: 'You're doing great! Time for your morning snack'.
	Integrated Behaviour Change Techniques Goal setting (outcome), such as weight change. Self-monitoring of outcome(s) of behaviour, such as weight change. Behaviour substitution, such as advice on alternative healthier food options. Conserving mental resources, such as an automatically generated shopping list that can be tailored to individual needs. Prompts/cues, such as in-app reminders to make a healthy shop list. Social support (unspecified), such as encouraging the user to seek support to enable performance of the desired behaviour.
	User Quality This app was rated as good but was of slightly lower quality than app B. It was aesthetically appealing with a clear flow between features that improved ease of use. It was considered less interactive than app B as minimal feedback on user progression was provided and reduced prompting of user interaction.
App B	**App Description** The primary goal is weight loss with users able to choose their own goal. Users can choose additional goals from a range of suggested healthy eating and physical activity goals or can input a specific goal of personal relevance. Users can set a daily calorie goal and monitor food consumption and physical activity to align with this goal. Goal reminders are sent via push notifications at a time and frequency chosen by the user. Users can add personal photos to act as a goal reminder or to monitor progress. Advice is provided on different aspects of healthy eating, including food purchasing. The user is able to choose particular health tips, or add personally relevant tips, which can be set as reminders for a relevant time and frequency. Examples include: 'Remember you are not depriving yourself, this is your choice'. Users can choose daily behaviour challenges, such as create a healthy shopping list, which give point rewards upon completion. These points build up over time to procure clothes for the user's virtual avatar. Challenges can be chosen from a suggested range or users can input their own. Advice is provided on how to use different app features.
	Integrated Behaviour Change Techniques Goal setting (outcome), such as weight change. Self-monitoring of outcome(s) of behaviour, such as weight change. Comparative imagining of future outcomes, such as encouraging the user to imagine the benefits of changing their food behaviour.

Journal Pre-proof

App B	Information about antecedents, such as advising the user to examine actions that occur prior to the purchasing of unhealthier foods. Behaviour substitution, such as advice on alternative healthier food options. Prompts/cues, such as in-app reminders to make a healthy shop list. Distraction, such as encouraging the user to identify cues which trigger undesirable food behaviours and focus on alternatives activities at this time. Restructuring the physical environment, such as planning navigation of the supermarket to support healthier purchasing behaviour. Restructuring the social environment, such as encouraging family and important individuals to support healthier food behaviours. Avoidance/reducing exposure to behaviour cues, such as avoiding certain supermarket aisles to reduce exposure to unhealthier food products. Social support (unspecified), such as encouraging the user to seek support to enable performance of desired behaviour. Information about others' approval, such as telling the user that healthier food behaviour is viewed positively by others. Non-specific reward, such as encouraging the user to reward oneself if healthier behaviour performed. Non-specific incentive, such as in-app gamification where points received for performing healthier food behaviours.
	User Quality This app had higher user quality than app A. It was aesthetically appealing with an easy to use interface. It was considered interactive and entertaining with many features that could be tailored to individual user needs. It was considered a credible app with sufficient quantity of relevant information.

264 Table 2. Overview of the Study Mobile Apps

Journal Pre-proof

Journal Pre-proof

Data Collection

Multiple data collection methods at different time-points were used (Table 3). All data collection was undertaken by the primary author.

Timeline	Data Source	Objective
Baseline (Week 0)	Accompanied shop using think-aloud & observations	Explore typical food shopping experience, identify behaviour cues, and examine app use or reference to use.
	Semi-structured interview	Explore food choice motives, purchasing behaviour, nutrition literacy, motivation for change, attitudes towards apps, and existing app use.
	Questionnaire	Examine technology acceptance and nutrition literacy.
App Initiation: Link for app download provided to all participants		
Interim	Grocery Receipts (Week 0 – 8/11)	Examine purchasing patterns with particular focus on fruit and vegetables (proxy for healthy food purchasing) and foods high in fat, salt, or sugar (proxy for unhealthy food purchasing).
	Reflective Account (Week 4/5)	Explore lived experience of changing purchasing behaviour and using the app to aid change.
Completion (Week 8-11)	Accompanied shop using think-aloud & observations	Explore differences in food shopping from baseline.
	Semi-structured interview	Explore the lived experience of changing food purchasing behaviour, using an app to facilitate change, and factors that influence experience.
	Questionnaire	Examine changes in nutrition literacy.

Table 3. Overview of Data Collection

Baseline Data Collection

Participants were met at an agreed time that coincided with a regular shopping trip. Participants completed an accompanied shop, incorporating the use of 'think-aloud' protocol and researcher observations, to explore typical behavior (Saarela *et al*., 2013). Participants were asked to verbalise their thoughts while shopping to gain insight into cognitive processes underlying decision-making (Ericsson and Simon, 1998). An example of 'think-aloud' was provided by the researcher at the beginning using a non-food item. The concurrent use of researcher observations aimed to identify additional cues used during decision-making. Observations were written notes made by the researcher as the shop progressed. Participants

Journal Pre-proof

were asked to shop in their usual manner. They were not accompanied by additional household members, which they confirmed as typical. Verbalisations were audio-recorded via a microphone that was attached to the participant. If the participant was silent for more than ten seconds, non-leading prompts were provided by the researcher, such as "Can you continue talking and thinking out loud, please?" Accompanied shops, at baseline, took an average of 26 minutes.

A semi-structured interview was undertaken upon completion of the accompanied shop. Participants were asked to discuss their purchasing behaviour, previous experience of behaviour change, nutrition knowledge, existing app use, and the perceived role that apps may play in supporting their healthier behaviour. Researcher observations were discussed, such as rationale for certain actions and cues used during shopping. The average interview time was 58 minutes. After the interview, participants were asked to self-complete a questionnaire that was developed by the research team and pretested with colleagues. This questionnaire examined attitudes towards mobile technology and experience of using mobile technology; these measures drew on Lowe *et al.* (2015) and Meuter *et al.* (2005) and were adapted to focus on health apps. Nutrition literacy was also examined in this questionnaire and used a measure developed by Gibbs and Chapman-Novakofski (2013) that was adapted for an Irish population. The questionnaire took, on average, 13 minutes to complete.

Initiation of App Use

Participants were randomly assigned, using an online randomisation programme, to use one of two apps for a minimum of eight weeks. A text was sent with a link to download the app and support was provided if any problems were encountered.

Interim Data Collection

Participants were asked to share their grocery receipts for the study duration. Each participant was given a set of stamped, addressed envelopes to return their receipts at fortnightly intervals. They were informed that the purpose was to gain a better understanding of their purchasing behaviour, such as frequency of shopping. A text reminder was sent at relevant time-points. Nine participants shared their receipts. The final participant stated that she failed to remember to keep receipts.

