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**FOOD INSECURITY AND SOCIO-DEMOGRAPHIC CHARACTERISTICS IN TWO UK ETHNIC GROUPS: AN  
ANALYSIS OF WOMEN IN THE BORN IN BRADFORD COHORT**

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## **ABSTRACT**

### **Background**

The use of food banks has risen sharply in the UK, however the epidemiology of UK food insecurity is undeveloped. This study contributes to the field by analysing socio-demographic risk factors for food insecurity in a female, ethnically diverse population.

### **Methods**

Data from the Born in Bradford cohort were matched with data on food insecurity from the nested BiB1000 study (N=1280). Logistic regression was used to model food insecurity in relation to ethnicity and socio-demographic factors.

### **Results**

Food insecurity, reported by 13.98% of the sample, was more likely among White British than Pakistani women (crude OR 1.94, 95% CI 1.37; 2.74, adjusted OR 2.37, 95% CI 1.57; 3.59). In fully adjusted analyses, food insecurity was associated with a range of socio-economic measures particularly the receipt of mean-tested benefits (adjusted OR 2.11, 95% CI 1.41; 3.15) and perception of financial insecurity (adjusted OR 8.91, 95% CI 4.14 to 19.16 for finding it difficult/very difficult compared to living comfortably).

### **Conclusions**

The finding that food insecurity prevalence may be higher than previously thought and that food insecurity is highly associated with socio-economic status, notably benefit receipt, is a cause of concern necessitating an urgent policy response.

## BACKGROUND

Food insecurity, defined as the “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways”,(1) has increased dramatically in the United Kingdom (UK) since 2008.(2) Between April 2015 and April 2016 over 1.1 million people were given at least three days’ worth of emergency food supplies from the Trussell Trust’s UK network of foodbanks.(3)

Despite the extent and urgency of people in need of food assistance, evidence on the prevalence and epidemiology of UK food insecurity remains sparse. Foodbank data serves as a proxy for a measure of food insecurity prevalence and provides the best insight into risk factors.(4) However, foodbank data underestimates the number of people facing insecure food access in the UK; United Nations (UN) survey data suggests that 8.4 million people, 10.1% of the UK population, were food insecure in 2014.(5)

There is an established body of international evidence indicating that food insecurity differs by sex. Women in low-income households are at particular risk of food insecurity and households with children headed by single females are more likely to be food insecure than other household types (6, 7). Household financial insecurity among female-headed households in North America appears to be inextricably linked to food insecurity. Tarasuk (8) found that, among women in Toronto, the circumstances identified as precipitating acute food shortages included chronically inadequate incomes; the need to meet additional, unusual expenditures; and the need to pay for accumulated debts.(8) However, a one-to-one correspondence between food insecurity and financial insecurity does not exist.(9, 10) Roughly 15% of all food insecure Canadian households are not income poor and, in 2012, 29% of food insecure US households had incomes higher than 185% of the federal poverty line.(10)

Food insecurity among women in the post-natal period may have serious implications for the wellbeing of the mother and the development of the child.(11, 12) Mothers in food insecure households often compromise their own food intake to ensure their children have sufficient food; this may lessen the direct effect of food insecurity on children in the household (through reduced food intake), however it may not necessarily protect children from the wider pervasive effects of food insecurity. The psychological consequences of maternal food insecurity have been linked to poorer infant feeding practices and increasing strain and irritability in parent-child interactions.(13)

Moreover, food in the immediate post-natal period may have long-term effects for the child: dietary patterns emerge early and track through infancy into later childhood and adulthood.(14) Given the strength of the influence of food practices throughout post-natal period on the health and wellbeing of the mother and the infant,(15, 16) improving household food security in the post-natal period is a key public health opportunity to improve long-term outcomes.

The findings of North American food insecurity research may not, however, translate directly onto the UK context, given cultural differences and variations in welfare-provision. Yet, in the absence of empirical UK evidence, understanding of predictors of food insecurity among UK populations is predominantly gleaned from North American studies. The available UK evidence suggests that food insecurity is negatively associated with household income and education (17) and is more common in households where the mothers are younger, smokers and in receipt of financial benefits.(18)

International evidence identifies ethnic variations in the prevalence of food insecurity.(7, 19-22) For example, in the United States, black and Mexican American families are more likely to be food insufficient than the general population.(7) There are reasons to believe that some UK ethnic minority groups may be particularly disadvantaged and highly vulnerable to food insecurity. In the UK, people from ethnic minority groups are more deprived and have worse health outcomes on average than the white ethnic majority.(23) Pakistanis and Bangladeshis report the poorest health, followed by Caribbeans, Indians and African Asians.(23)

There is an absence of quantitative evidence on ethnic differences in UK food insecurity. Qualitative studies in the UK have found very low use of food aid by certain ethnic minorities,(24) in particular those of Pakistani/Bangladeshi origin,(25) notwithstanding high rates of severe poverty among these groups. A possible explanation may be strong familial and social support networks among some ethnic minority groups, which shield the individual from the deleterious effects of poverty on health outcomes, such as food insecurity. However, this theory, known as the ethnic density hypothesis, has weak evidential support.

