**Resources in women's social networks for food shopping are more strongly associated with better dietary quality than people: a cross-sectional study**

Calum Shand1, Sarah Crozier1 4 , Ivaylo Vassilev3, Daniel Penn-Newmann1, Preeti Dhuria1, Cyrus Cooper1 2, Anne Rogers3, Janis Baird1 2 4, Christina Vogel1 2 4

1 Medical Research Council Lifecourse Epidemiology Unit, University of Southampton, Southampton General Hospital, Tremona Road, Southampton, SO16 6YD, UK

2 National Institute for Health Research Southampton Biomedical Research

Centre, University of Southampton and University Hospital Southampton

NHS Foundation Trust, Southampton SO16 6YD, UK

3 National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care, School of Health Sciences, Faculty of Environmental & Life Sciences, University of Southampton, Southampton, United Kingdom

4 NIHR Applied Research Collaboration Wessex, Southampton Science Park, Innovation Centre, 2 Venture Road, Chilworth, Southampton, SO16 7NP

**Acknowledgments**

We are grateful to the women who participated in this study and to the head-office staff working at Iceland Foods Ltd for facilitating participant recruitment. We are appreciative of the computing support provided by Patsy Coakley and Ben Barton. We thank our funders for their support and would like to acknowledge that the views expressed in this publication are those of the authors and not necessarily those of the funding organisations.

**Sources of funding**

This research and the authors of this paper are supported by the following funding sources: The Academy of Medical Sciences and Wellcome Trust (grant funding, HOP001\1067), University of Southampton (grant funding, RMC1516-12; fellowship to support CV, PCTA36/2015), National Institute for Health Research Southampton Biomedical Research Centre (grant: NBRC RS4h), Medical Research Council and National Institute for Health Research CLAHRC Wessex.

**Abstract**

When healthy people are part of an individual's social network, those individuals will have better dietary quality. Little, however, is known about whether social networks for food shopping, including both people and resources (e.g. recipes, weight loss programmes and food advertisements) are associated with dietary quality. The aim of this study was to explore the relationship between social networks for food shopping and dietary quality, and whether this differs for people and resources, among women aged 18-45 years. A total of 129 participants completed a cross-sectional questionnaire including an ego-centric Social Network Exposure tool and short Food Frequency Questionnaire. Associations between dietary quality and type of network member, perceived healthiness and support for healthy shopping choices were explored using linear regression models. Analyses revealed that participants who nominated people in their food shopping social network that eat healthily or support healthy food shopping had better dietary quality (β=0.16 SD per 1-point change on a 4-point scale, 95%CI -0.06, 0.39; β=0.20, 95%CI -0.07, 0.46, respectively). Resources in participants’ food shopping social networks which promote healthy eating or support healthy shopping were associated with better dietary quality. These associations remained robust after adjustment for confounding variables identified using a directed acyclic graph (β=0.31 SD per 1-point change on a 4-point scale, 95%CI 0.03, 0.58; β=0.44, 95%CI 0.09, 0.79 respectively). The results were strengthened when the outcome was multiplied by frequency of contact (β=0.33, 95%CI 0.05, 0.61; β=0.47, 95%CI 0.11, 0.83 respectively). This study suggests that resources which promote healthy eating and healthy food shopping have a stronger association with dietary quality than social support from people. Further research is required in a larger sample, including multiple time-points, to confirm these findings.

**Key words:** social networks; women; diet; food shopping; egocentric

**1. Introduction**

In the United Kingdom (UK), 89% of all adult deaths are caused by Non-Communicable Diseases (NCDs), (World Health Organisation, 2014) and related conditions such as obesity. Poor diet is a key modifiable risk factor for NCDs, and illness related to poor diet is estimated to cost the UK National Health Service (NHS) £5.8billion a year (GBD 2016. 2018; Scarborough et al., 2011). People from disadvantaged backgrounds often display poorer diets, and are at a greater risk of mortality from NCDs (Sommer et al., 2015). Exposure to risk factors for NCDs begin prior to conception and early in life (Stephenson et al., 2018). Thus, identifying interventions to improve maternal and infant nutrition, particularly among the most disadvantaged, is a top priority for NCD prevention (Barker et al., 2018). Interventions that show greatest promise for reducing dietary inequalities, are those addressing the broader social and environmental determinants of diet (McGill et al., 2015).

Research suggests that an individual’s dietary intake is affected by what foods, and how much of those foods, the people they surround themselves with eat ([Herman, Roth, & Polivy, 2003](#_ENREF_7); [Ruddock, Brunstrom, Vartanian, & Higgs, 2019](#_ENREF_13)). Much of the evidence about the social determinants of diet comes from social network studies which examine the interpersonal relationships that surround an individual, and the characteristics of those connections (Mitchell, 1969). A conceptual model, developed by Berkman et al. (2000), proposes five mechanisms by which social networks can influence health behaviours such as diet.

Much of the literature investigating how social networks influence diet has focused on three of Berkman’s mechanisms namely social engagement, social influence, and social support and used ego-centric social network methodology. Social engagement can influence both the quality and quantity of an individual’s diet because mealtimes offer opportunities for social participation and modelling of dietary behaviour. Evidence indicates that people eat more when their companion eats more, and eat less when their companion eats less or is attractive ([Baker, Strickland, & Fox, 2019](#_ENREF_1); [Herman et al., 2003](#_ENREF_7); [Vartanian, Spanos, Herman, & Polivy, 2015](#_ENREF_16)). Additionally, research with women found that those with poorer diets were more often embedded within unhealthy social networks (Mötteli et al., 2017).

The second mechanism by which social networks can affect diet is through social influences which occur in the absence of others but through normative guidance by comparing their behaviours with those of others (Berkman et al., 2000). Evidence suggests that when people are given information about the purchasing choices of their social network, particularly proximate family, friends and colleagues, they are more likely to choose a similar product (Salazar et al., 2013). Furthermore, a study investigating how women’s dietary behaviours were associated with social norms found that those who perceived that many women they knew ate fast food or drank soft drinks often had higher intakes of these foods (Ball et al., 2010).

