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Holm, Lotte; Nielsen, Annemette Ljungdahl; Lund, Thomas Bøker

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Adapting to financial pressure on household food budgets in Denmark: associations with life satisfaction and dietary health

Lotte Holm*, Annemette Ljungdalh Nielsen# and Thomas Bøker Lund*

*Department of Food and Resource Economics, University of Copenhagen, Denmark

Health and Care Administration, Municipality of Copenhagen, Denmark

Contact:

Loho@ifro.ku.dk

Original Article

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Abstract

In countries with wide income differentials, food insecurity leads to substantial changes in everyday food practices and to poor dietary and mental health. Less is known about consequences of food budget pressure in affluent populations and in social-democratic welfare societies with narrower income differentials. The paper describes relations between pressure on household food budgets and demographic factors in Denmark. It asks how budgetary constraint relates to life satisfaction and dietary health and how these relationships are affected when people adapt their food practices to manage pressure on budgets. Data from a representative 2015 survey of Danish households are employed. Levels of food budget pressure vary with income and household composition and are negatively associated with life satisfaction and dietary health. We find a sequence of food practice adaptations where changes in food quality, hospitality and seeking external help were being made when adjustments to food provisioning and kitchen practices were proving to be insufficient. We conclude that also in affluent social-democratic welfare societies pressure on food budgets has negative impacts on life satisfaction and health. Food budget pressure should be monitored in the future and addressed in public health policy.

Keywords

Food insecurity, health inequality, food consumption practices, life satisfaction, dietary health, social-democratic welfare society, coping, food budget pressure.

Introduction

Denmark enjoys one of the highest levels of income equality among OECD countries (OECD, 2017), but when it comes to the population's health there is a marked inequality, and in spite of political efforts to curb it, health inequality has almost doubled over the past 20 years (Koch et al., 2012). Food consumption is one contributing factor to this inequality. Unhealthy food consumption patterns are linked to cardiovascular disease, type-2 diabetes and obesity and they are strongly socially graded in the Danish population, being more than five times more prevalent in the lower strata of the population compared to the higher social strata (27% and 5% respectively) (Sundhedsstyrelsen, 2018). In public debate in Denmark this difference is often seen as the result of cultural difference linked to variations in educational level in the population rather than caused by differences in material resources (Fødevarestyrelsen, 2018), and in public health policy the role of social conditions are downplayed (Vallgård, 2011).

In this paper, we want to challenge this understanding by presenting an analysis of how people in Denmark adapt to financial pressure on their food budgets. We ask how financial pressure, adaptation of food practices and well-being and health are interrelated. The data we use stem from a representative household survey we conducted in 2015 as part of a large study about the experience and handling of financial pressure on food budgets in the Danish population. In the study, we use the term 'food budget pressure' to refer to situations where people to various degrees experience a need to reduce their expenditure on food. The term 'food security' refers to situations where people experience no such need, and the term 'food insecurity' to situations

where food budget pressure reaches the levels, which are in focus in the international research about food insecurity.

Food budget pressure and food insecurity

Food fulfills basic biological needs, necessary for health and survival but the management of food and eating is also an important practice in everyday life, which organizes social interaction and is closely related to life satisfaction. Through food and meals, people express cultural belonging and identity, and meals routinely bring social groups together on a daily basis (Holm, 2013). It follows that for most people food and eating are important for their general quality of life and in studies of life satisfaction meals are one of the daily activities which score highest in terms of joy and well-being (Csikszentmihalyi, 1997: 34 ff; Csikszentmihalyi and Hunter, 2014; Krueger et al., 2009). How people adapt their food practices when being faced with financial pressure may then influence their overall life satisfaction.

In international research *Food insecurity* is the key term used to study this issue. Food insecurity refers to the “inability to acquire or eat an adequate quality or sufficient quantity of food in socially acceptable ways (or the uncertainty of being able to do so)” (Dowler and O’Connor, 2012:45). In high-income countries with wide income differentials such as the US, Australia, United Kingdom, France and Canada, food insecurity has been routinely monitored or addressed (Bates et al., 2017; Bocquier et al., 2015; Coleman-Jensen et al., 2016; Nolan et al., 2006; Tarasuk et al., 2014) but this issue has only recently been taken up in social research in Scandinavian countries (Borch and Kjærnes 2016, Lund et al., 2018). In European statistics of poverty and social exclusion access to food is used as one of several measures of material deprivation (Eurostat, 2016), but no

specific monitoring is devoted to food deprivation. This is also the case in Scandinavian countries, such as Denmark, where research on poverty has no special focus on food consumption.

Negative impacts of food insecurity on life satisfaction are documented in qualitative in-depth studies showing that food insecurity often leads to feelings of deprivation, lack of choice, social isolation and anxiety over one's ability to provide for basic needs and feed children (Burns et al., 2013; Devine et al., 2006; Radimer et al., 1992, Dowler, 1997). Further, larger-scale survey studies show that food insecurity and mental health are negatively associated (Heflin et al., 2005; Whitaker et al., 2006) and in Denmark food insecurity is associated with low levels of life-satisfaction and psychological distress (Lund et al., 2018). Whether such associations also exist for less severe food budget pressure has not been examined.