This study draws upon Born in Bradford (BiB) cohort data to investigate food insecurity among a highly vulnerable population in the UK: women who have recently given birth.(26) The dataset provides a unique opportunity to explore socio-demographic differences in food insecurity between White British (WB) and Pakistani women, an under-researched topic in the UK and internationally. The study has two aims. First, to describe the prevalence of and socio-demographic risk factors for

food insecurity in a vulnerable female population and, second, to compare the prevalence and epidemiology of food insecurity between WB and Pakistani women.

## **METHODS**

The study design is a cross-sectional study in a cohort. We analysed survey data collected from the BiB birth cohort,(11) and we combined these data with data from the nested BiB1000 study.(27) Bradford is a northern English city with high levels of socio-economic deprivation and ethnic diversity. BiB is a cohort set up to examine the impact of social, environmental, psychological, behavioural and biological factors on maternal and child health and well-being. Pregnant women (N=12453) were recruited around 26 to 28 weeks pregnancy at Bradford's only maternity unit when attending universal screening for gestational diabetes between 2007 and 2010. More than 80% of women who attended the screening were recruited into the cohort,(26) and of these 1735 took part in BiB1000 after receiving an invitation from the BiB research team.

Ethics approval for the data collection was granted by Bradford Research Ethics Committee (Ref 07/H1302/112).

We matched data from the BiB questionnaire with data on food insecurity from the nested BiB1000 study, thereby including a sub-set cohort in the study.(12)

### *Outcome variables*

The outcome of interest was food insecurity, coded as binary variable: food secure and food insecure.

### *Exposure variables*

The exposure was multiple socio-demographic factors: self-assigned ethnicity (WB and Pakistani due to predominance of these ethnic groups in the sample); cohabitation status; number of people living in the household; maternal age; occupation of the father<sup>1</sup>; receipt of means-tested benefits; perception of financial security; and maternal education.

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<sup>1</sup> Paternal employment was employed as a marker of a woman's socio-economic status because a high proportion of Pakistani women had never been employed.

## *Covariates*

Covariates used in the analyses were: maternal age; socio-economic status (as indicated by occupation of the father); receiving means-tested benefits; perception of financial insecurity; mother's education; self-assigned ethnicity (two largest groups: WB and Pakistani); cohabitation status; and number of people living in the household (measured at the 12 month wave of the nested BiB1000 study).

## **Food insecurity questionnaire**

Household food insecurity was assessed when babies were 12 to 18 months using the validated 18-item US National Household Food Security Survey Measure (HFSSM).(28, 29) The food security questions condition the event or behaviour identified as being due to financial limitation (such as "... because we couldn't afford enough food"). Each question addresses an explicit time frame, either the past 12 months or the past 30 days. Taken together, the systematic set of 18 questions provide a single measure of the severity of food insecurity.(30)

Each household is classified into one of four food security status categories depending on its value on the food security scale. In 2006, following the recommendation of the US National Academy of Sciences, the four grouping classification scheme was abandoned for a scheme encompassing three groups.(29) The food insecurity survey used in the BiB1000 12 month survey wave unfortunately does not reflect these developments, using the original four group classification. Further, in the logistic regression, small sample sizes meant that the food insecurity variable had to be coded as a dichotomous variable: food secure and food insecure.

Within the BiB1000 12 month wave (N=1280), 14 women were excluded from the food insecurity analysis due to missing data or responding 'don't know' or 'refuse to answer'.

## **Statistical analysis**

We used multiple logistic regression analysis in the full sample and within the two largest ethnic groups, WB and Pakistani, to calculate unadjusted Odds Ratios (OR) of food insecurity in relation to all covariates separately. In addition, we calculated adjusted OR for 1) food insecurity in relation to all covariates combined in a multivariate model, 2) food insecurity in relation to all covariates with

p<0.1 in Model 1. Average Marginal Effects were calculated to facilitate interpretation of results. All analyses were conducted using Stata 14.