The third well-established social network correlate of healthy eating is social support, including emotional, instrumental and appraisal support (Berkman et al., 2000). There is strong evidence that higher levels of social support improve the adoption and maintenance of healthier dietary behaviours (Greaves et al., 2011; Shaikh et al., 2008). Among women, levels of social support for healthy eating from family members varies according to level of socioeconomic status, with low social support given to women from disadvantaged backgrounds (Vogel et al., 2019).

The conceptual model proposed by Berkman et al. (2000) also suggests that these mechanisms that link an individual’s social network with their health behaviours are moderated by the type of social relationship with the network member (i.e. friend, partner, parent etc.) and/or how frequently they see or have contact with each other. Household family members and those with whom the individual has more frequent contact hold greater concordance with the individual’s dietary behaviours than other network members (Conklin et al., 2014; Pachucki et al., 2011). For women, the most important eating companions have been shown to be their partners and other family members, regardless of their diet quality (Mötteli et al., 2017). Furthermore, evidence from a recent systematic review indicates that individuals eat significantly more in the company of familiar others (i.e. family and friends) than they do when eating alone ([Ruddock et al., 2019](#_ENREF_13)).

While there has been debate among sociologists as to whether humans and non-humans form part of an individual’s social network ([Barron, 2003](#_ENREF_2)), recent theory purports that a person’s interactions with non-humans can actively shape that individual’s sense of self, social relations and their behaviour ([Jerolmack & Tavory, 2014](#_ENREF_8)). More specifically, nonhumans such as clothing or pets can: determine how a person is perceived by others; constrain possibilities for alternative interpretation; or cause association with a particular social group. Pets have also been shown to provide intimate relationships that are otherwise absent, particularly enhancing the well-being of individuals suffering chronic illnesses by offering distraction from symptoms and encouraging physical activity ([H. Brooks, Rushton, Walker, Lovell, & Rogers, 2016](#_ENREF_3)). Additionally, innate objects and specific places have been identified by individuals as part of their social networks because they offer a sense of security and means of support ([H. L. Brooks, Bee, Lovell, & Rogers, 2020](#_ENREF_4)).

The Berkman et al. (2000) conceptual model suggests that access to resources and material goods through social network members can impact an individual’s health behaviours. Social networks can regulate an individual’s health improvement opportunities by sharing or restricting knowledge, information and/or material resources related to health behaviours such as food shopping and meal preparation (Vassilev et al., 2014). For example, low incomes families report being prohibited from buying healthy foods that are seen as less palatable by their children because the foods and money will be wasted; an issue better accommodated in high income families ([Baker et al., 2019](#_ENREF_1); [Wendy Lawrence et al., 2009](#_ENREF_9)). In a broader interpretation of information and resources, social networks may also affect an individual’s interaction with broader social environments such as media or advertising (Glanz et et al., 2005).

Few social network studies, however, have examined whether access to resources through an individual’s social network affects their health-related behaviours. Furthermore, little research has investigated how social networks affect food shopping patterns. Given that food shopping is a key determinant of dietary quality (Caspi et al., 2017; Stern et al., 2016), addressing this evidence gap may provide helpful insights for developing healthy eating interventions. We therefore assessed how people and resources that form part of a woman’s social network affect the healthfulness of her food shopping patterns (i.e. how much they support participants to purchase foods conducive to good health). Women represent an important target group for this study because they remain predominantly responsible for making household food decisions (Food Standards Agency, 2014). We used ego-centric social network methodology in which the individual or ‘ego’ identifies people or ‘alters’ in their life that have an impact on their health behaviour (Smith & Christakis, 2008).

The specific aims of this study were to: i) assess the proportion of people and resource alters within a woman’s social network related to her food shopping behaviours, ii) identify the level that people and resource alters supported healthy food shopping, and iii) determine the relationships between women’s dietary quality and people or resource alters’ support for healthy food shopping, and whether these relationships were affected by frequency of contact.

**2. Methods**

*2.1 Procedure & Participants*

Participants were women who completed baseline assessment (n=150) of an intervention study that aimed to understand how creating a healthy layout in supermarkets affects women customers’ dietary patterns (Vogel et al, unpublished). In brief, the setting was a UK discount supermarket chain and the study recruited women customers, aged 18-45 years, who shopped regularly in one of the six study stores, (3 intervention stores and 3 control stores), located across England. In intervention stores unhealthy foods were removed from checkouts and aisle-ends opposite, and an expanded range of fruit and vegetables was prominently positioned near store entrances. Participants were not informed about the supermarket intervention, rather were told the study aimed to assess how women customers’ shopping and dietary patterns change over time. The study was approved by the University of Southampton Faculty of Medicine ethics committee (Ethics ID 20986), and abides by the Declaration of Helsinki, Research Governance Framework for Health and Social Care and Data Protection regulations.

Women were recruited to the study through the supermarket chain’s loyalty card scheme via email, postal letter or while shopping in one of the six study stores. The data for this sub-study were collected from the final 6-month post intervention questionnaire, administered between February and May 2017. The questionnaire collected data about demographic characteristics including age, highest educational qualification attained, ethnicity, number of children, marital status, and employment status. Home postcode was obtained in order to determine level of neighbourhood deprivation according to 2015 English IMD deciles (Ministry of Housing., 2015). The questionnaire was administered over the phone by a trained researcher. Data for this study were treated as observational and cross-sectional because the intervention did not target social relationships.

*2.2 Dietary Quality*

A total of 129 women completed a validated 20-item Food Frequency Questionnaire (FFQ) that was derived from a 100-item FFQ used in the Southampton Women's Survey (SWS) (Crozier et al., 2010). The items within the 20 item FFQ were selected as the 20 most discriminatory foods in the original principal component analysis (10 healthy and 10 less healthy). Women were asked, during the 6-month follow-up questionnaire, to report how often they consumed each of the 20 food items over the past month, according to a six-point scale ranging from ‘never’ to ‘once or more than once a day’. A dietary quality score for each woman was calculated by multiplying their standardised reported frequency of consumption of each of the 20 items from their FFQ by corresponding weightings derived from the principal component analysis and then summing the results. Dietary scores were standardised to have a mean of 0 and standard deviation of 1 using Fisher-Yates normal scores (Armitage et al., 2002). Higher diet scores represent better dietary quality characterised by higher intakes of various vegetables, vegetarian foods and wholegrain bread, and lower intakes of white bread, processed meats, chips, crisps and sugar.