At the midway point, participants were asked to record a brief reflective account of their experience. A reminder text was sent with suggested reflective prompts, including any changes in behaviour or app use, perceived experience of change, perceived barriers or

Journal Pre-proof

facilitators, typical app use, and rationale underlying these points. Participants could also include points of personal relevance. Six of the ten participants provided reflective accounts. Four participants shared audio-recorded accounts and two participants shared written accounts. These provided insight into the initial stage of change and were drawn upon during the participant's final interview and subsequent analysis.

Follow-Up Data Collection

Follow-up data collection was conducted at 8 to 11 weeks after baseline depending on participant availability. Prior to this final meeting, all data for the participant were reviewed to provide individual context and ensure observations and interviews were tailored. An accompanied shop was conducted where think-aloud protocol and researcher observations were again employed. Accompanied shops, at follow-up, took an average of 22 minutes. A subsequent semi-structured interview explored their experience of changing behaviour and using an app to facilitate change, plus the personal, social, and environmental factors that influenced their experience. Points of interest from the reflective account were discussed. The average interview time at follow-up was 55 minutes. Participants were then asked to self-complete a questionnaire. Similar to baseline, this questionnaire examined nutrition literacy (Gibbs and Chapman-Novakofski, 2013). In the same questionnaire, participants were asked to record their highest level of education, their nationality, and their perceived financial pressure; the latter drew on measures from the European Social Survey (2016). The questionnaire took, on average, 13 minutes to complete. Participants were given a €75 voucher to acknowledge participation which was funded via internal departmental funding.

Analysis

In total, approximately 2½ to 4 hours of data were available per participant. All interviews, think-aloud verbalisations, researcher observations, and reflective accounts were transcribed verbatim by either the research team or an external transcription professional. All transcribed material was checked for accuracy against the original audio. Questionnaire data relating to nutrition literacy and attitudes towards technology were inputted into SPSS (Version 24) and informed the participant's individual context for subsequent analysis. Receipt data were inputted into Excel 2013. Food purchases were categorised according to the different levels of the food pyramid and the proportion spent on each category was calculated for each two-week period. Patterns were examined to identify changes in the proportion spent across time with a particular focus on fruit and vegetables and confectionary and fats. Receipts were also examined qualitatively to identify if healthier changes were made to the types of foods being

Journal Pre-proof

purchased, such as a change to wholegrain products or leaner meats. All data were combined for each participant and this formed the unit of analysis.

Interpretative phenomenological analysis was conducted in line with the guidelines by Smith *et al*. (2009). Analysis was initially conducted on a participant-by-participant basis before assessing common themes across participants. All data were incorporated, including think-aloud verbalisations, researcher observations, interview transcripts, questionnaire data, receipt data, and reflective accounts. Initially, all transcripts for the individual were read multiple times, plus familiarisation of receipt and questionnaire data. This provided a preliminary overview of the individual's experience. Initial exploratory comments were noted that examined data in three ways: 1) descriptive; 2) linguistic; and 3) conceptual. Descriptive comments highlighted particular actions, terms, and objects. Linguistic comments focused on the language used to describe actions and experiences. Conceptual comments described underlying ideas and patterns. Emergent themes were then developed, which aimed to "*produce a concise statement of what was important*" (Smith *et al.*, 2009), by drawing on the specific comment plus the broader participant context. Connections across themes were established at an individual level and a summary of the individual's experience was created. This process was undertaken separately for each participant.

Patterns across participants were then examined. Superordinate themes and relationships were re-examined and modified, if required, to incorporate additional emergent themes and ensure they reflected the proposed superordinate theme. Coding and theme development was undertaken by the primary author. Themes and relationships were discussed with co-authors to ensure credibility, and re-examined in the context of relevant theoretical perspectives. Relevant literature was used to frame the positioning of themes and relationships and refinement of themes continued via discussion until a final agreement was reached.

Results

An interpretative account of the individual's experience will initially be outlined. The potential importance of higher-order goals on directing behaviour change and the employment of conscious reflection is then discussed. This is followed by an overview of the perception held that individuals are responsible for change rather than requiring broader environmental change.

Journal Pre-proof

Journey of Change

This section describes the behaviour change experience and the means in which the app facilitated healthier behaviour.

Initial Routines

A routinised approach to food purchasing was evident at baseline although differences in script specificity was apparent. Such specificity appeared to influence the degree to which heuristics were used during shopping. Some individuals demonstrated a more abstract script. They appeared to enter the store with a flexible plan and typically relied on heuristics, primarily related to promotions or price, and personal resources to guide food choice. Christine, a mother of one son, demonstrated such an abstract approach that appeared to revolve around her regular weekly meal plan. She discussed in her initial interview that "*maybe on a Sunday or a Monday…I would do a casserole for the first part of the week*" and commented in her accompanied shop that "*on a Thursday… I usually try and cook a fish dinner*". This appeared to be driven by healthy food goals related to achieving a balanced diet. Little specification beyond these general plans was evident during her first shop where her choices for planned meals was driven by promotional offers rather than a particular intention to purchase those items. During the shop, Christine went straight to a particular fridge where fresh fish was normally on promotion: "*I get them in [this fridge] usually…I'm just looking to see if there's any offers…sometimes I just try different fish if it's on offer*". Possession of sufficient food-related knowledge meant that Christine could draw on such resources to meet multiple purchasing goals, which enabled the enactment of a more flexible script.

In contrast, some women demonstrated a more detailed scripted routine where purchasing was planned before entering the store. June has three children and she and her partner work in shift patterns. Their meal schedule changes regularly depending on her children's dietary needs and which parent is preparing meals. Before shopping, June reviewed their working patterns and planned meals to create a detailed list: "*everything is planned…I'd have a list for the week and I have to think I'm working Wednesday now…[my partner] may be cooking dinner so kievs, easy things…[we] have to cook for us and the boys separately…their needs are specific*". The importance of this list was evident as June consulted it immediately when the shop began and her navigation of the store appeared to be directed by list items. Generally, there was little deviation but she did purchase 'off-list' if particular items were on offer. Two of her children have special dietary needs so "*if stuff's on offer that's gluten free*

[because] it's a bit dearer, I would tend to buy it". This demonstrates that June may typically follow a specific routine but contextual cues may trigger a more flexible aspect of her purchasing script and prompt unplanned purchasing.

Participants were negotiating different goals during shopping. The need to satisfy the sensory preferences of family members appeared a primary goal at the beginning. Women appeared to sacrifice their own preferences and personal goals in favour of managing the multiple goals of family members. This appeared more apparent in those with children as their perceived role as a mother was associated with the need to maintain family harmony and avoid perceived hunger. Faye described in her interview: "*I could be cooking three different dinners a day and there's only four of us in the house…I do go out of my way, if they eat it I'd make it*". This need was very apparent during Faye's initial shop. Personal preferences influenced some choices: "*I like the chicken tikka… I'll prefer the iceberg lettuce…I love sweet potato chips seasoned, I'll get one of them*". This was minimal in comparison to the number of times that her childrens' preferences were cited: "*the pasta…I prefer the brown for myself but the kids prefer the penne…I have to get the one with no onions because they don't like vegetables… my daughter…doesn't like chewy bits, so I have to look for the leanest bit of ham…my son loves peanuts whereas my daughter doesn't so I'd be trying to balance both of them*". This is only a small number of examples and her childrens' perceived needs were frequently referenced during her shop. It is likely that she was primarily focused on their taste preferences during shopping with less consideration afforded to healthy food goals.