It is well established that low income is associated with poorer dietary health. The diets of low-income groups are typically high and dense in energy, containing substantial amounts of saturated fat and sugar, and less in the way of vegetables, fish and fiber than is recommended (Darmon and Drewnowski, 2008). The social grading of food consumption in Denmark is similar, with individuals with lower levels of education consuming less fruit and vegetables and more fatty foods (Groth, Fagt and Brøndsted, 2001). A number of studies show that food insecurity is associated with poor diets known to increase the risk of chronic disease (Leung et al., 2017; Simmet et al., 2017), and that food insecurity is associated with adult obesity, diabetes, and poor mental health (Gundersen and Ziliak, 2015; Hadley and Crooks, 2012). In Danish households with low and very low food security adults are found to have less healthy diets than adults do in food secure households (Lund et al., 2018). Despite this research activity, little is known about whether, and to what degree, more modest forms of food budget restriction are negatively associated with dietary health. A

study from the US suggests that households which are not food insecure but experience significant food budget pressure share socio-economic conditions with food insecure households (Coleman-Jensen, 2010). This may imply that they will be subject to the same risks of adverse outcomes, but this needs to be confirmed empirically.

While European statistics register material deprivation at a general level (Eurostat, 2016) less is known about the everyday practices surrounding the measured material indicators. However, these practices may contribute to promote or inhibit adverse outcomes. They are therefore important to study in quantitative social inequality research. Indeed, in the food consumption area, plenty of qualitative studies suggest an important connection between responses to budget constraints, life satisfaction and the healthiness of food. People experiencing food insecurity adapt their food practices in various ways relating to food provisioning, to the quality or quantity of foods consumed, to the social organization of meals, and to dependence on gifts or loans to obtain sufficient food (Kempson et al., 2002; Alkon et al., 2013; Burns et al., 2013; Canvin et al., 2009; Kaiser and Hermsen, 2015; Pfeiffer et al., 2011). Such experiences may influence quality of life and mental health, due to forced alterations of diets in a more monotonous, and inadequate direction (Tarasuk & Maclean, 1990; Hamelin, Beaudry, & Habicht, 2002; Nielsen et al., 2015). Further, pre-occupation with access to enough food induce stress and anxiousness, powerlessness, guilt and shame along with fear of being excluded from society (Hamelin, Beaudry, & Habicht, 2002; Purdam, Garratt, and Esmail, 2015). Recently, quantitative scales to assess hunger-coping behaviors in very low-income populations have been developed and tested (Pinard et al., 2016), but at the time of the survey reported here, these scales were unpublished, and their relevance for higher income populations is unknown. A Danish study showed that the ways households changed their practices with respect to shopping, storing, cooking and eating varied with levels of

food budget pressure (Nielsen et al., 2015). To our knowledge, no quantitative studies analyze whether, or how, different ways of adapting to food budget pressure affect life satisfaction or healthiness of food consumption.

The role of food prices for the social distribution of unhealthy food consumption is contested. On the one hand, food prices have been highlighted as one important mediator of the social gradient, as high-energy-density diets are associated with lower costs. In consumer studies and media debate about barriers to healthy eating food prices and the cost of healthy diets surface (Kneafsey et al., 2013). In the US the cost of food relative to income has been found to be the major obstacle preventing low-income families from accessing the foods they prefer (Alkon et al., 2013), and in United Kingdom a growing price gap between more and less healthy foods has been documented (Jones et al., 2014). On the other hand, it has been maintained that healthy diets need not be costly (Saxe, 2011). Mathematical modelling has demonstrated that nutritional recommendations for healthy diets can be followed at very low cost when foods are selected to optimize nutrient content (Parlesak et al., 2016). In principle, then, diets can be healthy without imposing extra costs on consumers. Whether in practice people actually adapt to food budget pressure in manners which conform to this (i.e. by concurrently reducing costs and maintaining the healthiness of the diet) is an empirical question which existing research suggest to answer negatively (Leung et al., 2017; Simmet et al. 2017). However, the food insecurity research only addresses low-income populations and it is not known whether there are similar consequences in social-democratic welfare regimes. Here public policy and services are generally known to provide its citizens a socially acceptable standard of living independently of labour market participation (Esping-Andersen, 1990). This suggests that no citizen should lack access to adequate quantities and qualities of food due to insufficient income. Whether this is the case is however also an

empirical question. Within the international food insecurity research more knowledge has been called for about the responses of less vulnerable, higher-income populations to food budget pressure (Ashby et al., 2016). Learning how higher-income populations adapt to financial pressure can add to current research by providing knowledge about earlier phases in the development of food insecurity. On this background, we initiated a study on food budget pressure in Denmark

The study

How people respond to food budget pressure is a focal point in the study. In food insecurity research the term 'coping strategies' is used to describe changes people make in their daily food-related habits (Kempson et al., 2002; Alkon et al., 2013; Kaiser and Hermsen, 2015; Devine et al., 2006). The term 'coping' derives from social-psychology, where it has been defined as individuals' 'cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the person's resources' (Folkman et al., 1986 p. 993), or as 'endeavors to minimize stress in terms of loss of resources' (Hobfoll, 2010). However, this perspective cannot stand alone. Sociological research drawing on newer practice theory (Halkier et al., 2011) suggests that food consumption is a social practice, i.e. a routinized type of behavior which combines materials, competences, knowhow and meanings (Warde, 2016). It is a weakly regulated 'compound' practice, i.e. a practice where standards are not uniform but draws on several autonomous sets of standards such as culinary culture, nutrition, cooking, etiquette and gastronomy (Warde, 2013). At the same time food consumption is a kind of practice that is performed in conjunction with other practices such as sustaining energy to keep going, resting, celebrating, orchestrating family life, etc. It follows that food consumption practices are

performed in many different ways. They are not performed according to strategic decision but when people respond to given situations by implementing procedures they anticipate as being suitable (Warde, 2016). Financial and food budget pressure change the situation people find themselves in and we use the term 'adaptation' rather than 'coping' when describing the changes that people make when facing food budget pressure. We do so to underline that we see such changes as formed by the options and triggers in situations rather than by individual strategic decision making according to well-defined goals.