*2.3 Social Network Exposure*

Participants were asked to identify components of their social network (people or non-people), described henceforth as ‘alters’, they perceived to be the most influential on their food shopping decisions, commonly referred to as the ‘name generator approach’ (Marsden, 2011). Participants were asked to describe the alter’s gender (if applicable), and frequency of contact on a 4-point scale (1 = daily, 2 = ≤ weekly, 3 = ≤ monthly, 4 = ≤ 3 monthly). Participants reported perceived health characteristics of the alters, including how often the person ate healthily or non-person promoted healthy eating on a 4-point scale (1 = never, 2 = sometimes, 3 = usually, 4 = always). Participants also reported how important, on a scale from 1 (not important) to 3 (very important), each alter was in determining which products they bought or avoided based on health. These options were derived from previous published work on social networks and health (Koetsenruijter et al., 2015; Vassilev et al., 2013).

*2.4 Data Analysis*

The alters were grouped into six categories, consistent with published social network analysis and health studies (Mötteli et al., 2017; Vassilev et al., 2013), including: i) *partners,* ii) *children,* iii) *other family and friends* (sibling, colleagues, grandchildren etc.)*,* iv) *health promoters* (health professional, sports instructor)*,* v) *recipes* (social media groups, TV cooking shows, celebrity recipes)*,* vi) *health improvement resources* (weight loss programme, health documentation), and viii) *food advertisements and media* (TV advert, news media, in-store adverts).Descriptive statistics (median (IQR) or n (%)) were used to summarise participants’ demographic characteristics (ethnicity, number of children in household, marital status, education level, IMD, and employment status) and the composition of participants’ social network (i.e. type of alters identified, gender, and frequency of contact).

Participants perception of how much an alter ate healthily/promoted healthy eating and their perception of alters’ influence on healthy shopping habits were explored as predictors of participant dietary quality using two separate linear regression models. Dietary quality in SDs was the outcome. The average of the participants’ alters eating healthily/promoting healthy eating scores and influence on healthy shopping habits score were calculated separately for people alters and for resource alters; these were the exposures of interest in the regression models. Confounding variables were selected using a directed acyclic graph drawn using the dagitty.net software package (see Supplementary Figure 1); this method enables rigorous identification of confounders by making explicit underlying assumptions about causal associations ([Greenland, Pearl, & Robins, 1999](#_ENREF_6); [Rohrer, 2018](#_ENREF_12); [Tennant et al., 2020](#_ENREF_15)). The estimand of interest is the total causal effect of ‘alter influence on healthy shopping decisions’ (exposure) on the prudent diet score (outcome). The DAG-implied adjustment set of variables are: number of children in the home, educational level, job status and neighbourhood deprivation. In additional analyses, the two exposure variables were multiplied by frequency of contact and divided by 4 (so that the associations including frequency of contact were comparable to the two original exposure variables) and these were also considered as predictors of the dietary quality index in the linear regression models. Effect modification of investigated associations by intervention group was explored because this observational study was set in an intervention trial. We added multiplicative interaction terms of alter influence and intervention group to all confounder-adjusted models; where a significant interaction was found linear regression models (as described above) were fitted within each intervention groups separately. All analyses were performed using Stata 14 ([Statacorp, 2015](#_ENREF_14)).

**3. Results**

The demographic characteristics of the 129 women in this study are presented in Table 1. The median age of participants was 36.1 years (interquartile range (IQR) 31.5, 41.2). Most participants were white British (91.5%), had low educational attainment (55.1%), and lived in neighbourhoods in the lowest 4 deciles of deprivation (65.1%). Half of the women were unemployed (51.6%).

Table 2 shows that people accounted for 71.9% of the identified alters and resources comprised 28.1%. Only two participants did not include any people in their network (1.6%), whereas 37 participants (28.7%) did not include any resources. *Partners* were mainly male (94.3%) and 57.8% of participants’ children were male. All other people alters were predominantly female (*other family and friends* 80.0%, *health promoters* 71.4%). Contact with the alters was generally daily (68.6%). *Children* had the most daily contact with participants (98.9%); *health promoters* had the least frequent contact with participants, with 57.1% having contact monthly or less. Most participants who reported *food advertisements and media* as an alter had daily or weekly contact with these resources (79.3%).

Table 3 shows the alter groups that were perceived to be more frequently ‘always’ promoting healthy eating were *health promoters* (85.7%) and *health improvement resources* (94.7%), whilst the group least likely to ‘always’ promote healthy eating was f*ood advertisements and media* (9.8%). *Children* were reported most frequently (27.8%) as having ‘very important’ positive influences on healthy shopping choices; as compared to *health promoters* and *recipes* which had limited reported influence.

As detailed in Table 4 and Table 5, linear regression models revealed, after adjustment for confounders (number of children in the home, educational level, job status and neighbourhood deprivation) a positive relationship between women’s dietary quality and people alters perceived to more frequently eat healthily (β=0.16 (95% CI -0.06, 0.39), p=0.16) and between dietary quality and people alters perceived to more frequently encourage healthy shopping choices (β=0.20 (-0.07, 0.46), p=0.14). These relationships were not strengthened when frequency of contact was included in the exposure measure (β=0.12 (-0.12, 0.36), p=0.32 and β=0.15 (-0.12, 0.43), p=0.27 respectively). After adjustment for confounders, a positive relationship was observed between women’s dietary quality and resource alters perceived to more frequently promote healthy eating (β=0.31 (95% CI 0.03, 0.58), p=0.03) and between dietary quality and resource alters perceived to more frequently support healthy shopping choices (β=0.44 (0.09, 0.79), p=0.02). These relationships were strengthened when frequency of contact was included in the exposure measure (β=0.33 (0.05, 0.15), p=0.02 and β=0.47 (0.11, 0.83 p=0.01 respectively).