## RESULTS

There was a relatively high prevalence of respondents who reported some form of food insecurity (13.98%), however, the majority of food insecure respondents reported moderate, rather than severe, food insecurity (see Table I). Food insecurity was reported more frequently among WB (18.1%) than women of Pakistani women (10.3%) (Pearson chi2 14.23, p<0.001).

Table I. Sample characteristics

<b>Individual characteristics</b>	<b>Number in sample N total = 1280 (%)</b>	<b>Pakistani N total = 624</b>	<b>White British N total = 480</b>
Ethnic group (baseline)			
Pakistani	780 (48.87)		
White British	596 (37.34)		
Mixed Other	87 (5.45)		
Indian	65 (4.07)		
Bangladeshi	36 (2.26)		
Black	32 (2.01)		
Mean maternal age at delivery (baseline)	27.49 (sd 5.61)	27.70 (sd 5.13)	26.91 (6.10)
Occupation of the father (baseline)			
Non-manual	669 (42.10)	266 (34.59)	300 (51.81)
Manual	494 (31.09)	302 (39.27)	137 (23.66)
Self-employed	187 (11.77)	112 (14.56)	53 (9.15)
Unemployed	177 (11.14)	77 (10.01)	75 (12.95)
Other (Don't know/student)	62 (3.90)	12 (1.56)	14 (2.42)
Mother's education (baseline)			
<5 GCSE equivalent	353 (23.93)	201 (27.13)	120 (21.90)
5 GCSE equivalent	513 (34.78)	249 (33.60)	217 (39.60)
A-level equivalent	217 (14.71)	89 (12.01)	95 (17.34)
Higher than A-level	392 (26.58)	202 (27.26)	116 (21.17)
Subjective poverty (baseline)			
Living comfortably	421 (26.49)	215 (27.71)	141 (23.78)
Doing alright	666 (41.91)	315 (40.59)	257 (43.34)
Just about getting by	366 (23.03)	191 (24.61)	143 (24.11)
Finding it difficult or very difficult to manage	136 (8.56)	55 (7.09)	52 (8.77)
Receiving means-tested benefits (baseline)			
Yes	646 (40.55)	352 (45.19)	221 (37.27)
No	947 (59.45)	427 (54.81)	372 (62.73)
Cohabitation status (baseline)			
Living with the baby's father or another partner	1,372 (86.29)	739 (95.11)	441 (74.49)
Not living with a partner	218 (13.71)	38 (4.89)	151 (25.51)

Household size			
2-4 people	749 (53.81)	220 (32.35)	412 (79.54)
5-15 people	643 (46.19)	460 (67.65)	106 (20.46)
Food insecurity			
Food secure	1101 (86.02)	560 (89.74)	393 (81.88)
Moderate food insecurity	133 (10.39)	50 (8.01)	62 (12.92)
Food insecure with hunger	39 (3.04)	12 (1.92)	22 (4.56)
Food insecure with severe hunger	7 (0.55)	2 (0.32)	3 (0.62)

WB women were more likely than Pakistani women to report food insecurity (crude OR 1.94, 95% CI 1.37 to 2.74 and adjusted OR 2.15, 95% CI 1.45 to 3.17) (Table II). In bivariate analyses, food insecurity was also associated with not living with a partner, receiving benefits, paternal manual employment and unemployment compared to non-manual employment, low maternal education and subjective poverty. The increased odds of food insecurity for women not living with a partner (crude OR 2.56, 95% CI 1.74 to 3.78) were no longer significant in the adjusted model (OR 0.96, 95% CI 0.53;1.74). Of the socio-economic measures, subjective poverty had by far the strongest association with food insecurity (adjusted OR 8.91, 95% CI 4.14 to 19.16 for finding it difficult/very difficult compared to living comfortably). The wide confidence intervals are due to small sample sizes, particularly in the upper categories of the variable. Receipt of means-tested benefits was also strongly associated with food insecurity; a mother reporting receipt of means-tested benefits has an estimated 17.7% probability of reporting food insecurity (95% CI 14.31; 21.20), compared with a 9.8% probability for a mother reporting no receipt.

When stratified by ethnicity, older maternal age was associated with food insecurity among Pakistani women (adjusted OR 1.06, 95% CI 1.00; 1.12), while being associated with lower levels of food insecurity among WB women (adjusted OR 0.95, 95% CI 0.90; 1.01). The relationships between socio-economic measures and food insecurity are stronger for WB than Pakistani women (Table II). For example, the probability of food insecurity according to the adjusted model is 25.9% (95% CI 19.45; 32.40) for WB women with means-tested benefits compared with 13.0% (95% CI 8.72; 17.20) for those without. For Pakistani women, the probability of food insecurity is 11.0% (95% CI 7.45; 14.47) for those reporting means-tested benefits and 8.9% (95% CI 5.62; 12.16) for those without.

