

*Nutritional adequacy and content of food bank parcels in Oxfordshire, UK: a comparative analysis of independent and organisational provision*

Article

Published Version

Creative Commons: Attribution 4.0 (CC-BY)

Open Access

Fallaize, R., Newlove, J., White, A. and Lovegrove, J. A. (2020) Nutritional adequacy and content of food bank parcels in Oxfordshire, UK: a comparative analysis of independent and organisational provision. *Journal of Human Nutrition and Diabetics*, 33 (4). pp. 477-486. ISSN 365-277X doi: <https://doi.org/10.1111/jhn.12740> Available at <https://centaur.reading.ac.uk/89085/>

It is advisable to refer to the publisher's version if you intend to cite from the work. See [Guidance on citing](#).

To link to this article DOI: <http://dx.doi.org/10.1111/jhn.12740>

Publisher: Wiley

All outputs in CentAUR are protected by Intellectual Property Rights law, including copyright law. Copyright and IPR is retained by the creators or other copyright holders. Terms and conditions for use of this material are defined in the [End User Agreement](#).

[www.reading.ac.uk/centaur](http://www.reading.ac.uk/centaur)

**CentAUR**

Central Archive at the University of Reading

Reading's research outputs online

## RESEARCH PAPER

# Nutritional adequacy and content of food bank parcels in Oxfordshire, UK: a comparative analysis of independent and organisational provision

R. Fallaize,<sup>1,2,\*</sup>  J. Newlove,<sup>1,\*</sup> A. White<sup>1,\*</sup> & J. A. Lovegrove<sup>1</sup> 

<sup>1</sup>Hugh Sinclair Unit of Human Nutrition, Department of Food and Nutritional Sciences, University of Reading, Reading, UK

<sup>2</sup>School of Life and Medical Sciences, University of Hertfordshire, Hatfield, UK

### Keywords

food banks, food insecurity, dietary analysis, nutritional adequacy.

### Correspondence

J. A. Lovegrove, Hugh Sinclair Unit of Human Nutrition, Department of Food and Nutritional Sciences, University of Reading, Whiteknights, PO Box 266, Reading RG6 6AP, UK.  
Tel.: +44 (0)118 378 6418  
Fax: +44 (0)118 931 0080  
E-mail: j.a.lovegrove@reading.ac.uk

### How to cite this article

Fallaize R., Newlove J., White A. & Lovegrove J.A. (2020) Nutritional adequacy and content of food bank parcels in Oxfordshire, UK: a comparative analysis of independent and organisational provision. *J Hum Nutr Diet*.  
<https://doi.org/10.1111/jhn.12740>

\*These authors contributed equally to the present study.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

### Introduction

Many people in the UK are struggling to feed themselves and their families, with 5.6% of the population, aged 15 years or over, reporting their struggle in 2014<sup>(1)</sup>. As a result, the use of food banks (charity or independent organisations that supply donated food directly to clients free of charge) is continuously rising in the UK. The majority of users are referred through government agencies or healthcare organisations and will typically be

### Abstract

**Background:** Food bank use has increased significantly in the UK. With the rise in demand, it is imperative that users are receiving food parcels that meet their requirements. The present study aimed to explore whether typical food parcels, supplied by The Trussell Trust and independent food banks, were meeting the daily nutrient and energy requirements of an adult user.

**Methods:** The Trussell Trust ( $n = 2$ ) and independent food banks ( $n = 9$ ) were surveyed in Oxfordshire, UK. Data were collected on food bank use, resources, donations and parcel content. The energy and nutrient contents of a representative parcel were compared with the average dietary reference values (DRVs) for an adult. Additional comparisons were made between The Trussell Trust and independent provision.

**Results:** Parcels provided energy, carbohydrate, sugar, protein and fibre contents that significantly exceeded the DRVs. In total, 62.2% of energy was provided as carbohydrate and 56.9% of the DRV was provided by sugars. The vitamin D and retinol content of the parcels was significantly lower than the DRVs, meeting 25% and 27% of users' needs respectively; provision of all other micronutrients exceeded the DRVs. The Trussell Trust's parcels provided significantly less vitamin D and copper than independent parcels.

