Preventive Medicine 88 (2016) 203–209

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Socioeconomic inequalities in the healthiness of food choices: Exploring the contributions of food expenditures

Rachel Pechey [a], Pablo Monsivais [b,*]

[a] Behaviour and Health Research Unit, Institute of Public Health, University of Cambridge, Cambridge CB2 0SR, UK
[b] Centre for Diet and Activity Research, University of Cambridge, School of Clinical Medicine, Box 285, Institute of Metabolic Science, Cambridge CB2 0QQ, UK

ARTICLE INFO

Article history:
Received 17 November 2015
Received in revised form 1 April 2016
Accepted 12 April 2016
Available online 16 April 2016

Keywords:
Socioeconomic factors
Food and beverages
Health behavior
Consumer behavior

ABSTRACT

Investigations of the contribution of food costs to socioeconomic inequalities in diet quality may have been limited by the use of estimated (vs. actual) food expenditures, not accounting for where individuals shop, and possible reverse mediation between food expenditures and healthiness of food choices. This study aimed to explore the extent to which food expenditure mediates socioeconomic inequalities in the healthiness of household food choices. Observational panel data on take-home food and beverage purchases, including expenditure, throughout 2010 were obtained for 24,879 UK households stratified by occupational social class. Purchases of (1) fruit and vegetables and (2) less-healthy foods/beverages indicated healthiness of choices. Supermarket choice was determined by whether households ever visited market-defined high-price and/or low-price supermarkets. Results showed that higher occupational social class was significantly associated with greater food expenditure, which was in turn associated with healthier purchasing. In mediation analyses, 63% of the socioeconomic differences in choices of less-healthy foods/beverages were mediated by expenditure, and 36% for fruit and vegetables, but these figures were reduced to 53% and 31% respectively when controlling for supermarket choice. However, reverse mediation analyses were also significant, suggesting that 10% of socioeconomic inequalities in expenditure were mediated by healthiness of choices. Findings suggest that lower food expenditure is likely to be a key contributor to less-healthy food choices among lower socioeconomic groups. However, the potential influence of cost may have been overestimated previously if studies did not account for supermarket choice or explore possible reverse mediation between expenditure and healthiness of choices.

1. Introduction

A body of evidence shows that purchasing and consumption of unhealthy diets, in particular, eating fewer fruits and vegetables, is strongly patterned by socioeconomic status (SES) (Appelhans et al., 2012; Darmon and Drewnowski, 2008; Giskes et al., 2010; Pechey et al., 2013; UK Department for Environment, Food and Rural Affairs, 2011). One likely contributor to the socioeconomic patterning in healthy diets is the cost of food: less nutritious, energy-dense foods are often cheaper sources of calories (Drewnowski, 2010; Jones et al., 2014), and higher diet quality has been associated with higher diet cost (Bernstein et al., 2010; Lee et al., 2011; Rao et al., 2013; Rehm et al., 2015). Moreover, given most research to date has estimated diet cost by linking dietary intake data to prevailing food price data, the socioeconomic inequalities in expenditure may have been underestimated by assuming a constant price for particular foods (i.e. only accounting for differences between types of foods purchased and not variation between brands) (Monsivais et al., 2013). Even so, dietary cost explains some of the relationship between SES and nutrient density of consumed foods (Monsivais et al., 2010), and estimated diet cost has also been shown to mediate the pathway between socioeconomic status (income) and diet quality in a US sample (Aggarwal et al., 2011).

A potentially related avenue of research has suggested that consumers who patronize low-priced supermarkets are more likely to have lower-quality diets (Aggarwal et al., 2014b) and higher BMI (Chaix et al., 2012; Drewnowski et al., 2012; Lear et al., 2013). Yet even within the same store, more educated households have been found to make healthier purchases (Handbury et al., 2015). One contributing factor may be the prioritization of low cost, which may lead to preferences for certain supermarkets and also limit food choices within store (Aggarwal et al., 2014a; Pechey and Monsivais, 2015). As such, concerns about cost may be driving some of the association between supermarket price tier and healthiness of diet. Conversely, if individuals choose to patronize a particular supermarket for reasons other than price (for example, believing a store to offer a wider range of healthy products), this choice may still contribute to subsequent diet cost, given expenditure is a consequence of customers' product choices. Both choice of products within store and choice of the store itself are likely to depend in part on individuals' motivations (e.g., price, health,

* Corresponding author.
E-mail address: rachel.pechey@medschl.cam.ac.uk (R. Pechey).

http://dx.doi.org/10.1016/j.ypmed.2016.04.012

convenience), which may vary by SES (Pechey et al., 2015). As such, the relationship between diet cost and diet quality may be bi-directional. Although the extent of this bi-directionality cannot be determined in cross-sectional analyses, reverse mediation analyses offer an initial exploration of the potential contributions of each factor to socioeconomic inequalities.

Of particular interest is the extent to which financial motivations mediate socioeconomic differences in healthiness of choices, given that this would likely indicate the potential effects of changing food prices on healthiness of diet. However, financial motivations are often not possible to reliably measure directly and instead food expenditure has often been used as a proxy. Food expenditure may be influenced by supermarket choice, which may in turn have been influenced by financial motivations, but may also have been determined by other motivations (e.g. convenience). As such, in the current study we will investigate whether food expenditure mediates the pathway between socioeconomic status and healthiness of choices, with and without controlling for supermarket choice. By supermarket choice, we potentially control for the likely self-selection to a given type of supermarket. On the other hand, without controlling for supermarket choice, we run the risk of ignoring that selection of supermarket is not necessarily a free choice (e.g. it may be limited by geographic access, which could be associated with SES). So the above mediation models may reflect upper and lower bounds. As such, this study aims to explore a range of values for the possible mediation of expenditure on the socioeconomic differences in healthiness of choices.