In instances when healthy food goals were cited as a consideration, in times of conflict they were often outweighed in favour of alternative goals, such as sensory or financial goals. Laura, who has four children, commented in her initial interview that health was important when shopping. She had recently started to cook more meals from scratch as "*it's healthier for [my children], it's healthier for myself and my husband*", which prompted her to purchase more fresh meat and vegetables. She did appear to purchase a variety of healthier foods during her first shop, but there was also a considerable inclusion of less healthy items, such as luncheon meats and sweets. Similar to Faye, the desire to satisfy the needs of others, especially children, appeared a key driver: "*we'll get your waffles…[my son] loves those… we got a pack of jellies…for [my son] since he's being so good*". Healthy food goals did appear to influence purchasing but were negotiated in the context of additional goals, such as family relationships.

Journal Pre-proof

In summary, participants displayed routinised behaviour at baseline although differed in terms of script specificity and the use of heuristics during shopping. While healthy food goals did appear to influence food purchasing behaviour at this initial stage, they appeared a less salient influence than the need to manage household relationships. The following sections will describe the process of change experienced and the role of the app, and integrated behaviour change techniques (see table 2), in facilitating such change.

Routine Disruption, Increased Reflection

The app appeared to facilitate the disruption of individual shopping routines and prompted a more reflective approach where healthy food goals directed purchasing behaviour. It appeared that this was primarily achieved by prompting a process of self-monitoring and/or problem solving. Self-monitoring entailed the monitoring of existing food behaviour, for example a food diary, to identify undesirable purchasing behaviours and/or associated behavioural cues. Problem solving involved a conscious review of existing behaviour and associated cues, plus selecting strategies to change behaviour. This reflection helped the individual to identify undesirable behaviours and strategies to establish a new routine. In-app reminders, or behavioural prompts, were then set for personally relevant times to disrupt undesirable behaviours and bring the individual into a more conscious decision-making space.

Isabel discussed in her final interview how information in the app encouraged problem solving by prompting a conscious review of store navigation: "*one of the tips is stick to the perimeters of the store and…I thought…that's right…all the supermarkets are the same…they have the fruit and veg on one side…and the biscuits and the crisps and junk right in the middle*". This reflection encouraged her to establish a new routine where she would "*try and avoid that aisle …the jar of coffee is only half way down and you can cut across before you pass the biscuits*". This new route helped her to avoid those cues that had previously prompted unhealthier purchasing behaviour without the need to employ significant cognitive effort or self-control. This new route was also noted in the researcher's observations. During her initial shop, Isabel visited each store aisle and made unplanned purchases based on promotional offers: "*I'm a bit of a sucker for special offer baskets*". However, her navigation of the store was more purposive during her final shop and she visited only those aisles where items were needed.

Journal Pre-proof

The app also appeared to disrupt existing routines for Teresa, who works as a deli assistant and lives in a house-share. The app encouraged a reflection on existing behaviour and "*what are my weak moments and when do I have a tendency to overindulge or just forget about [healthy eating]"*. This drew attention to her regular consumption of takeaways and an unintentional decline in cooking from scratch: "*sometimes you don't realise something until you say it out loud…I was like wow, I need to get into cooking again*". She often did not plan her dinner and consumed takeaways as her housemate was getting one or because she was too hungry to shop: "*if I don't have my shopping bought…I'm going to end up getting something that I shouldn't*". She used the app to set a reminder to prompt her to "*go over to [the supermarket]…pick up something healthy*". This behavioural prompt appeared crucial in disrupting her previous routine as she noted in her midpoint reflective account that they "*keep me more aware of what I'm eating*". The combination of self-monitoring and behavioural prompts appeared to encourage the employment of reflective cognition during food purchasing which supported healthier behaviour.

It appeared that exercising self-control was important for many to establish new shopping practices that aligned with healthy food goals. In the present context, self-control relates to an individual's capacity to alter their response to particular stimuli and replace with a more personally desirable response (Baumeister, 2002). This falls within the broader category of self-regulation which encompasses the purposive processes and self-corrective adjustments that individuals employ to enact particular behaviours (Carver and Scheier, 2011). It appeared that self-control was necessary due to the retail environment. The supermarket presented various cues that prompted goals that conflicted with healthy food goals, such as price promotions of unhealthier products that elicited financial goals. Disrupting routines encouraged a more conscious approach but also increased the awareness of the cues to which one is exposed in-store. Christine, who works in the library, commented in her final interview that the app prompted a more critical reflection of her food environments and she now "*realises how much we're bombarded with"*. The app encouraged her to "*become more conscious…try and think for myself...there's a lot of marketing of labels"*. She acknowledged the importance of self-control: "*you have to be a bit stricter with yourself…is it really that good or is it just because it's on offer…would I really eat it or buy it if it wasn't on offer*". The app enabled a more reflective approach but self-control appeared crucial to maintain healthier behaviour.

Journal Pre-proof

It must be acknowledged that participants did not use their app during their final accompanied shop nor did any participant report using it during their regular shopping trips. The app appeared to be more valuable during planning where it informed the recognition of purchasing needs, subsequent information search, and evaluation of alternatives. Faye, who is a mother of two children, demonstrated considerable changes in her shopping by the end. Receipt analysis illustrated that confectionary purchasing reduced and purchasing of fruits and vegetables increased throughout the study. Change was evident in her final shop as healthier substitutions were now purchased: "*Weetabix for the children…porridge for myself…instead at picking at junk I've been using the porridge to make porridge muffins which is a good substitute…when I'm doing my pasta dishes I don't use the jars of bolognese anymore, I use the passata*". This resulted from changes to her routine prior to entering the store. She now planned her weekly meals and searched online for healthier alternatives. She now created a mental shopping list, which directed her in-store behaviour and ensured that it was directed by healthy food goals rather than social or emotional states.

Consequently, it appears that the app facilitated routine disruption leading to more reflective decision-making. Differences were apparent in the extent to which individuals engaged in reflection and critical reflection. In the present context, reflection relates to the active review and logical analysis of available information while critical reflection relates to a more critical consideration of such information and individual assumptions (Kember *et al*., 2000). Isabel demonstrated reflective thinking as she actively considered previous behaviour and implemented a new healthier routine by drawing on available information. However, little conscious reflection was demonstrated by Isabel during her final shop. In contrast, Christine undertook a more critical process of reflective thinking and consciously considered the value of particular choices. She commented in her reflective account that "*I thought some things were healthy foods and I was proved wrong on going through [the app]*", which illustrates an ability to query her assumptions. An app may facilitate greater reflection but differences are likely in the level of critical reflection demonstrated.