The study is part of a larger project which included a qualitative interview study, a representative household survey combined with registry data about socio-economic factors, and analyses of food purchase data from a large household panel (GfK Scandinavia). Results have already been published about the experience of and adaptation of practices to food budget pressure (Nielsen et al., 2015; Nielsen and Holm, 2016), consequences of unemployment for food consumption (Smed et al., 2018) and the prevalence of food insecurity in the Danish population and its association with eating- and health-related variables (Lund et al., 2018). In the current paper we focus on the full spectrum of food budget pressure ranging from food security to food insecurity. We analyze how households adapt their food practices to budget pressure and which consequences this may have for wellbeing and health. The analysis is based on data from the aforementioned household survey. With a quantitative method we abstain from in-depth analysis of performance of food consumption practices. However, we believe that it is possible to address reflections of these practices by focusing on the actions people report when engaging in food practices and the foods they consume.

In the following we describe how degrees of food budget pressure relate to socio-demographic factors and to life satisfaction and healthiness of food consumption. We then analyze how people adapt to food budget pressure and how ways of doing so vary with degree of food budget pressure. Finally, we analyze how the different ways of adapting relate to life satisfaction and healthiness of food consumption. We end by discussing implications of our analysis. But first we describe our methodology and the measures used.

Methods and material

The study employed a cross-sectional, questionnaire-based survey carried out in Denmark in 2015. A mixed-mode response format allowed participants to respond via either the internet or telephone. The Danish National Statistics Bureau, Statistics Denmark, who also carried out the data collection, drew a random disproportional stratified sample of 4164 households. The disproportional sampling was carried out in order to improve the accuracy of the analysis, and it involved oversampling of households from the lowest income quintile, single-person and single-parent households. The oversampling helps to obtain more accurate estimates of population averages/proportions of the main measures (Hibberts et al 2012). To induce participation a prize draw was set up for people who responded. Adults (18 years or more, randomly selected from the household) were contacted by letter and first invited to respond to the questionnaire online. Reminders were sent out after two weeks, and individuals who did not respond online after this were contacted by telephone and invited to participate in a computer-assisted telephone interview if they preferred. The overall response rate was 45%, varying from 29% for single parent families in the lowest income quintile and 59% for couples with income above this level and no children. The varying response rates in different strata are not surprising, as low-status groups are

known to be less prone to participate in surveys. To account for the disproportional stratified sampling and non-response rates, data were weighted (adjusting to population prevalence regarding housing, education, region, income, and family type) in analyses where the whole sample was used (see later for details). Still, this does not guarantee that non-response bias is accounted for. We explored this risk further by comparing prevalence on some of the main measures in this study with prevalence observed in other studies. Judged by this comparison, the non-response issue appears to be very modest: (weighted) average life satisfaction in this study sample was 7.4 (95% CI 7.2-7.6) which is very similar to the 7.5 found in another Danish population survey carried out in 2015 (Statistics Denmark, 2015). The weighted proportion in this sample that ate a healthy and unhealthy diet, respectively, was 21.7% (95% CI 19.0-24.6) and 13.0% (95% CI 10.9-15.5). This is very similar to the proportions in a 2013 population survey of Danes where the same figures were 20.9% and 13.9% (Sundhedsstyrelsen, 2014).

Measures

Food budget pressure was measured on five levels. Based on a combination of question items respondents were categorized as *food secure*, *moderately budget restricted*, *severely budget restricted*, *having low food security*, or *very low food security* (the last two categories were re-named to accord with current terminology, as in earlier research they had been labelled *food insecurity*, and *food insecurity with hunger* (Bickel et al., 2000)). The first four levels have recently been shown to portray differences in responses to budget pressure in Danish households well (Nielsen et al., 2015), but additionally the present analysis allowed low and very low security to be separated. Two question items used in studies in New Zealand and the US, respectively measured the first three levels. Respondents were asked to state to what extent within the past 12 months

the following statement was true: “I/We have been forced to buy cheaper food in order to be able to afford other things” (Salmond et al., 2005). A second item asked respondents to choose which statement best characterized the food they had eaten in the household during the past 12 months (Bickel et al., 2000). Reply options were: “We always have enough to eat and the kinds of food we want”; “we have enough to eat but not always the kinds of food we want”; “sometimes we don’t have enough to eat”; and “often we don’t have enough to eat”. Respondents indicating that the first statement was untrue, and who used the first reply option in the second were categorized as *food secure*. Respondents who replied either ‘very often’ or ‘sometimes’ to the first question *or* did not confirm the first response in the second were *moderately food restricted*. Consumers who opted for *both* of these reply options were *severely food restricted*. To measure low and very low food insecurity we used the 6-item measure developed by the US Department of Agriculture which addresses degrees of inadequate access to food, both quantitatively and qualitatively (Bickel et al., 2000), (see also Lund et al., 2018 for details). Affirmative responses to the items produce total scores ranging from 0 to 6. The measure enables the identification of low (score 2-4) and very low food security (score 5-6). Respondents qualifying in several categories were placed in the most severe category, and those qualifying in none were classified as food secure.

Adaptation of food practices. Measures of responses to restrained food budgets drew on a set of question items designed to catch adaptations in food practices pertaining to provisioning and kitchen practices, quality of food, and social aspects of eating practices. Items were constructed with the aim of including ways of adaptation that can be anticipated in not only low-income groups but broader population segments. Based on qualitative studies of food insecurity and coping practices (Dowler, 1997; Hamelin et al., 2002; Radimer et al., 1992), and of Danes experiencing food budget constraints (Nielsen and Holm, 2016), twelve question items were

formulated asking respondents about the frequency of their adoption of a range of money-saving practices within the past 12 months (for details, see Results section). The response options were 'very often', 'often', 'sometimes', 'rarely', and 'never'. Most question items were tested in an earlier survey where they were used to distinguish between different general types of response to food budget pressure (Nielsen et al., 2015).