Since this observational study is based within an intervention trial, the interactions of the two types of alters and intervention group were added to the models to see whether the associations observed among the whole sample were retained in the two study groups. For people alters, after adjusting for confounders, there was no interaction between intervention group and frequency of eating healthily (p=0.52) or supporting healthy shopping choices (p=0.29) or for either predictor when multiplied by contact time (p=0.45 and p=0.29 respectively). For resource alters, after adjusting for confounders, there was no interaction between intervention group and frequency of promoting healthy eating (p=0.66), but a significant interaction was observed for frequency of importance for healthy shopping choices (p=0.05). This model was therefore stratified by study group. A strong, positive relationship was observed between women’s dietary quality and resource alters perceived to be important for healthy shopping choices in the control group (β=0.73 (95% CI 0.22, 1.25), p=0.007), but the relationship was weak among the intervention group participants (β=0.09 (95% CI -0.43, 0.60), p=0.73). Interactions between study group and promoting healthy eating or healthy shopping choices multiplied by frequency of contact were not observed (p=0.53 and p=0.13 respectively). When analyses presented in Table 4 were restricted to the 89 participants who identified resource alters in their food shopping network (and therefore had the same number of participants as Table 5) results were similar (data not shown).

**4. Discussion**

People made up the greatest proportion of women’s social networks, with immediate family the most frequently reported members. Almost three-quarters of women also reported that resources formed an important component of their food shopping social network, where food advertisements and news/social media were the most commonly cited resources. Children, partners and health improvement resources, such as weight loss programmes or health information, were considered most important for supporting participants in making healthy shopping choices. Food advertisements and social/news media were the social network component with the smallest proportion for promoting healthy eating or food shopping.

The results of our study showed that women who indicated people or resources in their food shopping social network that promote healthy eating or support healthy food shopping had better dietary quality than those with fewer people or resources supportive of healthy food-related behaviours. A particularly interesting finding from this study was that the strength of the association between diet and resource network components important for healthy shopping was stronger and more robust than that for people network members. Furthermore, increased contact with these resources enhanced the relationship with diet, while greater contact with people reduced the strength of the relationship with diet.

Social networks and the influence these have on people’s eating habits have been previously explored; however, to our best knowledge, this study offers an initial investigation into how women’s social networks for food shopping habits relate to their diet. Our findings, that the make-up of an individual’s social network is associated with their dietary-related behaviour, is consistent with previous literature. Similarly to our findings that women with healthier diets had people and resources in their social networks supportive of healthy eating and food shopping, Mötteli and Dohle (2017) demonstrated that women who dine more frequently with ‘healthy eating companions’, had better dietary quality. Collectively, these findings suggest that the healthfulness of dietary-related behaviours cluster in social networks.

Our inclusion of resources as part of an individual’s social network for food shopping is unique in social network literature. Our findings, however, concur with the broader evidence about the social and environmental determinants of dietary behaviours. For example, research from the UK with a nationally representative sample, showed that consuming food prepared at home, which had involved activities such as chopping, mixing, boiling or roasting, is associated with better dietary quality (Clifford-Astbury et al., 2019). Recipes are a key resource that support individuals with home cooking and, as highlighted by women participating in our study, they can often support healthy eating. While the effectiveness of interventions aimed at improving diet by increasing home cooking overall appears to be inconclusive (Rees et al., 2012), those incorporating close personal relationships, in particular learning cooking skills and recipe ideas from individuals within their close social network, are more consistently effective (Mills et al., 2017). This evidence also links to the conceptual model proposed by Berkman et al. (2000), demonstrating that health behaviours link to social networks through the mechanisms of social influence and resources. In this example, normative guidance from a network member can be facilitated by the transfer of healthy recipes.

Participants in our study reported that food advertising and media were moderately important for their food shopping choices, and that these resources were least likely to promote healthy eating. This finding is supported by empirical research which has shown that television advertising, online advertising and supermarket promotional activities are more prevalent for unhealthy than healthy foods (Bennett et al., 2020; Norman et al., 2018; Powell et al., 2007; Shaw et al., 2020). Advertising and media represented the greatest proportion of resources reported by women, and were hence likely to negatively affect the healthiness of women’s food shopping and dietary choices. Evidence for the negative impact that food advertising and media has on the dietary habits of children is strong (Boyland et al., 2016). Half the children described in this study were not supportive of their mothers making healthy food shopping choices. This finding may, in part, be explained by children being influenced by unhealthy food adverts and affecting their mothers’ shopping habits through pester power (Winkler et al., 2016). These findings further strengthen the roles of resources and social engagement (e.g. children accompanying parents food shopping) as mechanisms by which social networks affect health behaviours as proposed by Berkman et al. (2000).

Using the name generator approach to identify components of participants’ social networks for food shopping was a strength of this study, as was the use of a telephone interviews which provided an opportunity to verbally prompt participants to identify potential alters that might be overlooked in a postal questionnaire (Vassilev et al., 2013). Another strength was the novel inclusion of resources as possible alters in participants’ social networks. This approach allowed for deeper exploration of the various factors affecting women’s food shopping behaviours and identification of possible opportunities for intervention. This study also had high representation of women from disadvantaged backgrounds, and may offer insights for opportunities to better understand or reduce dietary inequalities.

This study has several limitations. Firstly, the analysis formed part of an intervention study, and stratified analyses identified a difference in key findings by study group. A positive relationship was observed between women’s dietary quality score and alter resources in the control group, in which store layout was not changed, but not in the intervention group. While the direct cause of this difference is not clear, one possible explanation could be that women in the intervention group who were exposed to a healthier shopping environment (i.e. fruit and vegetables at the front of the store and confectionery removed from checkout and aisle ends opposite) were less influenced by their social networks.

Although interviewer administered questionnaires generally show greater accuracy than self-administered surveys ([Cade, Burley, Warm, Thompson, & Margetts, 2004](#_ENREF_5); [O'Malley, Arbesman, Steiger, Fowler, & Christakis, 2012](#_ENREF_11)), the self-reported nature of exposure and outcome variable data introduces the possibility of recall bias. The data collected about network components is based entirely upon the knowledge, reflection and recall of the participant, which may not be consistent with alters’ perspectives. The data and analyses, however, remain appropriate because the participant’s perception of the relationship and alter characteristics may be more important for the participant’s behaviour than whether the perception is validated or reciprocated by the alter ([O'Malley et al., 2012](#_ENREF_11)).