**Conclusions:** Food bank parcels distributed in Oxfordshire, UK, exceeded energy requirements and provided disproportionately high sugar and carbohydrate and inadequate vitamin A and vitamin D compared to the UK guidelines. Improved links with distributors and access to cold food storage facilities would help to address these issues, via increased fresh food provision.

provided with a 3-day emergency food parcel. The Trussell Trust's (TT) Foodbank Network, which oversees 427 food banks in the UK, reported a 13% rise in use over the past year, with 1 332 952 3-day emergency parcels distributed between April 2017 and March 2018<sup>(2)</sup>. Primary reasons for referral were benefit delays and changes (41.5%) and low income (28.5%)<sup>(2)</sup>. A report by the All-Party Parliamentary Group on Hunger also estimated that almost half of the food given out to UK people in crisis is supplied by independent food banks and organisations

outside of the TT<sup>(3)</sup> and thus use is likely to be underestimated.

Given the reliance on food banks in the UK, it is becoming increasingly important to ensure that parcels are meeting users' nutritional requirements; however, a lack of research exists. Few studies available from Canada<sup>(4–6)</sup>, the USA<sup>(7,8)</sup> and the Netherlands<sup>(9)</sup> have consistently highlighted issues with limited fresh fruit, vegetable and dairy provision and its associated nutrients. Low amounts of dairy products, calcium and vitamins A and C were also reported in food bags following systematic review of food pantries in the USA, Canada and Australia<sup>(10)</sup>. Other studies have reported inadequate meat and meat substitutes in food baskets<sup>(6,11)</sup>. A study conducted in southwest UK, analysing food parcels ( $n = 126$ ) and associated hypothetical meal plans, also found inadequate intakes of fruits, vegetables and dairy products alongside a higher proportion of carbohydrate than recommended<sup>(12)</sup>. Ultimately, the quality of the contents of a parcel is dependent upon and directly correlates with the donations received by each food bank<sup>(9)</sup>, with significant variations between banks being reported in the literature<sup>(10)</sup>.

Food bank parcels typically consist of tinned, long shelf life products, such as soups, beans, tomatoes, vegetables, meats, fish, fruit and rice pudding, cereals/porridge, sugar and jam. The TT (for TT food banks) or food bank managers (independent organisations) provide guidelines of what to include in each parcel; however, the contents and nutritional value can vary considerably between food banks. For example, volunteers assembling parcels rely on stock availability and, although lists may stipulate the quantity of canned foods, a lack of guidance on variety/ 'quality' may increase the risk of providing nutritionally inadequate parcels. Adding perishable items (e.g. fresh apples, carrots, yogurts) to food bags has been found to improve the nutritional quality<sup>(10)</sup>, although these are challenging to store and provide to users.

Users of food banks typically have a lower socio-economic status, which has been associated with an energy dense, nutrient poor diet that is high in refined sugar and added fats, as well as low in fruits and vegetables<sup>(13)</sup>. Food insecurity is also associated with poorer health outcomes, as well as increased risks of being overweight and having diabetes and cardiovascular disease<sup>(14,15)</sup>. It is unlikely that recipients of food bank parcels are consuming a nutritionally balanced diet prior to service use and, increasingly, chronic food insecurity is reported<sup>(16)</sup>. Bazerghi *et al.*<sup>(17)</sup> also reported a shift in food bank use from short-term emergency cover to longer-term reliance for those experiencing deprivation. Hence, it is imperative that food banks work to promote long-term health goals by providing nutritionally adequate parcels for these vulnerable groups.

The present study aimed to investigate the nutritional adequacy of TT and independent food bank parcels provided in a region of the UK, Oxfordshire. The analysis focuses on adult users and parcels contents were compared to UK dietary guidelines<sup>(18–20)</sup>. It was hypothesised that the food parcels being provided in this region were not meeting the nutritional needs of adult users.