Life satisfaction. We measured life satisfaction through the *Overall satisfaction with life* single question item used in many international studies (Jeffrey et al., 2015). We asked the question "All things considered, how satisfied are you with your life nowadays?", and required respondents to rate their satisfaction on an 11-point scale with semantic anchor points (0=Very unsatisfied and 10=very satisfied). Applying cut-off points employed by EuroStat (EUROSTAT, 2015), we collapsed the scale into a binary variable indicating high (score 9-10) or low/moderate life satisfaction (0-8).

Healthiness of food consumption. To measure this we employed Dietary Quality Score (DQS) (Toft et al., 2007). DQS is a simple measure focusing on four food components: fruit, vegetables, fish, and fats. It has been validated in the Danish context and is based on responses to eight food frequency questions, resulting in 0-9 scores through which food consumption (diets) can be categorized as unhealthy (scores 1-3), average (4-6), or healthy (7-9).

Socio-demographic background factors. From Statistics Denmark we extracted register data on gender, age (divided into four brackets), population density in the households' area (four categories), and household composition. As a measure of household purchasing power we used *household equivalent disposable income*, which was calculated by subtracting all publicly registered paid debts and taxes from the household's earnings, and adjusting the figures to account for number of household members according to OECD's modified equivalence scale

(OECD, 2009). We divided household equivalent disposable income into five brackets ranging from OECD's relative poverty definition (50% below median) to the 9-10th decile. As additional socio-economic measures we included the main provider's income source, housing status (rental or owner), and highest completed educational level in the household.

Analysis

We first describe the distribution of the five food budget pressure categories across the socio-demographic factors. Unadjusted and adjusted tests of associations between the socio-demographic factors and each level of food budget pressure are also reported (using logistic regression). In adjusted analysis, all socio-demographic factors and response-modes (CATI or telephone) are inserted as control variables.

We report Spearman's rho correlation coefficients (which are recommended for ordinal level variables) in order to assess the association between level of food budget restriction and the outcome measures of interest: life satisfaction and healthiness of food consumption. To identify underlying patterns of adapting to food budget pressure, we conduct principal component analyses (PCAs) where 11 of the 12 items regarding responses to food budget restriction are input. We expected these 11 items to reflect and be reducible to four underlying types of adaptation (see Table 4 for details). The matrix input to the analysis is based on polychoric correlations, and for each component a Cronbach's alpha value is calculated (Gadermann et al., 2012). The 12th item is not input to the component analysis, as this is the only item centering on a fifth strategy of relevance ('Less hospitality/socializing'). On basis of the PCA we calculated composite scales reflecting each type of adaptation (based on the item raw scores). All scales were rescaled to range from 0 to 100 so they are presented on a common metric. We display the extent to which

adaptations take place in the budget-restricted households, and for each type of adaptation we report correlation coefficients (Spearman's rho, and tests of associations before and after adjustment for socio-demographic factors). Finally, we examine whether the types of adaptation are associated with high life satisfaction and unhealthy food consumption employing logistic regression. In analyses where the entire sample is featured (i.e. in Tables 1 and 2, and in supplementary Table 1) the weight variable described under 'Design of study' is employed. For details of the study sample, see additional material, Table 1.

Results

Table 1 shows how food security and different levels of food budget pressure relate to socio-demographic features of the population. Most of those sampled (66.2%) were food secure, 17.7% were moderately budget restricted, 7.8% were severely budget restricted, and 6.0% and 2.4% had low and very low food security, respectively. These levels of food security are in line with earlier findings from Denmark (Borch and Kjærnes, 2016; Nielsen et al., 2015). The levels of low and very low food security here are lower than they are in the US, Canada and the UK (data are shown in supplementary Table 1; for more detailed discussion, see (Lund et al., 2018)).

Table 1 here

The table shows that level of food budget pressure varies systematically with income. The prevalence of food security increases with higher income while the prevalence of all other categories of food budget pressure decrease with higher income. The prevalence of low food

security and very low food security is highest among those with household incomes below the poverty line. Source of income (from employment, pensions or welfare benefits) is insignificant when other sociodemographic factors are controlled for (this reflects a close association with disposable income). Food budget pressure also varies significantly with household composition: Highest prevalence of food security is found among couples without children and lowest among single-parent households, whereas low and very low food insecurity as well as severe budget restriction is most prevalent among single parents. Educational background only varies significantly with low food security where it is more prevalent among people with the lowest educational levels. Variations according to gender and age are unsystematic. While more women appear to be severely budget restricted, very low food security is most prevalent among men and those aged 30-59 years. It is worth noticing that moderate food budget pressure is reported relatively evenly across all socio-demographic groups except the highest income group.

But what is the association between food budget pressure and life satisfaction and healthiness of food consumption? This is addressed in table 2.

Table 2 here

Table 2 shows clear, statistically significant associations between levels of food budget pressure and both outcomes. Degree of food budget pressure is negatively associated with life satisfaction and with healthy eating. High life satisfaction is systematically and negatively associated with level of food budget pressure, and is quite dramatically lower among those with low and, especially, very low food security. Thus, the incidence of high life satisfaction is very low among adults from households with very low food security. Still, the difference between other groups is quite

considerable too. High life satisfaction in the severely budget restricted group is almost only half of that found among the food secure and mild budget restricted households. Post-hoc tests for differences in proportions show a clear statistical significant difference (food secure vs. severely budget restricted: Chi^2 37.8(1); $p < 0.01$; mild budget restricted vs. severely budget restricted: Chi^2 17.5(1); $p < 0.05$). In contrast, a post-hoc test shows no difference between the food secure and mild budget restricted households (Chi^2 37.8(1); $p = 0.57$). For dietary health, there is a marked difference between those with low and very low food security and the rest of the population, while differences between the food secure, and the moderately, and the severely budget restricted are small and unsystematic. The differential appears primarily with regard to prevalence of an unhealthy diet which adults with low and very low levels of food security are more than twice as likely to eat compared with those in the more secure groups.