Another limitation of this study is that the sample size was relatively small. In order to confirm the results of this exploratory study, the methods used in this study will be replicated as part of a full-scale intervention trial (Vogel et al., 2020). Scientific understanding of how social networks influence food shopping would be strengthened if future research examined the extent to which people and resource alters interact within the context of people’s networks related to healthy and/or unhealthy diet-related behaviours. The interaction between social network components and the underlying mechanisms through which they work, need to be explored using qualitative, quantitative, and social network methodologies. Such research would help to evolve the conceptual model by Berkman et al. (2000) from one that is linear, to a systems framework detailing interconnections between the mechanisms of social engagement, social influence, social support and resources in their relationships with health behaviours such as food shopping and eating.

Results from the present study provide some support for the NHS national implementation of ‘Making Every Contact Count’ (MECC), which recognises the importance of supporting individuals with behaviour change verbally and emotionally, in addition to providing appropriate health information (Public Health England, 2016). Women participants identified health information as an important resource to support healthy shopping habits. Research supporting the MECC agenda has shown that health information can be effective at improving health behaviours when it is coupled with interpersonal interactions from primary care practitioners who empower patients to make changes to manage their own health ([W. Lawrence et al., 2021](#_ENREF_10)).

Additionally, our findings showed that food advertising and media formed the greatest proportion of resources and were least likely to promote healthy eating. These results provide some support for the UK government’s intention to ban online advertising (Department of Health and Social Care, 2020a) and television advertising before 9pm (Department of Health and Social Care, 2020b) of food and drink that is high in fat, salt and sugar in an effort to curb rising obesity rates.

1. **Conclusion**

The findings of this study suggest that within a woman’s social network, resources which promote healthy eating and healthy food shopping, have a stronger association on their dietary quality than the support provided by people. Interventions to improve food shopping and dietary behaviours may be particularly effective if resources, such as advertising and media, promoted healthy foods and diets more frequently, and health improvement programmes and materials were more widely available. Further research is needed to understand how people and resource components within a social network for food shopping interact in their influence on diet.

**References**

Armitage, P., Berry, G., & Matthews, J. N. S. (2002). *Statistical Methods in Medical Research, Third Edition*. Oxford, United Kingdom: Blackwell Science Ltd.

Ball, K., Jeffery, R. W., Abbott, G., McNaughton, S. A., & Crawford, D. (2010). Is healthy behavior contagious: associations of social norms with physical activity and healthy eating. *Int J Behav Nutr Phys Act, 7*, 86. doi:10.1186/1479-5868-7-86

Baker, M., Strickland, A., & Fox, N.D. (2019). Choosing a meal to increase your appeal: How relationship status, sexual orientation, dining partner sex, and attractiveness impact nutritional choices in social dining scenarios. *Appetite,* 133, 262-269.

Barker, M., Dombrowski, S.U., Colbourn, T., Fall, C.H.D., Kriznik, N.M., Lawrence, W.T., Norris, S.A., Ngaiza, G., Patel, D., Skordis-Worrall, J., Sniehotta, F.F., Steegers-Theunissen, R., Vogel, C., Woods-Townsend, K., Stephenson, J. (2018). Intervention strategies to improve nutrition and health behaviours before conception. *Lancet, 391*(10132), 1853-1864. doi:10.1016/S0140-6736(18)30313-1

Barron, C. (2003). A Strong Distinction between Humans and Non-Humans is no Longer Required for Research Purposes: A Debate Between Bruno Latour and Steve Fuller. *History of the Human Sciences,* 16, 77-99.

Bennett, R., Zorbas, C., Huse, O., Peeters, A., Cameron, A. J., Sacks, G., & Backholer, K. (2020). Prevalence of healthy and unhealthy food and beverage price promotions and their potential influence on shopper purchasing behaviour: A systematic review of the literature. *Obesity Reviews, 21*(1), e12948. doi:10.1111/obr.12948

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Soc Sci Med, 51*(6), 843-857. doi:10.1016/s0277-9536(00)00065-4

Boyland, E. J., Nolan, S., Kelly, B., Tudur-Smith, C., Jones, A., Halford, J. C. G., & Robinson, E. (2016). Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults1,2. *American Journal of Clinical Nutrition, 103*(2), 519-533. doi:10.3945/ajcn.115.120022

Brooks, H., Rushton, K., Walker, S., Lovell, K., & Rogers, A. (2016). Ontological security and connectivity provided by pets: a study in the self-management of the everyday lives of people diagnosed with a long-term mental health condition. *BMC Psychiatry,* 16, 409.

Brooks, H.L., Bee, P., Lovell, K., & Rogers, A. (2020). Negotiating support from relationships and resources: a longitudinal study examining the role of personal support networks in the management of severe and enduring mental health problems. *BMC Psychiatry,* 20, 50.

Cade, J.E., Burley, V.J., Warm, D.L., Thompson, R.L., & Margetts, B.M. (2004). Food-frequency questionnaires: a review of their design, validation and utilisation. *Nutr Res Rev,* 17, 5-22.

Caspi, C. E., Lenk, K., Pelletier, J. E., Barnes, T. L., Harnack, L., Erickson, D. J., & Laska, M. N. (2017). Food and beverage purchases in corner stores, gas-marts, pharmacies and dollar stores. *Public Health Nutr, 20*(14), 2587-2597. doi:10.1017/s1368980016002524

Clifford-Astbury, C., Penney, T. L., & Adams, J. (2019). Home-prepared food, dietary quality and socio-demographic factors: a cross-sectional analysis of the UK National Diet and nutrition survey 2008–16. *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 82. doi:10.1186/s12966-019-0846-x

Conklin, A. I., Forouhi, N. G., Surtees, P., Khaw, K.-T., Wareham, N. J., & Monsivais, P. (2014). Social relationships and healthful dietary behaviour: Evidence from over-50s in the EPIC cohort, UK. *Social Science & Medicine, 100*, 167-175. doi:https://doi.org/10.1016/j.socscimed.2013.08.018

Crozier, S. R., Inskip, H. M., Barker, M. E., Lawrence, W. T., Cooper, C., & Robinson, S. M. (2010). Development of a 20-item food frequency questionnaire to assess a 'prudent' dietary pattern among young women in Southampton. *European Journal of Clinical Nutrition, 64*(1), 99-104.