Consequence of Higher-Order Goals

A change towards healthier purchasing behaviour appeared driven by healthy food goals, but associated higher-order goals appeared to differ between individuals and influenced the behaviour change process. Healthy food goals were connected to higher-order goals that related to either a desired body image or a sense of health and wellbeing. In the former, individuals were motivated to attain a desired body image, in terms of weight or body shape,

in response to sociocultural ideals. Isabel acknowledged in her first interview that it "*was vanity…that I wanted to lose a bit of weight*" that prompted a focus on healthy purchasing. Her primary motive was to lose weight to fit in with her social group: "*if I'm going to be keeping up with them now I need to cop myself on (sort it out) here a bit*". This desire for a specific body weight was mentioned frequently throughout all interviews with Isabel. In contrast, individuals motivated by health and wellbeing focused on achieving improved general health. Julie, who works as a receptionist, focused on longer-term health as she hoped to conceive in the coming years: "*I'm thinking long term if I start having a family…it's not about looking fabulous*". She moved away from primarily focusing on weight-loss towards achieving a balanced lifestyle.

This variation appeared to result in different goal system architectures (Figure 2). While healthy food goals were the primary goal connected to body image, emotional goals were also viewed as central to health and wellbeing. Food was viewed as a means of satisfying emotional goals, such as dealing with stress, and purchasing behaviour facilitated their attainment. Aisling who works as a care assistant demonstrated this. In her final interview, she commented that work was emotionally draining and viewed food as a means of addressing this negative state and supporting positive mental health: "*Oh [life is] hard, I'm just having a Dairy Milk now*". She also commented in her reflective account how she "*still make[s] room for a little sweet treat in the evening*" to satisfy emotional goals.

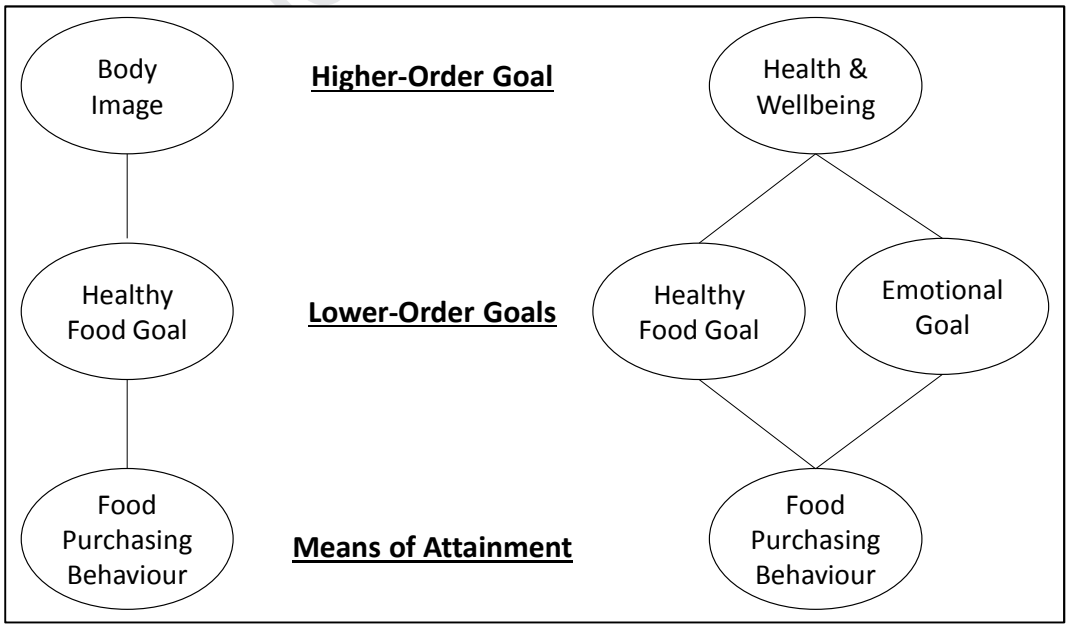


Figure 2. Variation in Goal System Architecture

Journal Pre-proof

As apparent from Aisling's example, unhealthier food products were usually viewed as more appropriate for satisfying emotional goals. This was echoed by Claire, a mother of two children, who professed "*you just have to be kind to yourself sometimes and if you really just need a bar of chocolate then just have [it]*". Individuals understood that these were less healthy options and consumption conflicted with the attainment of healthy food goals. In certain contexts, this was accepted as a satisfactory balance of emotional and healthy food goals in order to attain the higher-order goal of health and wellbeing. Thus, a counterfinality configuration of means-goals occurred in certain circumstances where emotional and healthy food goals conflicted and attainment of one goal undermined the other.

Differences in higher-order goals appeared to contribute to variation in the use of conscious reflection during behaviour change. Individuals motivated by body image goals appeared more likely to form detailed intentions and use simple rules. June, a mother of three children, put in place such rules. In her initial interview, she stated that she purchased confectionary to consume "*when [her children are] gone to bed and I deserve something*". In her final interview, she commented that she had set a rule to consume chocolate only on a Thursday night, which reduced her purchasing of these unhealthier foods. Thus, individuals motivated by body image goals appeared to express a form of self-regulation where detailed rules were formed to direct behaviour. Individuals motivated by health and wellbeing appeared to engage in more conscious reflection during shopping. Ellen, who works as a shop assistant, appeared to employ a more reflective approach during her final shop. She assessed promotional offers and reflected on whether they met her goals: "*I look at the offers…nothing really I need… grapes, I won't, last time I didn't eat them…I need peas…no added sugar, I didn't even know there is sugar added in some of them…there's probably more sugar in that…take the less sugar*". This group appeared more likely to employ reflective cognitive processes to inform purchasing choice.

The extent to which reflective cognitive resources was employed appeared to be influenced by higher-order goals. The counterfinality configuration appeared more complex and goal negotiation was required. It is possible that greater conscious cognition was required to avoid goal frustration. The unifinality configuration, where one goal is served by a single means as demonstrated in the body image instance, appears more straightforward. This configuration may facilitate the use of rule-based decision-making where less conscious effort is required.

Journal Pre-proof

Perceived Individual Responsibility for Change

There appeared a collective perception that food behaviour was primarily controlled by the individual, and that nutrition knowledge and self-control was sufficient to purchase healthier food. Julie, who lives with her partner, confirmed in her final interview that she sometimes had difficulty in understanding some nutrition labels. She viewed this as an individual failure in not possessing the necessary knowledge rather than a failing of the manufacturer, or policy regulation, to allow easier interpretation: "*maybe it's myself…that I'm just not good at it…at deciphering the labels*". However, she had achieved an adequate nutrition literacy score in the measure used in this study, part of which assessed her ability to interpret nutrition labels. This suggests that she may have sufficient knowledge but reduced self-efficacy impedes her greater use of nutrition labels during shopping.