Table II. Logistic regression analysis of food insecurity (12 months) by explanatory variables at baseline (except for household size, which is taken at 12 months)

	All women			Pakistani origin		White British	
Explanatory variables	Unadjusted bivariate OR	Multivariate OR (a)	Multivariate OR (b)	Unadjusted bivariate OR	Multivariate OR	Unadjusted bivariate OR	Multivariate OR
<b>Ethnicity</b>							
Pakistani	1.00	1.00	1.00	n/a	n/a	n/a	n/a
White British	1.94 (1.37;2.74)	2.54 (1.55;4.16)	2.15 (1.45;3.17)	n/a	n/a	n/a	n/a
p value	<0.001	<0.001	<0.001	n/a	n/a	n/a	n/a
<b>Household size</b>							
2-4	1.00	1.00	n/a	1.00	1.00	1.00	n/a
5-15	1.12 (0.80;1.57)	0.97 (0.59;1.59)	n/a	1.17 (0.63;2.15)	n/a	1.29 (0.72;2.30)	n/a
p value	0.500	0.895		0.618		0.385	
<b>Age</b>	0.97 (0.95;1.00)	1.01 (0.97;1.05)	n/a	1.07 (1.02;1.12)	1.06 (1.00;1.12)	0.93 (0.89; 0.97)	0.95 (0.90;1.01)
p value	0.091	0.641		0.007	0.041	0.001	0.107
<b>Cohabitation status</b>							
Living with the baby's father or another partner	1.00	1.00	n/a	1.00	1.00	1.00	1.00
Not living with a partner	2.56 (1.74; 3.78)	0.96 (0.53;1.74)	n/a	1.26 (0.43;3.73)	n/a	1.87 (1.13;3.09)	0.91 (0.48;1.74)
p value	< 0.001	0.886	n/a	0.671	n/a	0.014	0.779
<b>Measures of SES</b>							
<b>Receipt of means-tested benefits</b>							
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.47 (1.79;3.40)	2.00 (1.27;3.14)	2.11 (1.41;3.15)	1.70 (1.01;2.87)	1.31 (0.74;2.34)	4.26 (2.61;6.93)	2.77 (1.50;5.11)
p value	< 0.001	0.003	< 0.001	0.047	0.353	<0.001	0.001
<b>Paternal employment</b>							
Non-manual	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Manual	1.75 (1.21;2.55) *	1.59 (0.96;2.63)	n/a	1.29 (0.71;2.35)	n/a	3.09 (1.76;5.41) *	2.29 (1.17;4.49) *

Self-employed	0.58 (0.29;1.17)	0.60 (0.25;1.44)	n/a	0.32 (0.09;1.11)	n/a	0.72 (0.24;2.17)	0.74 (0.22;2.43)
Unemployed	2.46 (1.52;3.97) *	1.38 (0.71;2.69)	n/a	1.49 (0.64;3.47)	n/a	3.62 (1.83;7.14) *	1.26 (0.55;2.91)
Other	1.97 (0.78;5.00)	1.41 (0.28;6.97)	n/a	-	-	3.18 (0.78;12.99)	1.32 (0.24;7.32)
<b>Mother's education</b>							
<5 GCSE equivalent	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5 GCSE equivalent	0.81 (0.54;1.21)	0.83 (0.49;1.41)	0.80 (0.50;1.28)	0.55 (0.28; 1.07)	0.59 (0.29;1.18)	0.83 (0.46;1.50)	1.34 (0.66;2.73)
A-level equivalent	0.68 (0.40;1.16)	0.88 (0.44;1.77)	0.81 (0.44;1.51)	0.66 (0.27; 1.63)	0.87 (0.34;2.22)	0.57 (0.27;1.23)	1.01 (0.41;2.52)
Higher than A-level	0.31 (0.18;0.52) *	0.47 (0.23;0.96) *	0.50 (0.27;0.92) *	0.45 (0.21;0.94) *	0.44 (0.20;0.95) *	0.18 (0.07;0.48) *	0.75 (0.24;2.37)
<b>Subjective poverty</b>							
Living comfortably	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Doing alright	2.20 (1.25;3.85) *	2.46 (1.15;5.24) *	1.86 (0.97;3.56)	2.48 (1.04;5.91) *	2.11 (0.87;5.15)	2.27 (0.90;5.73)	1.58 (0.60;4.22)
Just about getting by	5.71 (3.26;9.98) *	6.13 (2.86;13.13) )*	4.61 (2.42;8.78) *	4.24 (1.76;10.18) )*	3.41 (1.38;8.43) *	9.00 (3.62;22.35) )*	5.90 (2.24;15.52) )*
Finding it difficult/very difficult to manage	10.91 (5.80;20.56) )*	12.14 (4.99;29.53) )*	8.91 (4.14;19.16) )*	8.30 (2.99;23.02) )*	8.39 (2.93;23.99) )*	17.00 (5.91;48.87) )*	11.84 (3.61;38.80) )*

(a) Multivariate model controlling for ethnicity, household size, age cohabitation status and paternal employment.