We now analyze the ways people adapt to food budget restriction. Table 3 presents data showing the take-up of eleven specific practices by study participants. Food secure participants are omitted from this analysis.

Table 3 here

The table shows that the commonest adaptation relates to shopping, with participants purchasing foods either when they are on offer or from cheaper stores. This is followed by taking care to store and use leftovers, and substituting food with cheaper versions (conventional instead of organic foods, minced meats instead of whole cuts). More than half of the food budget pressured population reported acting in these ways often or very often. Making compromises on health, tastiness and variation in foods, and stretching the food were reported by between 21% and 48%,

and almost a third, made sure to invite fewer guests for meals in their homes. A much lower proportion of households (approximately 10%) reported receiving food from family or friends as a form of help with their budgeting, or borrowing money to pay for foods.

Results from the PCA are also displayed in Table 3. Four factors were identified: 'Buying cheaper foods' (i.e. saving money during food provisioning), 'Compromising on food quality' (compromises on the quality, taste and variations in foods), 'Preparing frugal meals' (cooking and kitchen practices), and 'Depending on external help' (receiving food gifts or borrowing money to buy food). Scale means for the four derived factors showed that 'Buying cheaper foods' and 'Preparing frugal meals' were more widely adopted than 'Compromising on food quality' and, especially, 'Depending on external help'. The stand-alone measure of less hospitality/socializing is included as a fifth way of adapting to food budget pressure.

Next, we analyze how the five ways of adapting food practices relate to food budget pressure.

Table 4 here

Table 4 shows that all five ways of adapting food practices are positively associated with level of food budget pressure. The use of all ways of adapting increases with higher pressure. Adapting by 'Buying cheaper foods' and 'Preparing frugal meals' are used relatively frequently by the respondents experiencing food budget pressure, including the moderately budget restricted. 'Compromising on food quality' and 'Less hospitality/socializing' are only taken up by a minority of the moderately budget restricted (mean 30.2 and 25.9, respectively) while they are used much more frequently by those with low or very low food security. 'Depending on external help' is

hardly reported in the moderately and severely budget restricted groups, but occurs frequently in households with low food security (mean 30.0) and even more in those with very low food security (mean 52.6). In general, the correlation coefficients increase in tandem with the seriousness of the adaptations. 'Compromising on food quality' ($r=0.491$: 95% CI 0.437-0.542), 'Less hospitality/socializing' ($r=0.520$: 95% CI 0.459-0.570), and especially 'Depending on external help' ($r=0.551$: 95% CI 0.496-0.604) have stronger correlations with degree of food budget restriction than do Buying cheaper foods ($r=0.418$: 95% CI 0.352-0.477) and 'Preparing frugal meals' ($r=0.311$: 95% CI 0.242-0.374). This reveals, numerically speaking, that the more extreme adaptations are set in motion primarily when respondents are forced to adopt them by financial strain. All differences are significant also when controlling for socio-demographic factors, indicating that level of food budget pressure per se is decisive for the extent and type of adaptation embarked on.

Next, we analyze whether type of adaptation is associated with life satisfaction and dietary health when degree of food-budget restriction and socio-demographic factors are controlled for.

Table 5 here

The table shows that the adaptations of food practices relate to the two outcomes in different ways. First, going for foods with lower prices and cutting down on having guests are not important for neither life satisfaction nor healthiness of food consumption, as 'Buying cheaper foods' and 'Less hospitality/socializing' are not significantly associated with either of the outcomes. Changing kitchen practices in terms of 'Preparing more frugal meals' appears to be linked with more healthy food consumption and leave life satisfaction unaffected, while making changes that are entail

'Compromising on food quality' are negative both for life satisfaction and healthiness of food consumption. Surprisingly, 'Depending on external help' increases the probability of having high life satisfaction.

Discussion

In this article, we present the first study of the ways in which food budget pressure relates to dietary health and quality of life in an affluent population. Using data from a representative survey of Danish households we show that also in the Scandinavian welfare society Denmark food budget pressure and food insecurity exist and are associated with negative impact on life satisfaction and health. In Denmark, food budget pressure varies first of all with income and household composition, and we confirm findings from a US based study, that those facing severe food budget restriction share socio-economic conditions with those facing low and very low food security (Coleman-Jensen, 2010). In addition, we find that life satisfaction is markedly lower not only in households with low and very low food security, but also in those with severe food budget restrictions. For dietary health, however, only the groups with low and very low food security have markedly higher frequency of unhealthy food consumption. In an affluent population as the Danish, then, financial pressure on food budgets appears to affect life satisfaction at an earlier stage than healthiness of food consumption. Still, the results suggest that more modest forms of food budget restriction may have negative outcomes.