The role of the retail store in directing purchasing towards unhealthier foods was acknowledged. Christine, who also has adequate nutrition literacy, noted that "*a lot of the things on offer are bad…big boxes of chocolates…then you go up to the counter…and the [cashier] says you can get two…and you don't really want to*". The customer was viewed as being pushed towards purchasing unhealthier foods and self-control was necessary to overcome such unplanned purchasing. Despite this, Christine perceived that individuals were personally responsible for ensuring that healthy behaviour was maintained. She viewed such retail strategies as part of modern life as "*[retailers] have to sell I suppose*". This sentiment was echoed by June who recognised that the retail environment had a negative influence on the healthfulness of her purchasing: "*all the end of aisles are replaced by junk, it's so easy to throw it in*". She also believed that "*shops aren't going to [make changes] because then they wouldn't sell as much*". Consequently, she perceived that it was the responsibility of the consumer to control their purchasing and ensure that behaviour was healthy.

Discussion

This phenomenological inquiry provided insight into the experience of changing purchasing behaviour using an app. The app appeared to facilitate disruption of existing routines and prompt the individual to employ conscious reflection and draw upon nutrition information and healthy food goals to drive behaviour (Wood *et al*., 2005). This was primarily achieved via the use of self-monitoring, problem solving, and behavioural prompting techniques. This illustrates the potential effectiveness of disrupting existing behavioural patterns, alongside

Journal Pre-proof

information provision, as a means of supporting healthier purchasing (van't Riet *et al*., 2011). Yang *et al.* (2012) propose that conscious reflection is most effective at supporting healthier behaviour. Such self-regulation, however, is effortful and its continued employment may be difficult (Baumeister, 2002). While this sample expressed that a more conscious approach was effective, it may be difficult for them to maintain in the long-term. Petit *et al.* (2016) suggest a focus on "*embodied self-regulation*", where bodily states, such as hunger and emotions, are integrated into the self-regulation process. By enhancing the association of bodily states with healthier behaviour, the influence of states associated with unhealthier behaviours should diminish and reduce the need for conscious cognition (Petit *et al*., 2016). This may be more relevant for individuals that experience a counterfinality goal configuration who may need to negotiate between healthy food and emotional goals. A greater focus on eating pleasure in dietary interventions may aid an embodied approach and support behaviour change (Petit *et al*., 2016, Pettigrew, 2016).

In examining the individual experience, some participants expressed the continued use of less conscious processes as part of their food purchasing at the end of the study. While this does not employ the conscious "*cold reasoning*" proposed as effective by Yang *et al.* (2012), their use appeared to contribute to the attainment of healthy food goals. Given the level of decision-making that is required in the retail store, a conscious approach may not be feasible for some consumers and such processes are employed to minimise time and effort (Mick *et al*., 2004). A lack of conscious reflection is proposed to result in less precise decisions (Mick *et al*., 2004) and lead to unhealthier purchasing in the present context. However, similar choices may be made regardless of whether heuristics or a more reflective approach is used as consumers focus on the most salient attributes (Scheibehenne *et al*., 2007). Ensuring that heuristics are based upon healthy cues and accurate nutrition knowledge may be a focus of future interventions to ensure behaviour aligns with healthy standards. Heuristics are often dictated by social and cultural norms and facilitating alignment with such norms may aid healthier purchasing (Petit *et al*., 2016). The use of less conscious processes, therefore, may not be detrimental to healthier behaviour and may be integrated into future interventions.

Individuals further expressed that sufficient self-control was required to enact new healthier behaviours in the existing retail environment. Self-control capacity is limited (Baumeister, 2002) and natural fluctuations in self-control influence the ability to consistently self-monitor and enact new behaviours (Muraven *et al*., 1998). This suggests that relying on the individual to disrupt existing routines and control subsequent behaviour may not be appropriate for all.

Additionally, the approach employed in the present research relied on individuals identifying the cues that prompted undesirable behaviours. Verplanken (2005) suggests that any environmental feature can act as a cue, and it may be difficult to identify cues relevant to one's own behaviour (Wood *et al*., 2005). Broader environmental changes that do not rely on individual cognitive effort may be more relevant, such as choice architecture. This approach involves environmental changes that allow individual choice but encourage healthier choices (Thaler and Sunstein, 2008). The acceptability of such approaches, however, is unclear.

In the present research, participants did not appear to view changes in the retail environment as essential for behaviour change. They acknowledged the strategies used by retailers to influence behaviour but saw them as natural obstacles that must be overcome to maintain healthier behaviour. This aligns with the pervasive attitude that unhealthier behaviours are due to individual irresponsibility or failings in morality or willpower rather than broader environmental determinants (Delaney and McCarthy, 2014; Thomas-Meyer, Mytton, and Adams, 2017). Such attitudes may arise from the traditional medical model of health, where individuals are seen as rational agents, or may be due to political discourse and action (Brown, Maslen, and Savulescu, 2018). Such discourse may generate the perception that environmental changes threaten freedom of choice (Bos *et al*., 2015), thereby directing individuals to adopt responsibility. It may be that restricting options in the store is viewed as controlling individual freedom and thus is not welcomed. Such attitudes are important considerations in intervention design as they may influence acceptance (Mazzocchi *et al.*, 2015). Further research is necessary to examine the degree of change that may be accepted and their potential role in supporting healthier behaviour (Sparks and Burt, 2017).

"*Goals constitute the focal points around which human behaviour is organised…and guide one's behavioural responses to the social environment*" (Fishbach and Ferguson, 2007). While healthy food goals were clear focal points for individuals, examination of the detailed experiential accounts identified that the broader goal system was also important. The presence of a counterfinality configuration, where fulfilment of one goal undermines the attainment of another (Kruglanski *et al*., 2015), appeared to prompt a greater employment of conscious cognitive processes to negotiate goals. In contrast, a unifinality configuration, where one goal is served by a single means (Kruglanski *et al*., 2015), appeared to be associated with more action-oriented tendencies. In such instances, individuals create detailed rules to direct behaviour and are typically better able to self-regulate behaviour (Babin and Darden, 1995). Differences in higher-order goals may influence the cognitive processes

Journal Pre-proof

employed for behaviour change. It may be beneficial to take a holistic view of an individual's goal system to understand their approach to behaviour change and ensure that interventions are appropriately designed (Gebhardt, 2008, Turner-McGrievy *et al*., 2014).

The personal and social identities that we inhabit are considered a significant driver of behaviour (Biddle *et al*., 1987). Food is a central part of life and often used to express identity (Strachan and Brawley, 2009). In the present research, the importance of self-identity was evident as many expressed that their perceived maternal roles guided their purchasing behaviour. In this role, it appeared that food was primarily purchased as a means of supporting harmony within the household. This meant that healthy food goals were sometimes deprioritised if they were not compatible with fulfilling this perceived maternal role. Providing nutritious meals is viewed as central to being a good mother (Johnson *et al*., 2011) although this may be sacrificed in order to avoid conflict and create feelings of contentment (McCafferty *et al*., 2019). These are important considerations for future intervention design.