Department of Health and Social Care. (2020a). *Introducing a total online advertising restriction for products high in fat, sugar and salt (HFSS)*. Retrieved December 17, 2020 from https://www.gov.uk/government/consultations/total-restriction-of-online-advertising-for-products-high-in-fat-sugar-and-salt-hfss/introducing-a-total-online-advertising-restriction-for-products-high-in-fat-sugar-and-salt-hfss

Department of Health and Social Care. (2020b). *Tackling obesity: empowering adults and children to live healthier lives*. Retrieved December 17, 2020 from https://www.gov.uk/government/publications/tackling-obesity-government-strategy/tackling-obesity-empowering-adults-and-children-to-live-healthier-lives

Food Standards Agency. (2014). *The 2014 Food and You survey*. NatCen Social Research. Retrieved October 1, 2019 from https://www.food.gov.uk/research/food-and-you/food-and-you-wave-four

GBD 2016 Risk Factors Collaborators. (2018). Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet, 390*(10100), 1345-1422. doi:10.1016/S0140-6736(17)32366-8

Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L. D. (2005). Healthy Nutrition Environments: Concepts and Measures. *American Journal of Health Promotion, 19*(5), 330-333. https://doi.org/10.4278%2F0890-1171-19.5.330

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., Schwarz, P. and the IMAGE Study Group. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health, 11*, 119. doi:10.1186/1471-2458-11-119

Greenland, S., Pearl, J., & Robins, J. M. (1999). Causal diagrams for epidemiologic research. *Epidemiology, 10*(1), 37-48.

Herman, C., Roth, D., & Polivy, J. (2003). Effects of the Presence of Others on Food Intake: A Normative Interpretation. *Psychological bulletin, 129*, 873-886. doi:10.1037/0033-2909.129.6.873

Jerolmack, C., & Tavory, I. (2014). Molds and Totems:Nonhumans and the Constitution of the Social Self. *Sociological Theory,* 32, 64-77.

Koetsenruijter, J., van Lieshout, J., Lionis, C., Portillo, M. C., Vassilev, I., Todorova, E., Foss, C., Gil, M. S., Knutsen, I. R., Angelaki, A., Mujika, A., Roukova, P., Kennedy, A., Rogers, A., & Wensing, M. (2015). Social Support and Health in Diabetes Patients: An Observational Study in Six European Countries in an Era of Austerity. PloS one, 10(8), e0135079. https://doi.org/10.1371/journal.pone.0135079

Lawrence, W., Skinner, C., Haslam, C., Robinson, S., Inskip, H., Barker, D., et al. (2009). Why women of lower educational attainment struggle to make healthier food choices: The importance of psychological and social factors. *Psychology & Health,* 24, 1003-1020.

Lawrence, W., Watson, D., Barker, H., Vogel, C., Rahman, E., & Barker, M. (2021). Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management. *Perspect Public Health*, 1757913920977030.

Marsden, P. V. (2011). Survey methods for network data. In J. Scott & P. Carrington (Eds.), *The SAGE handbook of social network analysis* (pp. 370-388).

McGill, R., Anwar, E., Orton, L., Bromley, H., Lloyd-Williams, F., O'Flaherty, M., Taylor-Robinson, D., Guzman-Castillo, M., Gillespie, D., Moreira, P., Allen, K., Hyseni, L., Calder, N., Petticrew, M., White, M., Whitehead, M., & Capewell, S. (2015). Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. BMC public health, 15, 457. https://doi.org/10.1186/s12889-015-1781-7

Mills, S., White, M., Brown, H., Wrieden, W., Kwasnicka, D., Halligan, J., Robalino, S., & Adams, J. (2017). Health and social determinants and outcomes of home cooking: A systematic review of observational studies. *Appetite, 111*, 116-134. doi:https://doi.org/10.1016/j.appet.2016.12.022

Ministry of Housing. (2015). *English indices of deprivation 2015: research report*. Retrieved October 11, 2019 from https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/464597/English\_Indices\_of\_Deprivation\_2015\_-\_Research\_Report.pdf.

Mitchell, J. (1969). *The Concept and Use of Social Networks*.

Mötteli, S., & Dohle, S. (2017). Egocentric social network correlates of physical activity. *Journal of Sport and Health Science*. doi:https://doi.org/10.1016/j.jshs.2017.01.002

Mötteli, S., Siegrist, M., & Keller, C. (2017). Women's social eating environment and its associations with dietary behavior and weight management. *Appetite, 110* (Supplement C), 86-93. doi:https://doi.org/10.1016/j.appet.2016.12.014

Norman, J., Kelly, B., McMahon, A. T., Boyland, E., Baur, L. A., Chapman, K., King, L., Hughes, C., & Bauman, A. (2018). Sustained impact of energy-dense TV and online food advertising on children’s dietary intake: a within-subject, randomised, crossover, counter-balanced trial. *International Journal of Behavioral Nutrition and Physical Activity, 15*(1), 37. doi:10.1186/s12966-018-0672-6

O'Malley, A.J., Arbesman, S., Steiger, D.M., Fowler, J.H., & Christakis, N.A. (2012). Egocentric social network structure, health, and pro-social behaviors in a national panel study of Americans. *Plos One,* 7, e36250.

Pachucki, M. A., Jacques, P. F., & Christakis, N. A. (2011). Social network concordance in food choice among spouses, friends, and siblings. *Am J Public Health, 101*(11), 2170-2177. doi:10.2105/ajph.2011.300282

Powell, L. M., Szczypka, G., Chaloupka, F. J., & Braunschweig, C. L. (2007). Nutritional content of television food advertisements seen by children and adolescents in the United States. *Pediatrics, 120*(3), 576-583. doi:10.1542/peds.2006-3595

Public Health England. (2016). *Making Every Contact Count (MECC): implementation guide*. Leeds. Retrieved December 17, 2020 from https://www.makingeverycontactcount.co.uk/media/1015/mecc\_implementation\_guide.pdf.

Rees, R., Hinds, K., Dickson, K., O’Mara-Eves, A., & Thomas, J. (2012). Communities that cook: a systematic review of the effectiveness and appropriateness of interventions to introduce adults to home cooking. In: Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]. York (UK): Centre for Reviews and Dissemination (UK); 1995-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK127560/>

Rohrer, J.M. (2018). Thinking Clearly About Correlations and Causation: Graphical Causal Models for Observational Data. *Advances in Methods and Practices in Psychological Science,* 1, 27-42.

Ruddock, H.K., Brunstrom, J.M., Vartanian, L.R., & Higgs, S. (2019). A systematic review and meta-analysis of the social facilitation of eating. *Am J Clin Nutr,* 110, 842-861.