We identified five ways of adapting food consumption to budget pressure, which are parallel to those reported in studies of food insecurity from other countries (Alkon et al., 2013; Burns et al., 2013; Dowler, 1997; Pfeiffer et al., 2011). Our analysis shows that while 'Preparing frugal meals'

was positively associated with healthy food consumption 'Compromising on food quality' were negatively so. This suggests that the idea based on theoretical modelling, namely that healthy dietary recommendations and low costs can readily be accommodated at the same time (Parlesak et al., 2016; Saxe, 2011), needs to be moderated, as real-life adaptations of food consumption practices are diverse. The contrasting association to dietary health may reflect the substantive nature of the two ways of adapting food consumption practices. 'Compromising on food quality' involves altering composition of food consumption in a less healthy direction. This mirrors findings from other countries linking food insecurity to less fruit and vegetables, and to higher intake of cheap, energy-dense foods (Leung et al., 2017). It also echoes a Danish longitudinal study showing that, in the long run, unemployment leads to replacement of fresh and animal-based foods by carbohydrate- and sugar-rich foods (Smed et al., 2018). Preparing frugal meals, by contrast, probably supports the maintenance of existing eating habits, in the sense that more efficient kitchen practices (e.g. using left-overs) make it unnecessary to switch to cheaper, and less healthy foods.

It is surprising that 'Buying cheaper foods' and 'Less hospitality/socializing' were not associated with life satisfaction as meals are cornerstones in social life and central to conceptions of 'the good life'. However, life satisfaction not only depends on food, and the very strong association with food budget pressure could then be reflections of other hardships with food budget pressure than those related to food per se. Likewise, it was somewhat surprising to find that 'Depending on external help' was associated with high life satisfaction. This suggests that in Denmark gifts of food and loans of money for food tend to take place within social networks and personal relationships, rather than in transactions with charitable institutions, as described in other countries (Kaiser and Hermsen, 2015; Lambie-Mumford and Dowler, 2014).

We found that type and degree of adaptation depended on level of restriction per se. A sequence, or cascade, of adaptations were at work here, with changes in food quality, hospitality and seeking external help being made only when adjustments to food provisioning and kitchen practices were proving to be insufficient adaptations. A recent summary of qualitative studies from other countries has pointed to a sequence of just this kind (Lambie-Mumford et al., 2014) and a few quantitative surveys display sequences in how adaptations are taken up. A Danish survey had similar results to ours, (Nielsen et al., 2015) while two US studies among low and very low income groups showed sequences in people's reliance on more, and increasingly distant, personal relations for gifts and loans for food (Kaiser and Hermsen, 2015) and in the adoption of an increasing number of hunger-coping strategies (Pinard et al., 2016).

In an affluent state as Denmark, specific adaptations to budget pressure thus differ from those taken up in less affluent groups. Still, it is noteworthy, that in our study a proportion even of the moderately and severely budget restricted respondents reported limiting meal invitations to guests and 'Compromising on food quality'. Thus, even before reaching the point of low or very low food security, people seem, to some extent, to be making changes, which influence their social life and the quality of their food. This confirms the relevance of studying how people in affluent groups adapt to food budget pressure (Ashby et al., 2016).

We have contributed to existing research with the first nationally representative survey of adaptation to food budget pressure in a social-democratic Scandinavian welfare state. We have shown that even in an affluent country with a universal welfare system, food budget pressure and food insecurity are negatively associated with life satisfaction and dietary health. Our results have implications for policy and research.

Firstly, our results critique the idea, which is dominant in Danish debate and policy, that unhealthy food consumption is caused by cultural factors in terms of low educational background. Instead, our results show that material circumstances in terms of income and household structure are decisive for the pressure on food budgets people experience and its negative consequences. For public authorities in Denmark this points to a need to address more directly structural factors in public health policy. It also underlines the need for the continuous monitoring of the Danish populations' diet which has taken place since 1985 (Pedersen et al., 2015) to start paying special attention to issues of food budget pressure and food insecurity. For sociological poverty research, our study highlights the relevance of a special focus on food consumption. First, responses to food insecurity may entail a less healthy diet, and this has relevance for health inequality. This aspect should be central when analyzing consequences of deprivation. Further, food consumption practices intersect with multiple other daily practices that are central for daily life and life satisfaction. It is therefore one avenue to study in more detail the impact of poverty and deprivation on social interaction, family life, identity and wellbeing. But food is also a basic and absolute physiological need. In research, poverty and deprivation are relative phenomena related to the resources needed to obtain the living condition which is customary in their society (Lister, 2004). A focus on food consumption may highlight how even in affluent societies deprivation promotes practices which fail to fulfill basic needs.

It is a limitation of this study that it is cross-sectional, and therefore does not throw light on causality. Our findings testify to developments over time, which we cannot document with the present study design, so longitudinal studies that examine the combined trajectories and influences between budget pressure, adaptations and adverse outcomes are important to initiate. Further research is also necessary to gain more knowledge about how materials, meanings and

competences are involved in adaptation of food consumption practices following food budget pressure. The response rate of the survey was comparatively lower than typical population-based surveys carried out by Statistics Denmark. This is because of the disproportional sampling design where low-income, single-adult, and single parent households were oversampled. While, we cannot rule out non-response bias we registered only minor differences between this study and other Danish data sources regarding prevalence of healthiness/unhealthiness of food eaten, and levels of life satisfaction.

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The Authors declare that there is no conflict of interest.

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Table 1. Prevalence of food security, moderate budget restriction, severe budget restriction, low food security and very low food security across socio-demographic characteristics (n=1877) – unadjusted and adjusted p-values^A