Limitations

Self-selection bias is an important limitation as factors that influence an individual's choice to participate may influence their experience of behaviour change (Robinson, 2014). Participants were more likely to reflect a health-conscious group with many possessing adequate nutrition knowledge. This may influence their behaviour change and their ability to benefit from particular techniques. Self-selection may also be associated with differences in individual characteristics, such as involvement and personality, which may differentiate participants from the broader population (Tarquinio *et al.,* 2015). While qualitative research does not aim for validity in the same way as quantitative research, it is still important that data are reflective and transferable to the population of interest. Self-selection bias may limit the relevance of findings to the wider lower socioeconomic population. Eligibility criteria for participation were defined such that participants would be sufficiently motivated to change behaviour and are more likely to represent a specific sub-sample. The sample, however, is likely to represent those most likely to use a health app in a real-life setting, thereby providing insight for future intervention design. This suggests that individuals with lower nutrition literacy may not avail of an app-led dietary intervention and alternative measures may be necessary.

Journal Pre-proof

Social desirability bias, the tendency to behave in a particular way that is viewed as socially desirable but differs from the individual's true behaviour (Miller *et al*., 2008), is also important. This is a common challenge in dietary research as individuals overestimate or positively report those behaviours perceived as healthier (Widmar *et al*., 2016). Consequently, self-reported measures may not provide a valid insight. Participants may have modified their purchasing behaviour or expressed performance of particular behaviours during interviews to align with those perceived as socially desirable, but little 'real' change was experienced. It may have influenced engagement with the app as they desired to portray altruistic traits to the researcher. Social desirability is typically higher in women and those with lower education levels (Hebert *et al*., 2008), and consequently is likely to be present in the current sample. While it is difficult to assess the extent to which this bias was present, the use of multiple methods may reduce its detrimental influence. The use of receipts and reflective accounts allowed additional insight, and their completion in private may minimise bias. The language and technique employed during each participant interaction focused on creating a trusting relationship such that they felt comfortable discussing sensitive information and behaviours perceived as undesirable.

Participation may have influenced behaviour change, both in terms of continuation of app use and motivation to change. Each participant was asked in their final interview if they believed that participation had influenced behaviour change. Many were unsure of its particular impact although agreed that participation may have had some influence. A small number of participants commented that the initial shop and interview had drawn their attention to particular undesirable behaviours. It is possible that this interaction disrupted existing patterns and prompted conscious reflection rather than the app. It is important to highlight that none of the participants held this view and considered the app as a facilitator of change.

The use of think-aloud protocol and researcher observations was somewhat novel. A potential criticism of think-aloud is that it may fail to give adequate insight into less conscious cognitive processes (Nielsen *et al*., 2002). The use of researcher observations attempted to address this concern and allow introspection during interviews. Purchasing goals, however, may be inferred based on the habits performed (Wood and Neal, 2009). This may limit the level of true introspection possible and obscure insight into the goals underlying less conscious behaviour.

Journal Pre-proof

Participants differed in their capacity to verbalise their thoughts during an accompanied shop. It may be that there are individual differences in the application of this method depending on personal traits, such as self-confidence. Some individuals did not appear concerned about talking aloud in the store and required little prompting. A small number of participants appeared more self-conscious which may have hampered their cognitive flow and influenced the extent to which their usual thoughts were verbalised. While every effort was made to prompt these individuals, their verbalisations may not have fully represented their typical thought processes. While this may be a potential limitation, it is not considered to have a significant negative impact on the present findings. It was only apparent in a small number of participants and a good insight into purchasing behaviour was still attained. It is an important consideration for future application of its use.

Conclusions

This phenomenological exploration illustrates that an app may facilitate a change towards healthier food purchasing behaviour by disrupting existing behavioural patterns and encouraging a more conscious, reflective approach to decision-making. Nevertheless, sufficient self-control was necessary to implement and maintain healthier behaviour due to the various competing strategies used in the retail store. The importance of an individual's broader goal system was important as higher-order goals appeared to influence the strategies employed to facilitate change. In the present research, individuals appeared to assume responsibility for behaviour change rather than seeking broader environmental change. These findings reflect some factors that may shape the potential effectiveness of future interventions, and it is important that they are appropriately considered.

References

Anderson, M. (2015) *Technology Device Ownership: 2015*, Washington, DC: Pew Research Center.

Armitage, C. J. (2006) 'Evidence That Implementation Intentions Promote Transitions between the Stages of Change', *Journal of Consulting and Clinical Psychology*, 74(1), pp. 141-51.

Atkinson, R. and Flint, J. (2001) 'Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies', *Social Research Update,* 33.

Babin, B. J. and Darden, W. R. (1995) 'Consumer Self-Regulation in a Retail Environment', *Journal of Retailing,* 71(1), pp. 47-70.

Ball, K., McNaughton, S. A., Mhurchu, C. N., Andrianopoulos, N., Inglis, V., McNeilly, B., et al. (2011) 'Supermarket Healthy Eating for Life (Shelf): Protocol of a Randomised Controlled Trial Promoting Healthy Food and Beverage Consumption through Price Reduction and Skill-Building Strategies', *BMC Public Health,* 11(1), pp. 715.

Ball, K., Mouchacca, J. and Jackson, M. (2014) 'The Feasibility and Appeal of Mobile 'Apps' for Supporting Healthy Food Purchasing and Consumption among Socioeconomically Disadvantaged Women: A Pilot Study', *Health Promotion Journal of Australia,* 25(2), pp. 79-82.

Baumeister, R. F. (2002) 'Yielding to Temptation: Self-Control Failure, Impulsive Purchasing, and Consumer Behavior', *Journal of Consumer Research,* 28(4), pp. 670-676.

Bettman, J. R., Johnson, E. J. and Payne, J. W. (1991) 'Consumer Decision Making', in Robertson, T.S. and Kassarjian, H.H. (eds.) *Handbook of Consumer Behavior*. Englewood Cliffs, N.J.: Prentice-Hall, pp. 50-84.

Bhuyan, S. S., Lu, N., Chandak, A., Kim, H., Wyant, D., Bhatt, J., et al. (2016) 'Use of Mobile Health Applications for Health-Seeking Behavior among Us Adults', *Journal of Medical Systems,* 40(6), pp. 153.

Biddle, B. J., Bank, B. J. and Slavings, R. L. (1987) 'Norms, Preferences, Identities and Retention Decisions', *Social Psychology Quarterly*, pp. 322-337.

Bol, N., Helberger, N. and Weert, J. C. M. (2018) 'Differences in Mobile Health App Use: A Source of New Digital Inequalities?', *The Information Society,* 34(3), pp. 183-193.

Bonevski, B., Randell, M., Paul, C., Chapman, K., Twyman, L., Bryant, J., et al. (2014) 'Reaching the Hard-to-Reach: A Systematic Review of Strategies for Improving Health and Medical Research with Socially Disadvantaged Groups', *BMC Medical Research Methodology,* 14(1), pp. 42.

Journal Pre-proof

Bos, C., Lans, I., Van Rijnsoever, F. and Van Trijp, H. (2015) 'Consumer Acceptance of Population-Level Intervention Strategies for Healthy Food Choices: The Role of Perceived Effectiveness and Perceived Fairness', *Nutrients*, 7(9), pp. 5370.