(b) Final multivariate model with predictors from Model a with  $p < 0.1$

\*  $p$  value  $< 0.05$ .

## DISCUSSION

### Main finding of this study

In our low-income, multi-ethnic UK sample 14% was food insecure. Food insecurity was higher among WB (18.9%) than Pakistani (10.3%) women, over and above other socio-demographic factors. Food insecurity was associated with maternal age and multiple markers of socio-economic status (SES). A woman's perception of her financial security had the strongest association with food insecurity, even when adjusted for other demographic characteristics such as ethnicity, age and

cohabitation status. However, receipt of means-tested benefits was also highly associated with food insecurity. The demographics of food insecurity differed between Pakistani and WB women. Maternal age was only associated with food insecurity among Pakistani women and the relationships between various SES measures and food insecurity were stronger for WB women.

### **What is already known on this topic**

The prevalence of food insecurity (14%) was higher than that reported in the Southampton Women's Survey (SWS) cohort study (4.6%) (18) and the E-Risk Study (9.7%).(31) Differences in methodology used for the assessment of food insecurity and socio-demographic differences between the populations make direct comparisons difficult. However, given the strong demand found at the ten food banks in Bradford,(24) the high prevalence of food insecurity identified is likely to reflect a contemporary acute need for support. It is well established that SES, particularly income, is the household characteristic most predictive of food insecurity status,(9, 32-35) as was apparent here. In this study, financial insecurity had the strongest association with food insecurity; while this may be a reflection of the strength of the association between perception of financial insecurity and food insecurity, it may also be attributable to the subjective nature of both measures. Further, SES is not a relevant predictor of food insecurity for everyone.(9) In the United States, half of those experiencing hunger have incomes above the poverty level.(9) Reflecting this, 15.2% of women in our sample reporting to be 'living comfortably'/'doing alright' reported food insecurity.

International evidence finds ethnic variations in the prevalence and experience of food insecurity (19, 21, 36) and identifies an over-representation of US African Americans at food pantries.(37, 38) This study also identified variations in food insecurity by ethnicity, with Pakistani women reporting lower levels than WB women. No studies on food insecurity and ethnicity have, to our knowledge, disaggregated South Asians into Indians, Pakistanis and Bangladeshis, limiting comparison or validation of these findings. Our finding that Pakistani women are statistically less likely to report food insecurity than WB women may be explained by multiple factors. Extended living, the traditional norm in many immigrant communities of South Asian origin, where three or more generations of a family live in the same household, may be associated with good health outcomes.(39) When living in socioeconomic deprivation, extended families may be more likely to share the burden of financial restrictions and provide emotional support. However, we found that, although Pakistani women were more likely to live in larger households, the number of people in the household was not associated with food insecurity. Alternatively, intra- and inter-household social

support may be a protective factor against food insecurity.(16) Some South Asian cultures observe a tradition whereby women receive social support in the period immediately after birth; evidence suggests that women who have lower levels of social support find it difficult to adhere to traditional eating practices, cook and consume healthy foods following birth.(16) However, self-perceived social capital within Pakistani households in Bradford is lower than that within WB households.(39) It is possible that wider social networks provide financial and emotional support to poor Pakistani families within the community, making them less vulnerable to poor health outcomes, such as food insecurity. Although the evidence is mixed, studies indicate that social capital can buffer health outcomes of disadvantaged groups.(40-44) The *biraderi* – kinship networks within the Pakistani community – operate in Bradford and may be an important social structure within which social and economic capital are exchanged.(45, 46) However, the extent to which social networks mitigate food insecurity among the Pakistani community requires more research.