	Food secure		Moderately budget restricted		Severely budget restricted		Low food security		Very low food security	
	%	Unadjusted/Adjusted p-values	%	Unadjusted/Adjusted p-values	%	Unadjusted/Adjusted p-values	%	Unadjusted/Adjusted p-values	%	Unadjusted/Adjusted p-values
Gender										
Woman	63.9	n.s/n.s	18.7	n.s/n.s	9.9	<0.01/<0.01	6.0	n.s/n.s	1.6	n.s/<0.05
Man	68.8		16.6		5.4		5.9		3.4	
Age										
18-29 years	45.7	<0.0001/n.s.	27.0	n.s/n.s	14.1	<0.01/n.s.	11.7	<0.05/n.s.	1.5	<0.01/<0.0001
30-44 years	58.1		20.4		10.6		6.8		4.1	
45-59 years	63.9		17.0		7.8		7.3		4.0	
60 years +	76.5		14.8		4.8		3.4		0.5	
Family type										
Couple without children	73.9	<0.0001/<0.05	18.1	n.s/n.s	4.2	<0.01/n.s.	2.3	<0.001/<0.05	1.5	<0.01/n.s.
Couple with children	62.2		20.7		9.7		6.8		0.7	
Lives alone	63.8		14.4		9.3		8.3		4.2	
Single-parent	39.3		18.6		16.6		16.8		8.7	
Housing										
Owns house/flat	72.6	<0.0001/n.s.	16.8	n.s/n.s	6.4	n.s/n.s	3.9	<0.05/n.s.	0.3	<0.0001/<0.05
Rents house/flat	57.6		18.9		10.0		8.7		5.2	
Source of income										
Employment (including self-employed, student)	63.7	<0.001/n.s.	19.7	n.s/n.s	8.6	n.s/n.s	6.3	<0.0001/n.s.	2.1	<0.0001/n.s.
Welfare benefit	54.5		6.3		6.7		21.2		11.3	
Disability pension	52.9		5.5		10.5		20.3		10.9	

Unemployment benefit	38.1		12.9		5.8		28.4		19.5	
Pension	75.4		15.4		5.8		2.7		0.7	
Household disposable income^B										
Poverty (<50% median) threshold	39.6	<0.0001/<0.0001	22.5	<0.05/<0.01	10.8	<0.0001/<0.0001	19.7	<0.0001/<0.01	7.5	<0.01/n.s
Poverty threshold to 2rd decile	53.5		17.7		16.8		8.6		3.4	
3rd and 4th decile	57.5		18.6		12.4		7.2		4.2	
5th and 7th decile	67.9		21.6		4.4		5.2		0.9	
8th to 9th decile	89.1		10.0		0.6		0.3		0	
Highest education										
No higher education	63.4	<0.05/n.s.	14.4	n.s/n.s	6.4	n.s/n.s	11.2	<0.001/<0.01	4.7	n.s/n.s
High school	48.1		25.7		12.3		12.0		1.9	
Practical education	64.9		18.8		8.0		5.78		2.6	
1-2 years higher education	76.8		8.9		9.6		1.0		3.6	
3-4 years higher education	68.9		17.2		9.8		3.2		0.9	
5 years higher education +	71.8		22.3		3.5		2.4		0	
Residential area										
West Denmark	64.9	<n.s/n.s.	17.5	n.s/n.s	8.8	n.s/n.s	7.2	n.s/n.s	1.7	n.s/n.s
East Denmark	67.8		18.0		6.5		4.5		3.2	
Total	66.2		17.7		7.8		6.0		2.4	

Notes: A: Controls include all socio-demographic factors reported in the table (input as factorial variables).

B: Poverty (<50% median) threshold: <113350 DKK; Poverty threshold to 2rd decile:113.350-155.735 DKK; 3rd and 4th decile:155.735-226.684 DKK; 5th and 7th decile: 226.684-322.871 DKK; 8th to 9th decile: >322.871 DKK.

Table 2. Degree of food budget , Dietary Quality Score and Life satisfaction

	Food secure	Moderately budget restricted	Severely budget restricted	Low food security	Very low food security	Test statistics
Dietary quality score						
Unhealthy diet (%)	10	8	11	26	35	
Medium (%)	68	74	70	62	58	
Healthy diet (%)	22	18	19	12	8	Spearman's rho -0.138; N= 1867; p < 0.001
High life satisfaction (%)						
	44	38	22	11	4	Spearman's rho -0.252; N= 1877; p < 0.001

Table 3. Details, and principal component analysis, of 11 questions about food-related adaptation to budget pressure ^A among Danes who are food budget restricted (N=752)

	Results from principal component analysis ^D				
	Mean ^B / % ^C	Buying cheaper foods	Preparing frugal meals	Compromising on food quality	Depending on external help
Shopped in cheaper places than usual	3.2 / 79.0	0.55			
Purchased more products on offer	3.3 / 83.8	0.52			
Purchased minced meat instead of whole cuts	2.6 / 58.6	0.39			
Avoided purchasing organic foods	2.8 / 64.4	0.49			
Took care to store and use leftovers	3.1 / 76.1		0.70		
Stretched the food to make it last longer	2.4 / 48.1		0.70		
Made compromises regarding the healthiness of the food	1.8 / 29.1			0.53	
Made compromises regarding the variation of foods and dishes	2.0 / 35.5			0.54	
Made compromises regarding the tastiness of foods and dishes	1.5 / 21.3			0.61	
Received food products from family, friends or others in order to help on a stretched budget	0.8 / 9.7				0.69
Borrowed money (e.g. from friends or family) to make sure that there was enough food at the end of the month	0.7 / 9.6				0.72
I made sure to invite fewer guests over to eat in our home ^G	1.8 / 32.4				
Scale mean (s.d.) ^E /	45.5 (34.4)	74.6 (21.5) /	68.4 (24.9) /	44.0 (26.2) /	19.1 (24.9) /
Cronbach's alpha ^F		0.82	0.86	0.77	0.78

^A For all question items, respondents were instructed to think about the last 12 months and asked to report how often the strategy in question had been employed. Five response options were offered: 0=Never, 1=Seldom, 2=Sometimes, 3=Often, 4=Very often.

^B The item mean was calculated on basis of the coding of responses described in note A.

^C Percentage responding “often” or “very often”

^D Polychoric correlation matrix was used as input to the principal component analysis. Factor loadings from oblimin rotation are reported (loadings <0.20 are suppressed).