Bowen, G.A. (2008). Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research*, 8(1) 137–152.

Braun, V. and Clarke, V. (2013) 'Planning and Designing Qualitative Research', in Braun, V. & Clarke, V. (eds.) *Successful Qualitative Research. A Practical Guide for Beginners*. London: Sage Publications, pp. 42-74.

Brown, R. C. H., Maslen, H. and Savulescu, J. (2018) 'Responsibility, Prudence and Health Promotion', *Journal of Public Health*, pp. 1-5.

Buttle, F. (1992) 'Shopping Motives Constructionist Perspective', *The Service Industries Journal*, 12(3), pp. 349-367.

Carver, C. S. and Scheier, M. F. (2011) 'Self-Regulation of Action and Affect', in Vohs, K.D. & Baumeister, R.F. (eds.) *Handbook of Self-Regulation*. New York: The Guilford Press, pp. 3-21.

Central Statistics Office. (2012). '*This is Ireland. Highlights from Census 2011, Part 2*', Dublin: Central Statistics Office.

CESCA (2015) '*CESCA Area Profile - Cork City*', Cork: CESCA.

Checkout. (2017) 'Women Responsible for Two-Thirds of Ireland's Grocery Shopping', *Checkout*, Dublin: Checkout Publications.

Delaney, M., and McCarthy, M. B. (2014). Saints, sinners and non-believers: the moral space of food. A qualitative exploration of beliefs and perspectives on healthy eating of Irish adults aged 50–70. *Appetite*, *73*, 105-113.

Dey, A. K., Wac, K., Ferreira, D., Tassini, K., Hong, J.-H. and Ramos, J. (2011). 'Getting Closer: An Empirical Investigation of the Proximity of User to Their Smart Phones'. *Proceedings of the 13th International Conference on Ubiquitous Computing*, Beijing, China: 17-21 September.

Ericsson, K. A. and Simon, H. A. (1998) 'How to Study Thinking in Everyday Life: Contrasting Think-Aloud Protocols with Descriptions and Explanations of Thinking', *Mind, Culture, and Activity*, 5(3), pp. 178-186.

Journal Pre-proof

European Social Survey. (2016) '*European Social Survey Round 8 Source Questionnaire*', London: European Social Survey.

Fishbach, A. and Ferguson, M. J. (2007) 'The Goal Construct in Social Psychology', in Higgins, E.T. and Kruglanski, A.W. (eds) *Social Psychology: Handbook of Basic Principles.* Second Edition. New York: Guilford Press, pp. 490-515.

Flaherty, S.-J., McCarthy, M., Collins, A., & McAuliffe, F. (2018). Can existing mobile apps support healthier food purchasing behaviour? Content analysis of nutrition content, behaviour change theory and user quality integration. *Public Health Nutrition*, 21(2), pp. 288-298.

Gebhardt, W. A. (2008) 'On Multiple Goals and Continuous Conflict', *European Health Psychologist,* 10(2), pp. 25-28.

Gibbs, H. and Chapman-Novakofski, K. (2013) 'Establishing Content Validity for the Nutrition Literacy Assessment Instrument', *Preventing Chronic Disease,* 10, pp. e109.

Goulding, C. (2005). Grounded theory, ethnography and phenomenology: A comparative analysis of three qualitative strategies for marketing research. *European Journal of Marketing,* 39**,** 294-308.

Gray, D. E. (2014). Theoretical perspectives and research methodologies. *In:* Gray, D. E. (ed.) *Doing research in the real world.* 3rd ed. London: Sage Publications.

Heron, K. E. and Smyth, J. M. (2011) 'Ecological Momentary Interventions: Incorporating Mobile Technology into Psychosocial and Health Behaviour Treatments', *British Journal of Health Psychology,* 15(1), pp. 1-39.

Johnson, C. M., Sharkey, J. R., Dean, W. R., McIntosh, W. A. and Kubena, K. S. (2011) 'It's Who I Am and What We Eat. Mothers' Food-Related Identities in Family Food Choice', *Appetite,* 57(1), pp. 220-228.

Kahneman, D. (2011) *Thinking, Fast and Slow.* London: Allen Lane.

Kember, D., Leung, D. Y. P., Jones, A., Loke, A. Y., McKay, J., Sinclair, K., et al. (2000) 'Development of a Questionnaire to Measure the Level of Reflective Thinking', *Assessment & Evaluation in Higher Education,* 25(4), pp. 381-395.

Kruglanski, A. W., Chernikova, M., Babush, M., Dugas, M. and Schumpe, B. M. (2015) 'The Architecture of Goal Systems: Multifinality, Equifinality, and Counterfinality in Means-End Relations', in Elliot, A.J. (ed.) *Advances in Motivation Science*, Elsevier, pp. 69– 98.

Lowe, B., Fraser, I. and Souza-Monteiro, D. M. (2015) 'A Change for the Better? Digital Health Technologies and Changing Food Consumption Behaviors', *Psychology & Marketing*, 32(5), pp. 585-600.

Malterud, K. (2001). Qualitative research: Standards, challenges, and guidelines. *The Lancet*, 358**,** 483-488.

Mazzocchi, M., Cagnone, S., Bech-Larsen, T., Niedźwiedzka, B., Saba, A., Shankar, B., et al. (2015) 'What Is the Public Appetite for Healthy Eating Policies? Evidence from a Cross-European Survey', *Health Economics, Policy and Law*, 10(3), pp. 267-292.

McCafferty, C., Shan, L. C., Mooney, R., O'Rourke, C., Pourshahidi, K., Livingstone, B., et al. (2019) 'How Do Adults Define the Treats They Give to Children? A Thematic Analysis', *Appetite*, 133, pp. 115-122.

McCartney, D. M. A., Younger, K. M., Walsh, J., O'Neill, M., Sheridan, C. and Kearney, J. M. (2013) 'Socio-Economic Differences in Food Group and Nutrient Intakes among Young Women in Ireland', *British Journal of Nutrition*, 110(11), pp. 2084-2097.

Meuter, M. L., Bitner, M. J., Ostrom, A. L. and Brown, S. W. (2005) 'Choosing among Alternative Service Delivery Modes: An Investigation of Customer Trial of Self-Service Technologies', *Journal of Marketing*, 69(2), pp. 61-83.

Mick, D. G., Broniarczyk, S. M. and Haidt, J. (2004) 'Choose, Choose, Choose, Choose, Choose, Choose, Choose: Emerging and Prospective Research on the Deleterious Effects of Living in Consumer Hyperchoice', *Journal of Business Ethics*, 52(2), pp. 207-211.

Morrow, S. L. (2005). Quality and Trustworthiness in Qualitative Research in Counseling Psychology. *Journal of Counseling Psychology*, 52, 250–260.

Muraven, M., Tice, D. M. and Baumeister, R. F. (1998) 'Self-Control as a Limited Resource: Regulatory Depletion Patterns', *Journal of Personality and Social Psychology*, 74(3), pp. 774.