### **What this study adds**

This study is the first on food insecurity in an ethnically diverse population in the UK. The finding that food insecurity prevalence may be higher than previously thought and that food insecurity is highly associated with SES, notably benefit receipt, is a cause for concern necessitating an urgent policy response. The rapid spread of foodbanks is a new phenomenon, raising concerns from the UK's Faculty of Public Health that "the welfare system is increasingly failing to provide a robust last line of defence against hunger."(47) Changes to the social security system, as well as the inadequacy of social security payments for a minimum standard of living,(48) appear to be a key driver of increases in UK food insecurity.(49) In this study, 33.3% of women in receipt of Income Support and 26.1% in receipt of Job Seekers Allowance reported food insecurity, pointing to the insufficiency of this state support for women with young children at a crucial time of life.

Physicians have key roles as advocates, however in the current foodbank system physicians are adopting gatekeeper roles.(50) According to a recent survey, 22% of GPs have been asked to make referrals to foodbanks.(50) In Canada, household food insecurity has been found to be a robust predictor of both health care utilization and health-related costs incurred by working-age adults.(51) Indeed, NHS statistics show that 7366 people were admitted to hospital with a primary or secondary diagnosis of malnutrition between August 2014 and July 2015.(52) Action on the root social and economic factors that trigger reliance on food banks is urgently required.

Food insecurity was lower in Pakistani households and the strength of the association between food insecurity and SES was weaker in the Pakistani sub-sample. This may be attributable to under-diagnosis of food insecurity, inadequate measurement of SES among Pakistani households (53) and/or the protective role of social networks within ethnic minority groups,(42) providing a buffer against the detrimental effects of poverty on health outcomes. Further research on the perception and experience of food insecurity in varying ethnic groups is required to explain differences.

### **Limitations of this study**

The sample consists of a highly selected cohort - women in Bradford obtaining practical care at the Bradford Royal Infirmary from 2007-09 - and cannot be generalized to all pregnant women. The sample is more ethnically diverse and has higher levels of deprivation than the UK average; the findings may, therefore, have limited relevance for affluent, ethnically homogenous areas of the UK. Sample size limitations restricted the number of ethnic groups available for analysis and, hence, we focused on the two largest ethnic groups – WB and Pakistani. In addition, the demographics of the sample allow for conclusions about food insecurity among women only.

The food insecurity questionnaire was conducted at one time-point, precluding longitudinal analysis, and hunger was self-reported, raising questions about the reliability of the measure. It is possible that the measure of household food insecurity is a poor reflection of the food security status of the women in the sample as among pregnant women and new mothers, evidence suggests that, household food insecurity may not be associated with overall diet quality.(54) In the multivariate analysis, adult items are not considered separately from child items and, hence, differences in reporting child experiences of hunger could underlie differences in the prevalence of food insecurity. Further research (sensitivity analyses) is required re-running the analysis only using items in the adult set to assess whether ethnic differences still hold.

Immigration status is not addressed in the study and it is possible that differences exist between women who are first generation immigrants and those from families that have been in the UK for over 30 years. However, the issues are too complex and the people's status too ambiguous for immigration status to be included as an aside in this article. An in-depth consideration of the effect of immigration on food security is a subject for further research.

Unfortunately it was not possible to obtain a valid measure of income for all sample participants and perceived financial security, highly associated with food insecurity, may be problematic. It is a) subjective b) highly correlated with food insecurity, opening up the possibility of collinearity c) subject to very small sample sizes in the more severe categories, resulting in large confidence intervals.

## REFERENCES

1. Anderson S, A. Core Indicators of Nutritional State for Difficult-to-Sample Populations. *The Journal of Nutrition*. 1990; 120:1555-600.
2. Loopstra R, Reeves A, Taylor-Robinson D, Barr B, McKee M, Stuckler D. Austerity, sanctions, and the rise of food banks in the UK. *BMJ* 2015; 350:h1775
3. Trussell Trust. Foodbank use tops one million for first time says Trussell Trust. Trussell Trust 2016.
4. Loopstra R, Fledderjohann J, Reeves A, Stuckler D. The impact of benefit sanctioning on food insecurity: a dynamic cross-area study of food bank usage in the UK. Oxford: University of Oxford. 2016.
5. Taylor A, Loopstra R. Too Poor to Eat: Food insecurity in the UK. London: The Food Foundation May 2016.
6. Dixon LB, Winkleby MA, Radimer KL. Dietary Intakes and Serum Nutrients Differ between Adults from Food-Insufficient and Food-Sufficient Families: Third National Health and Nutrition Examination Survey, 1988–1994. *The Journal of Nutrition*. 2001; 131:1232-46.
7. Alaimo K, Briefel RR, Frongillo EA, Olson CM. Food insufficiency exists in the United States: results from the third National Health and Nutrition Examination Survey (NHANES III). *American Journal of Public Health*. 1998; 88:419-26.
8. Tarasuk V. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. *Journal of Nutrition*. 2001; 131:2670-6.
9. Rose D. Economic Determinants and Dietary Consequences of Food Insecurity in the United States. *The Journal of Nutrition*. 1999; 129:517.
10. Olabiyi OM, McIntyre L. Determinants of Food Insecurity in Higher-Income Households in Canada. *Journal of Hunger & Environmental Nutrition*. 2014; 9:433-48.
11. Leadbeater BJ, Bishop SJ. Predictors of Behavior Problems in Preschool Children of Inner-City Afro-American and Puerto Rican Adolescent Mothers. *Child Development*. 1994; 65:638-48.
12. Silver EJ, Bauman LJ, Camacho S, Hudis J. Factors Associated with Psychological Distress in Urban Mothers with Late-Stage HIV/AIDS. *AIDS and Behavior*. 2003; 7:421-31.