Salazar, H. A., Oerlemans, L., & van Stroe-Biezen, S. (2013). Social influence on sustainable consumption: evidence from a behavioural experiment. *International Journal of Consumer Studies, 37*(2), 172-180. doi:10.1111/j.1470-6431.2012.01110.x

Scarborough, P., Bhatnagar, P., Wickramasinghe, K. K., Allender, S., Foster, C., & Rayner, M. (2011). The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006-07 NHS costs. *J Public Health (Oxf), 33*(4), 527-535. doi:10.1093/pubmed/fdr033

Shaikh, A. R., Yaroch, A. L., Nebeling, L., Yeh, M. C., & Resnicow, K. (2008). Psychosocial predictors of fruit and vegetable consumption in adults - A review of the literature. *American Journal of Preventive Medicine, 34*(6), 535-543.

Shaw, S.C., Ntani, G., Baird, J., Vogel C,A. (2020). A systematic review of the influences of food store product placement on dietary-related outcomes. Nutr Rev. 1;78(12):1030-1045. doi: 10.1093/nutrit/nuaa024.

Smith, K. P., & Christakis, N. A. (2008). Social Networks and Health. *Annual Review of Sociology, 34*(1), 405-429. doi:10.1146/annurev.soc.34.040507.134601

Sommer, I., Griebler, U., Mahlknecht, P., Thaler, K., Bouskill, K., Gartlehner, G., & Mendis, S. (2015). Socioeconomic inequalities in non-communicable diseases and their risk factors: an overview of systematic reviews. *BMC Public Health, 15*, 914-914. doi:10.1186/s12889-015-2227-y

Statacorp. (2015). Stata Statistical Software: Release 14 (Version 14). Texas: College Station.

Stephenson, J., Heslehurst, N., Hall, J., Schoenaker, D., Hutchinson, J., Cade, J. E., Poston, L., Barrett, G., Crozier, S. R., Barker, M., Kumaran, K., Yajnik, C. S., Baird, J., & Mishra, G. D. (2018). Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. *Lancet, 391*(10132), 1830-1841. doi:10.1016/s0140-6736(18)30311-8

Stern, D., Ng, S. W., & Popkin, B. M. (2016). The nutrient content of US household food purchases by store types. *American Journal of Preventive Medicine, 50*(2), 180-190. doi:10.1016/j.amepre.2015.07.025

Tennant, P.W.G., Murray, E.J., Arnold, K.F., Berrie, L., Fox, M.P., Gadd, S.C., et al. (2020). Use of directed acyclic graphs (DAGs) to identify confounders in applied health research: review and recommendations. *Int J Epidemiol*.

Vartanian, L. R., Spanos, S., Herman, C. P., & Polivy, J. (2015). Modeling of food intake: a meta-analytic review. *Social Influence, 10*(3), 119-136. doi:10.1080/15534510.2015.1008037

Vassilev, I., Rogers, A., Blickem, C., Brooks, H., Kapadia, D., Kennedy, A., Reeves, D. (2013). Social Networks, the ‘Work’ and Work Force of Chronic Illness Self-Management: A Survey Analysis of Personal Communities. *PLoS ONE, 8*(4), e59723. doi:10.1371/journal.pone.0059723

Vassilev, I., Rogers, A., Kennedy, A., & Koetsenruijter, J. (2014). The influence of social networks on self-management support: a metasynthesis. *BMC Public Health, 14*(1), 719. doi:10.1186/1471-2458-14-719

Vogel, C., Abbott, G., Ntani, G., Barker, M., Cooper, C., Moon, G., Baird, J. (2019). Examination of how food environment and psychological factors interact in their relationship with dietary behaviours: test of a cross-sectional model. *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), 12. doi:10.1186/s12966-019-0772-y

Vogel, C., Crozier, S., Dhuria, P., Shand, C., Lawrence, W., Cade, J., Moon, G., Lord, J., Ball, K., Cooper, C., & Baird, J. (2020). Protocol of a natural experiment to evaluate a supermarket intervention to improve food purchasing and dietary behaviours of women (WRAPPED study) in England: a prospective matched controlled cluster design. *BMJ Open, 10*(2), e036758. doi:10.1136/bmjopen-2020-036758

Winkler, L. L., Christensen, U., Glumer, C., Bloch, P., Mikkelsen, B. E., Wansink, B., & Toft, U. (2016). Substituting sugar confectionery with fruit and healthy snacks at checkout - a win-win strategy for consumers and food stores? a study on consumer attitudes and sales effects of a healthy supermarket intervention. *BMC Public Health, 16*(1), 1184. doi:10.1186/s12889-016-3849-4

World Health Organisation. (2014). Noncommunicable Diseases (NCD) Country Profiles - United Kingdom. Retrieved Octover 1, 2019 from http://www.who.int/nmh/countries/gbr\_en.pdf

**Conflicts of interest statement**

This study involves a non-financial collaboration with Iceland Foods Ltd. CS, CV, SC, DPN, IV and AR have no conflicts of interests to declare and no further financial disclosures to make. JB has received grant research support from Danone Nutricia Early Life Nutrition. CC has received consultancy, lecture fees and honoraria from AMGEN, GSK, Alliance for Better Bone Health, MSD, Eli Lilly, Pfizer, Novartis, Servier, Medtronic and Roche. The study described in this manuscript is not related to these relationships.

**Data availability statement**

Data described in this manuscript that has been collected by the research team during this study, data that can be anonymized can be made available upon reasonable request to the corresponding author and data manager pending approval.