Nielsen, J., Clemmensen, T. and Yssing, C. (2002). 'Getting Access to What Goes on in People's Heads?: Reflections on the Think-Aloud Technique', *Proceedings of the Second Nordic Conference on Human-Computer Interaction*, Aarhus, Denmark: 19-23 October.

Ni Mhurchu, C. N., Blakely, T., Funaki-Tahifote, M., McKerchar, C., Wilton, J., Chua, S. and Jiang, Y. (2009) 'Inclusion of Indigenous and Ethnic Minority Populations in

Journal Pre-proof

Intervention Trials: Challenges and Strategies in a New Zealand Supermarket Study', *Journal of Epidemiology and Community Health*, 63(10), pp. 850.

Patton, M. Q. (2002) *Qualitative Research & Evaluation Methods.* Third Edition. Thousand Oaks, CA: Sage Publications.

Petit, O., Basso, F., Merunka, D., Spence, C., Cheok, A. D. and Oullier, O. (2016) 'Pleasure and the Control of Food Intake: An Embodied Cognition Approach to Consumer Self-Regulation', *Psychology & Marketing*, 33(8), pp. 608-619.

Pettigrew, S. (2016) 'Pleasure: An under-Utilised 'P' in Social Marketing for Healthy Eating', *Appetite*, 104, pp. 60-69.

Prochaska, J. O., Redding, C. A. and Evers, K. (2008) 'The Transtheoretical Model and Stages of Change ', in Glanz, K., Rimer, B.K. & Viswanath, K. (eds.) *Health Behavior and Health Education. Theory, Research, and Practice.* Fourth Edition. San Francisco: Jossey-Bass, pp. 97-121.

Robinson, O. C. (2014) 'Sampling in Interview-Based Qualitative Research: A Theoretical and Practical Guide', *Qualitative Research in Psychology*, 11(1), pp. 25-41.

Rothman, A. J., Sheeran, P. and Wood, W. (2009) 'Reflective and Automatic Processes in the Initiation and Maintenance of Dietary Change', *Annals of Behavioral Medicine*, 38(1), pp. 4-17.

Saarela, A. M., Kantanen, T. T., Lapveteläinen, A. T., Mykkänen, H. M., Karppinen, H. A. and Rissanen, R. L. (2013) 'Combining Verbal Analysis Protocol and Wireless Audiovisual Observation to Examine Consumers' Supermarket Shopping Behaviour', *International Journal of Consumer Studies*, 37(5), pp. 577-584.

safefood (2012) *Food Behaviours. The International Evidence*, Dublin: safefood.

safefood (2013) *Good Days Bad Days: Habits of Shoppers When They Do or Don't Buy Healthy Foods.*, Cork: safefood.

Scheibehenne, B., Miesler, L. and Todd, P. M. (2007) 'Fast and Frugal Food Choices: Uncovering Individual Decision Heuristics', *Appetite*, 49(3), pp. 578-589.

Schnirer, L. and Stack-Cutler, H. (2012) *Recruitment and Engagement of Low-Income Populations: Service Provider and Researcher Perspectives.*, Edmonton, AB: Community-University Partnership for the Study of Children, Youth, and Families.

Journal Pre-proof

Smith, J. A., Flowers, P. and Larkin, M. (2009) *Interpretative Phenomenological Analysis:Theory, Method and Research* London: Sage Publications.

Sobal, J., Kettel Khan, L. and Bisogni, C. (1998) 'A Conceptual Model of the Food and Nutrition System', *Social Science & Medicine,* 47(7), pp. 853-863.

Sparks, L. and Burt, S. (2017) *Identifying and Understanding the Factors That Can Transform the Retail Environment to Enable Healthier Purchasing by Consumers*. Stirling: University of Stirling.

Story, M., Kaphingst, K. M., Robinson-O'Brien, R. and Glanz, K. (2008) 'Creating Healthy Food and Eating Environments: Policy and Environmental Approaches', *Annual Review of Public Health,* 29(1), pp. 253-272.

Strachan, S. M. and Brawley, L. R. (2009) 'Healthy-Eater Identity and Self-Efficacy Predict Healthy Eating Behavior. A Prospective View ', *Journal of Health Psychology,* 14(5), pp. 684–695.

Tarquinio, C., Kivits, J., Minary, L., Coste, J. and Alla, F. (2015) 'Evaluating Complex Interventions: Perspectives and Issues for Health Behaviour Change Interventions', *Psychology & Health,* 30(1), pp. 35-51.

Thaler, R. H. and Sunstein, C. R. (2008) *Nudge: Improving Decisions About Health, Wealth, and Happiness.* New Haven, CT: Yale University Press.

Thomas-Meyer, M., Mytton, O. and Adams, J. (2017) 'Public Responses to Proposals for a Tax on Sugar-Sweetened Beverages: A Thematic Analysis of Online Reader Comments Posted on Major UK News Websites', *PLoS One,* 12(11), pp. e0186750.

Turner-McGrievy, G. M., Wright, J. A., Migneault, J. P., Quintiliani, L. and Friedman, R. H. (2014) 'The Interaction between Dietary and Life Goals: Using Goal Systems Theory to Explore Healthy Diet and Life Goals', *Health Psychology and Behavioral Medicine,* 2(1), pp. 759-769.

Turrell, G. and Kavanagh, A. M. (2006) 'Socio-Economic Pathways to Diet: Modelling the Association between Socio-Economic Position and Food Purchasing Behaviour', *Public Health Nutrition,* 9(3), pp. 375-83.

Journal Pre-proof

van't Riet, J., Sijtsema, S. J., Dagevos, H. and De Bruijn, G.-J. (2011) 'The Importance of Habits in Eating Behaviour. An Overview and Recommendations for Future Research', *Appetite*, 57(3), pp. 585-596.

Verplanken, B. (2005) 'Habits and Implementation Intentions', *The ABC of Behavioural Change*. Oxford, UK: Elsevier Science, pp. 99-109.

Widmar, N. J. O., Byrd, E. S., Dominick, S. R., Wolf, C. A. and Acharya, L. (2016) 'Social Desirability Bias in Reporting of Holiday Season Healthfulness', *Preventive Medicine Reports*, 4, pp. 270-276.

Wood, W., Tam, L. and Witt, M. G. (2005) 'Changing Circumstances, Disrupting Habits', *Journal of Personality and Social Psychology*, 88(6), pp. 918.

Wright, P. and McCarthy, J. (2010) 'Experience-Centered Design: Designers, Users, and Communities in Dialogue', *Synthesis Lectures on Human-Centered Informatics*, 3(1), pp. 1-123.

Yang, H., Carmon, Z., Kahn, B., Malani, A., Schwartz, J., Volpp, K. and Wansink, B. (2012) 'The Hot–Cold Decision Triangle: A Framework for Healthier Choices', *Marketing Letters*, 23(2), pp. 457-472.

Journal Pre-proof