13. Collins L. The Impact of Food Insecurity on Women's Mental Health: How it Negatively Affects Children's Health and Development. *Journal of the Association for Research on Mothering*. 2009; 11.
14. Sahota P, Rudolf MCJ, Dixey R, Hill AJ, Barth JH, Cade J. Randomised controlled trial of primary school based intervention to reduce risk factors for obesity. *BMJ*. 2001; 323:1029.
15. Higginbottom GMA, Morgan M, Dassanayake J, Eyford H, Alexandre M, Chiu Y, et al. Immigrant women's experiences of maternity-care services in Canada: a protocol for systematic review using a narrative synthesis. *Systematic Reviews*. 2012; 1:27.
16. Higginbottom GMA, Hadziabdic E, Yohani S, Paton P. Immigrant women's experience of maternity services in Canada: A meta-ethnography. *Midwifery*. 2014; 30:544-59.
17. Tingay RS, Tan CJ, Tan NCW, Tang S, Teoh PF, Wong R, et al. Food insecurity and low income in an English inner city. *Journal of Public Health*. 2003; 25:156-9.
18. Pilgrim A, Barker M, Jackson A, Ntani G, Crozier S, Inskip H, et al. Does living in a food insecure household impact on the diets and body composition of young children? Findings from the Southampton Women's Survey. *Journal of Epidemiology and Community Health*. 2012; 66:e6.
19. Stuff JE, Casey PH, Szeto KL, Gossett JM, Robbins JM, Simpson PM, et al. Household Food Insecurity Is Associated with Adult Health Status. *The Journal of Nutrition*. 2004; 134:2330-5.
20. Chilton M, Black MM, Berkowitz C, Casey PH, Cook J, Cutts D, et al. Food Insecurity and Risk of Poor Health Among US-Born Children of Immigrants. *American Journal of Public Health*. 2009; 99:556-62.
21. Haering SA, Syedm SB. Community Food Security in United States Cities: A Survey of the Relevant Scientific Literature: Center for a Livable Future Johns Hopkins Bloomberg School of Public Health 2009.
22. Slocum R. Race in the study of food. *Progress in Human Geography*. 2011; 35:303-27.
23. Nazroo J. *The Health of Britain's Ethnic Minorities: Findings from a National Survey* London 1997.
24. Power M, Doherty B, Small N, Teasdale S, Pickett KE. All in it Together? Community Food Aid in a Multi-Ethnic Context. *J Soc Policy*. 2017:1-25.
25. Fitzpatrick S, Bramley G, Sosenko F, Blenkinsopp J, Johnsen S, Littlewood M, et al. *Destitution in the UK*. York: Joseph Rowntree Foundation 2016.
26. Wright J, Small N, Raynor P, Tuffnell D, Bhopal R, Cameron N, et al. Cohort profile: The Born in Bradford multi-ethnic family cohort study. *Int J Epidemiol*. 2013; 42.