^E All scales of ways of adapting are composites based on raw scores of the items that load highly on the dimension. The raw scores were rescaled to range from 0-100.

^F Cronbach’s alpha calculated using the formula: $(k * r_{avg}) / (1 + (k - 1) * r_{avg})$, where k is number of items and r_{avg} is the average of all polychoric correlations of the particular scale (Gadermann et al 2012).

^G This was a stand-alone measure of less hospitality / socializing. Therefore, it was not used in the principal component analysis.

Table 4. The use of five coping strategies by four food budget pressure groups – Spearman’s correlation coefficients with 95% CI intervals^A tests of association before and after adjustment for socio-demographic variables^B

	Buying cheaper foods (N=769)		Preparing frugal meals (N=776)		Compromising on food quality (N=772)		Less hospitality/socializing (N=771)		Depending on external help (N=780)	
	Means (sd.)		Means (sd.)		Means (sd.)		Means (sd.)		Means (sd.)	
Degree of food budget restriction										
Moderately budget restricted	64.3	(21.0)	59.3	(25.2)	30.2	(19.7)	25.9	(26.1)	6.1	(12.8)
Severely budget restricted	75.1	(20.4)	68.3	(22.9)	40.3	(24.2)	42.9	(31.5)	12.7	(16.5)
Low food security	81.3	(18.9)	72.5	(25.2)	54.3	(23.0)	59.7	(32.4)	30.0	(25.3)
Very low food security	88.7	(17.5)	85.0	(18.7)	73.2	(24.0)	82.1	(24.8)	52.6	(31.7)
Spearman’s correlation	0.418		0.311		0.491		0.520		0.551	
95% CI Intervals	0.352-0.477		0.242-0.374		0.437-0.542		0.459-0.570		0.496-0.604	
Unadjusted / adjusted test of association	< 0.001 / < 0.001		< 0.001 / < 0.001		< 0.001 / < 0.001		< 0.001 / < 0.001		< 0.001 / < 0.001	

^A Bias-corrected confidence intervals were calculated using bootstrapping (1000 replications) in Stata. Only observations where there were no missing values regarding the coping strategies were used in this analysis (N=752).

^B Socio-demographic variables included in the adjustment analysis were gender, age, household type, housing, source of income, household disposable income, highest level of education, and residential area. Only observations where there were no missing values regarding the coping strategies were used in this analysis (N=752)

Table 5. Associations between ways of adapting food consumption and high life satisfaction and unhealthy diet

Ways of adapting	High life satisfaction (N=752) ^a			Unhealthy diet (N=752) ^a		
	Coefficient	p-value	Standard Error	Coefficient	p-value	Standard Error
Buying cheaper foods	0.001	n.s.	.006	0.008	n.s.	.007
Preparing frugal meals	0.003	n.s.	.005	-0.012	*	.007
Compromising on food quality	-0.019	***	.006	0.020	***	.006
Less hospitality/socializing	-0.006	n.s.	.004	-0.001	n.s.	.004
Depending on external help	0.021	***	.006	0.005	n.s.	.005
<i>Constant</i>	-2.633	**	1.12	4.07	***	1.321

Unstandardized coefficients.

^a Results from logit regression.

In all three models, the five ways of adapting were entered as continuous predictors. Control variables entered into the regression were (all were entered as factorial predictors): degree of budget restriction, gender and age of the respondent, family type, housing, source of income, household disposable income (OECD modified), highest completed level of education in the household, residential area, and response mode.

* p < 0.10; ** p < 0.05; *** p < 0.01; n.s.: not significant.

Supplementary material: Table I. Descriptive statistics – socio-demographic variables, food budget restrictions, and reasons for food budget restriction (N=1877)

	Weighted % of the study sample (unweighted %)
Socio-demographic variables (n=1877)	
Gender	
Man	46.7 (40.8)
Woman	53.3 (59.2)
Age	
18-29 years	8.6 (13.9)
30-44 years	21.8 (25.2)
45-59 years	29.3 (32.4)
60 years +	40.4 (28.4)
Household type	
Couple without children	38.3 (28.4)
Lives alone	27.4 (16.0)
Couple with children	30.1 (26.7)
Single-parent with children	4.2 (29.0)
Housing	
Owns house/flat	57.1 (43.8)
Rents house/flat	42.9 (56.1)
Source of income	
Income from employment (employee- self-employed- student)	65.2 (66.7)
Welfare benefit	1.9 (6.3)
Disability pension	2.9 (3.1)
Unemployment benefit	1.4 (3.1)

Pensioner	28.6 (20.7)
Household disposable income	
Below poverty threshold (<60% median)	6.1 (18.4)
Poverty threshold to 3rd decile	11.2 (19.8)
3rd to 5th decile	30.4 (29.5)
5th to 9th decile	52.3 (32.3)
Highest education	
No higher education	21.2 (20.1)
High school	4.1 (8.7)
Practical education	36.9 (33.0)
1-2 years higher education	5.3 (5.3)
3-4 years higher education	20.7 (21.6)
5 years higher education +	11.9 (11.3)
Residential area	
West Denmark	55.5 (53.5)
East Denmark	45.5 (46.5)
Degree of food budget restriction (n=1877)	
Food secure	66.2
Moderately budget restricted	17.7
Severely budget restricted	7.8
Low food security	6.0
Very low food security	2.4
Reasons for food budget restrictions (n=834)	
"Our monthly costs have increased"	14.2
"We have used more money than usual"	20.0
"Unplanned events (e.g. divorce, unemployment, lower salary)"	22.8

“Planned events (e.g. pension, maternity leave, educational leave)”	11.2
“Other”	29.5
No response	2.2