**Table 1. Sociodemographic characteristics (n=129)**

|  |
| --- |
| **Demographic Characteristic** |
|  | **Median** | **IQR** |
| **Age (years)** | 36.1 | (31.5, 41.2) |
|  | **n** | **%** |
| **Ethnicity**  |  |  |
| White British | 118 | 91.5 |
| Other | 11 | 8.5 |
| **Children (under 18) in the house** |  |  |
| 0 | 20 | 16.0 |
| 1-3 | 90 | 72.0 |
| 4+ | 15 | 12.0 |
| **Marital status** |  |  |
| Single | 54 | 41.9 |
| Married | 61 | 47.3 |
| Separated/Divorced/Widowed | 14 | 10.9 |
| **Education level** |  |  |
| Low educational attainment (≤16 years of age) | 70 | 55.1 |
| Mid educational attainment | 42 | 33.1 |
| High educational attainment (degree qualifications) | 15 | 11.8 |
| **Index of Multiple Deprivation Decile (IMD)**  |  |  |
| ≤ 4 (1=most deprived) | 84 | 65.1 |
| **Employment status** |  |  |
| Unemployed | 66 | 51.6 |
| Employed | 62 | 48.4 |

**Table 2: Characteristics of alters reported by participants to affect their food shopping patterns (n=577)**

|  |  |  |
| --- | --- | --- |
|  | **n** | **%** |
| **Grouped alters identified**  |  |  |
| ***People*** | **414** | **71.9** |
| Partners | 88 | 15.3  |
| Children | 176 | 30.6 |
| Other family and friends | 136 | 23.6 |
| Health promoters | 14 | 2.4 |
| ***Resources*** | **192** | **28.1** |
| Recipes | 42 | 7.3 |
| Health improvement resources | 38 | 6.6 |
| Food advertisements/ mediaa,b | 82 | 14.2 |
| **Gender of alters** |  |  |
| Male | 210 | 37.5 |
| Female | 194 | 34.6 |
| Not applicable | 156 | 27.9 |
| **Frequency of Contact** |  |  |
| Daily | 396 | 68.6 |
| Weekly | 128 | 22.2 |
| Monthly | 35 | 6.1 |
| < Monthly | 18 | 3.1 |

a Television, radio, social media, news media and in-store advertisements, in-store and fast-food promotions, social media, television and celebrity recipes

*b* These include people alters that were unable to be categorised by gender, for example colleagues were grouped together rather than specifying particular colleagues. This group was predominantly resources.

**Table 3: Participants’ perception of the frequency that alter groups eat healthily/promote healthy eating or are important for healthy shopping choices**

|  |  |  |
| --- | --- | --- |
|  | **Eat healthily/Promote healthy eating** |  **Important in for healthy shopping choices** |
|  | **Never** | **Sometimes** | **Usually** | **Always** | **Not important** | **Somewhat important** | **Very important** |
| **Alter Group** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Partners | 13 | 14.8 | 32 | 36.4 | 24 | 27.3 | 19 | 21.6 | 46 | 52.3 | 24 | 27.3 | 18 | 20.5 |
| Children | 30 | 17.1 | 52 | 29.6 | 54 | 30.7 | 40 | 22.7 | 89 | 50.6 | 38 | 21.6 | 49 | 27.8 |
| Other family and friends | 13 | 9.6 | 52 | 38.2 | 35 | 25.7 | 36 | 26.5 | 82 | 60.3 | 37 | 27.2 | 17 | 12.5 |
| Health promoters | 0 | 0.0 | 2 | 14.3 | 0 | 0.0 | 12 | 85.7 | 11 | 78.6 | 3 | 21.4 | 0 | 0.0 |
| Recipes | 0 | 0.0 | 23 | 54.8 | 8 | 19.1 | 11 | 26.2 | 29 | 69.1 | 12 | 28.6 | 1 | 2.4 |
| Health improvement resources | 0 | 0.0 | 0 | 0.0 | 2 | 5.3 | 36 | 94.7 | 14 | 36.8 | 16 | 42.1 | 8 | 21.1 |
| Food advertising and media | 5 | 6.1 | 62 | 75.6 | 7 | 8.5 | 8 | 9.8 | 28 | 35.0 | 38 | 47.5 | 14 | 17.5 |

|  |  |  |
| --- | --- | --- |
|  | **Unadjusted** | **Adjustedc** |
| **Variable** | **β** | **(95% CI)** | **P-value** | **n** | **β** | **(95% CI)** | **P-value** | **n** |
| **Eat healthilya** | 0.17 | (-0.06, 0.40) | 0.15 | 124 | 0.16 | (-0.06, 0.39) | 0.16 | 118 |
| **Eats healthily x contacta** | 0.11 | (-0.14, 0.35) | 0.39 | 124 | 0.12 | (-0.12, 0.36) | 0.32 | 118 |
| **Important for healthy shopping choicesb** | 0.22 | (-0.05, 0.48) | 0.12 | 124 | 0.20 | (-0.07, 0.46) | 0.14 | 118 |
| **Important for healthy shopping choices x contactb** | 0.14 | (-0.13, 0.42) | 0.30 | 124 | 0.15 | (-0.12, 0.43) | 0.27 | 118 |

**Table 4: Four linear regression models describing associations between participants’ dietary quality score (SDs) and their perceptions that people alters eat healthily or are important for healthy shopping choices**

Note that each line in this table describes unadjusted and adjusted regression models that are separate from models in other lines

aOn a scale of 1 to 4

bOn a scale of 1 to 3

cAdjusted for number of children in the home, educational level, job status and index of multiple deprivation decile

**Table 5: Four linear regression models describing associations between participants’ dietary quality score (SDs) and their perceptions that resource alters promote healthy eating or are important for healthy shopping**

|  |  |  |
| --- | --- | --- |
|  | **Unadjusted** | **Adjustedc** |
| **Variable** | **β** | **(95% CI)** | **P-value** | **n** | **β** | **(95% CI)** | **P-value** | **n** |
| **Promote healthy eatinga** | 0.31 | (0.05, 0.57) | 0.02 | 86 | 0.31 | (0.03, 0.58) | 0.03 | 83 |
| **Promote healthy eating x contacta** | 0.35 | (0.09, 0.62) | 0.009 | 86 | 0.33 | (0.05, 0.61) | 0.02 | 83 |
| **Important for healthy shopping choicesb** | 0.39 | (0.05, 0.73) | 0.03 | 86 | 0.44 | (0.09, 0.79) | 0.02 | 83 |
| **Important for healthy shopping choices x contactb** | 0.45 | (0.11, 0.80) | 0.01 | 86 | 0.47 | (0.11, 0.83) | 0.01 | 83 |

Note that each line in this table describes unadjusted and adjusted regression models that are separate from models in other lines

aOn a scale of 1 to 4

bOn a scale of 1 to 3

cAdjusted for number of children in the home, educational level, job status and index of multiple deprivation decile.