27. Bryant MJ, Santorelli G, Fairley L, West J, Lawlor DA, Bhopal R, et al. Design and characteristics of a new birth cohort, to study the early origins and ethnic variation of childhood obesity. *Longitudinal and Life Course Studies*. 2013; 4:119-35.
28. Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo CM, Olson CM, et al. Household Food Security in the United States in 1995: Summary Report of the Food Security Measurement Project. Alexandria,VA: Report prepared for the U.S. Dept. Agr., Food and Consumer Service, Alexandria1997.
29. United States Department of Agriculture Economic Research Service (USDA). Definitions of Food Security. United States Department of Agriculture Economic Research Service; 2016 [cited 2016 01/02/16]; Available from: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security.aspx>.
30. Bickel G, Nord M, Price C, Hamilton WL, Cook JT. Guide to Measuring Household Food Security, Revised 2000. Alexandria, VA: USDA, Food and Nutrition Service 2000.
31. Whitaker RC, Phillips SM, Orzol SM. Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics*. 2006; 118:8.
32. Laraia BA, Siega-Riz AM, Gundersen C, Dole N. Psychosocial Factors and Socioeconomic Indicators Are Associated with Household Food Insecurity among Pregnant Women. *The Journal of Nutrition*. 2006; 136:177-82.
33. Heflin CM, Corcoran M, Siefertm K. Work Trajectories, Income Changes, and Food Insufficiency in a Michigan Welfare Population. *Soc Serv Rev*. 2007; 81:3-25.
34. Gunderson C, Gruber J. *The Dynamic Determinants of Food Insufficiency*. Washington, D.C.2001.
35. Blaylock JR, Blisard WN. Food security and health status in the United States. *Applied Economics*. 1995; 27:961-6.
36. Felker-Kantor E, Wood CH. Female-headed households and food insecurity in Brazil. *Food Security*. 2012; 4:607-17.
37. Slocum R. Anti-racist Practice and the Work of Community Food Organizations. *Antipode*. 2006; 38:327-49.
38. Slocum R. Whiteness, space and alternative food practice. *Geoforum*. 2007; 38:520-33.
39. Cabieses B, Fairley L, Uphoff E, Santorelli G, Petherick E, Prady S, et al. Household Typology and Family Social Capital Among White British and Pakistani Women in Bradford, England. *Current Women's Health Reviews*. 2014; 10:9-15.
40. Sun X, Rehnberg C, Meng Q. How are individual-level social capital and poverty associated with health equity? A study from two Chinese cities. *Int J Equity Health*. 2009; 8.

41. Pearson JA, Geronimus AT. Race/ethnicity, socioeconomic characteristics, coethnic social ties, and health: evidence from the national Jewish population survey. *Am J Public Health*. 2011; 101.
42. Pickett KE, Wilkinson RG. People like us: ethnic group density effects on health. *Ethnicity & Health*. 2008; 13:321-34.
43. Bécares L, Nazroo J, Albor C, Chandola T, Stafford M. Examining the differential association between self-rated health and area deprivation among white British and ethnic minority people in England. *Social Science & Medicine*. 2012; 74:616-24.
44. Shaw RJ, Atkin K, Becares L, Albor CB, Stafford M, Kiernan KE, et al. Impact of ethnic density on adult mental disorders: narrative review. *Br J Psychiatry*. 2012; 201.
45. Bolognani M. The Myth of Return: Dismissal, Survival or Revival? A Bradford Example of Transnationalism as a Political Instrument. *Journal of Ethnic and Migration Studies*. 2007; 33:59-76.
46. Small N, Bittles AH, Petherick ES, Wright J. Endogamy, consanguinity and the health implications of changing marital choices in the UK Pakistani community. *Journal of Biosocial Science*. 2016:1-12.
47. Ashton JR, Middleton J, Lang T. Open letter to Prime Minister David Cameron on food poverty in the UK. *The Lancet*. 383:1631.
48. Davies A, Hill K, Hirsch D, Padley M. A Minimum Income Standard for the UK in 2016. York: Joseph Rowntree Foundation 2016.
49. Cooper N, Dumbleton S. *Walking the breadline: the scandal of food poverty in 21st century Britain*. Oxford: Oxfam GB2013.
50. Matthews-King A. Increasing number of GPs asked to refer patients to foodbanks. *Pulse* 2015.
51. Tarasuk V, Cheng J, de Oliveira C, Dachner N, Gundersen C, Kurdyak P. Association between household food insecurity and annual health care costs. *Canadian Medical Association Journal*. 2015.
52. Kirby D. Malnutrition and 'Victorian' diseases soaring in England 'due to food poverty and cuts'. *The Independent*. 2015 28 October.
53. Uphoff EP, Pickett KE, Wright J. Social gradients in health for Pakistani and White British women and infants in two UK birth cohorts. *Ethnicity & Health*. 2016; 21:452-67.
54. Gamba R, Leung CW, Guendelman S, Lahiff M, Laraia BA. Household Food Insecurity Is Not Associated with Overall Diet Quality Among Pregnant Women in NHANES 1999–2008. *Maternal and Child Health Journal*. 2016; 20:2348-56.

## **AUTHORS' CONTRIBUTIONS**

MP, NS, EU, BD, B S-K and KP contributed to the design and planning of the study; MP and NU were responsible for the acquisition of the data; MP and EU contributed to the analysis and interpretation of the data; all authors contributed to the drafting and revision of the study; all authors gave final approval for the study to be published.

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