This study extends explorations of the role of food costs as a mediator of socioeconomic inequalities in healthiness of choices; firstly, by looking at actual expenditure (rather than estimated diet costs) in a large UK sample. Secondly, reverse mediation between food expenditure and healthiness of choices will be explored. Thirdly, it will explore the associations between SES, food expenditure and healthiness of choices alongside the contribution of supermarket choice.

2. Methods

2.1. Sample

Data were obtained from the Kantar WorldPanel (KWP) UK household survey from 2010 (as this involved analyzing de-identified existing data, ethical approval was not required). The sample consists of an ongoing panel, originally recruited via post or email to be representative of the UK in terms of age group, household size and region of residence. Households must meet minimum volume and spending criteria based on household size for inclusion, based on 4-week purchasing blocks. Further details of sample recruitment and quality control have been described elsewhere (Pechey and Monsivais, 2015).

Participating households (n = 24,879) recorded all food and beverage purchases brought home (i.e. excluding purchases that were consumed away from home), including volume purchased, spend, nutritional content, and the retail chain from which products were purchased. Sociodemographic data including number of adults and children in each household, ages and genders of household members, and socioeconomic indicators were also collected.

2.2. Measures

2.2.1. Socioeconomic status

Head-of-household occupation using the UK Registrar General's social class classification (Rose and Pevalin, 2001) was categorized into three groups: Higher Managerial and Professional ('Higher': n = 5332); White Collar and Skilled Manual ('Middle': n = 13,621); and Semi-skilled and Unskilled Manual ('Lower': n = 5926).

2.2.2. Food expenditure

Expenditure was calculated from the households' total spend (£) on take-home food and beverages over the 52 week period, divided by the total number of calories those purchases for the same period, multiplied by 2000 to give an energy-adjusted food expenditure variable (£ per 2000 kcal).

2.2.3. Supermarket choice

We defined supermarket choice as in Pechey and Monsivais (2015): firstly, supermarkets were categorized as high-, medium- or low-cost based on market definitions (Food and Drink Economics branch: DEFRA, 2006; USDA Foreign Agricultural Service: Global Agriculture Information Network, 2013). Households were then classified according whether or not they ever patronized high- or low-cost supermarkets (in addition to medium-cost supermarkets, which were almost universally patronized), giving four groups: Used low-cost supermarkets exclusively or low- and medium-cost supermarkets ('Low-cost'); Used medium-cost supermarkets only ('Medium-cost'); Used high-cost supermarkets exclusively or medium- and high-cost supermarkets ('High-cost'); Used all three tiers of supermarkets ('All-types').

2.2.4. Healthiness of food and beverage choices

Two outcome variables assessed healthiness of food and beverage choices, comprising less-healthy and healthier indices:

1. Percentage of food energy purchased from less-healthy foods and non-alcoholic beverages, as classified by FSA Nutrient Profile (Rayner et al., 2005) scores for individual products (Scores are calculated from the energy, saturated fat, sugar, sodium, fiber, protein, and fruit, vegetable and nut content, per 100 g; foods scoring 4 or more, and beverages 1 or more, are categorized as less-healthy).
2. Percentage of food energy purchased from fruit and vegetables — this included fresh, canned, frozen and dried fruit, vegetables and legumes, but excluded juice, potatoes, and fruit and vegetables present in processed products.

2.3. Statistical analysis

Firstly, multiple regression analyses were conducted to explore the pathways linking 'Socioeconomic status' → 'Food expenditure' → 'Healthiness of choices' in this dataset, estimating:

1. Food expenditure by SES (using dummy variables) (*pathway 'a1/a2' in* Fig. 1)
2. The percentage of energy purchased from (a) less-healthy foods/beverages and (b) fruit and vegetables by:
   i. expenditure (*pathway 'b'*); and/or
   ii. SES (*pathway 'c'*)

Mediation analyses (conducted using the product of coefficients method with bootstrapped standard errors) then examined the role of expenditure as a potential mediator of socioeconomic inequalities in healthiness of choices (i.e. '*Socioeconomic status*' → '*Food expenditure*' → '*Healthiness of choices*': *pathways* '*a1/a2*', '*b*' *and* '*c*'' *in* Fig. 1), as well as the reverse pathway (the role of healthiness of choices as a potential mediator of socioeconomic inequalities in expenditure, i.e. '*Socioeconomic status*' → '*Healthiness of choices*' → '*Food expenditure*' *in* Fig. 1 ('*a1/a2*', '*c*'' *and* '*d*')). Socioeconomic status was indicated by three ordinal levels of occupational social class, modelled using dummy variables, running separate analyses for Higher vs. Middle occupational social class and Higher vs. Lower occupational social class (with Higher occupational social class as the reference group in both analyses). These estimates were then aggregated to give the total indirect and direct effects of expenditure as a mediator of occupational social class in healthiness of choices. Model estimates reflect the difference in purchase of each food group associated with decreasing occupational social class. To examine the impact of supermarket choice on these relationships, analyses were conducted with and without controlling for supermarket choice (i.e. *comparing* '*a1*' *and* '*a2*').