## Materials and methods

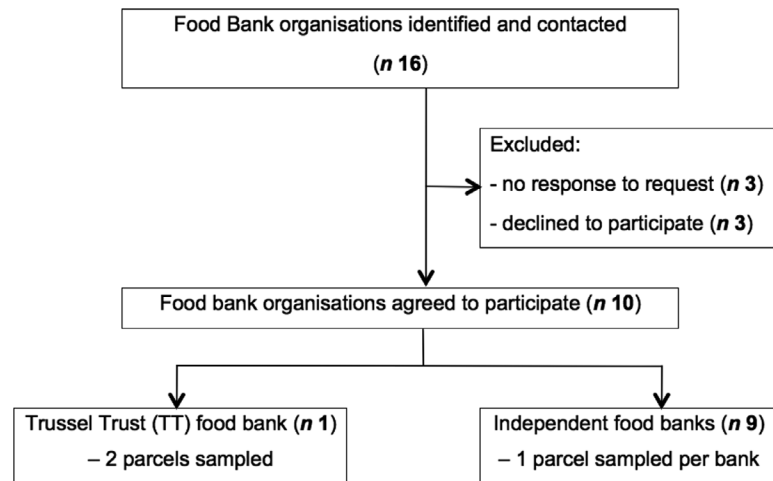
In total, 16 food bank organisations, which operated 24 food banks, were identified across Oxfordshire, UK, through Good Food Oxford (<https://goodfoodoxford.org>). Inclusion criteria were a willingness to participate and regular (more than once a week) provision of food bank parcels to users. Ten food banks, one of which was run by TT (Bicester) and nine run by separate independent organisations, agreed to participate in the study (Fig. 1). The remaining six organisations either declined to participate ( $n = 3$ ) or did not respond to the request ( $n = 3$ ). The participating banks were located in Abingdon, Banbury Salvation Army, Bicester, Farrington, Henley, North Oxfordshire, Oxford Community Emergency Food Bank, Thame, Wallingford and Wantage & Grove.

## Procedure

With the exception of Wantage & Grove, for which the response was made via e-mail including pictures of the food parcels, questionnaires were completed in person alongside food bank managers. Visits, which were conducted during food bank working hours, followed the same procedure; an average of 30 min was spent with each food bank manager completing the questionnaire, followed by a tour of the food bank's facilities and data collection on the contents of a typical food parcel. Food parcels were either made previously or compiled in real-time during the study visit for waiting clients. To enable comparison and ensure minimal assumptions as to how much of the parcel would be consumed by each service user, parcels intended for one user were selected for analysis over those intended for use by a couple or family.

## Data collection

Data were collected using a standardised questionnaire containing open and closed-ended questions regarding the number and demographic of users, sources of donations, resources provided (e.g. recipe cards, equipment, cooking advice) and whether specialist dietary requirements, such as food intolerances, were met (where data available). Food parcel data were collected in detail including type, brand (e.g. 'Green Giant'), quantity (e.g.



**Figure 1** Selection of food banks for study participation, Oxfordshire (UK).

two cans), weight (e.g. 300 g), drained weight (e.g. 180 g) and any claims regarding ‘low-fat’ or ‘low-sugar’. The amount of time the parcel was expected to last (e.g. 3 days) was also recorded.

#### Food parcel analysis

Food parcels were analysed using DIETPLAN7 (Forestfield Software Ltd, Horsham, UK) and, where available, exact product matches were made; otherwise, the product with the closest nutritional content was selected. An independent researcher verified 20% of data entries. All of the parcels analysed contained at least 500 g of white refined sugar and a jar of jam/marmalade (400 g), which were unlikely to be consumed over the suggested 3-day period. To avoid assumptions on the daily usage of the sugar/jam, the data were included both with and without these items, resulting in two outputs for each food bank. The outputs were recorded as a whole parcel and split into days of use (i.e. energy and nutrient content per day), as stated by the food bank managers.

#### Data analysis

To assess the nutritional adequacy of food parcels, outputs were compared with the UK dietary reference values (DRV) for energy, macronutrients (total fat, saturated fat, polyunsaturated fat, monounsaturated fat, protein, carbohydrate, fibre and total sugar) and micronutrients<sup>(18,19)</sup>. So that the DRVs were representative of all possible adult food bank users, an average of the values stated for a male and female ( $\geq 19$  years of age) was calculated in each case. This was calculated by finding the average of the six DRVs provided, where relevant; for example, male and female for each age bracket (19–64 years, 65–74 years and  $\geq 75$  years). This ensured minimal assumption regarding who would be the main user consuming the food parcel.

#### Statistical analysis

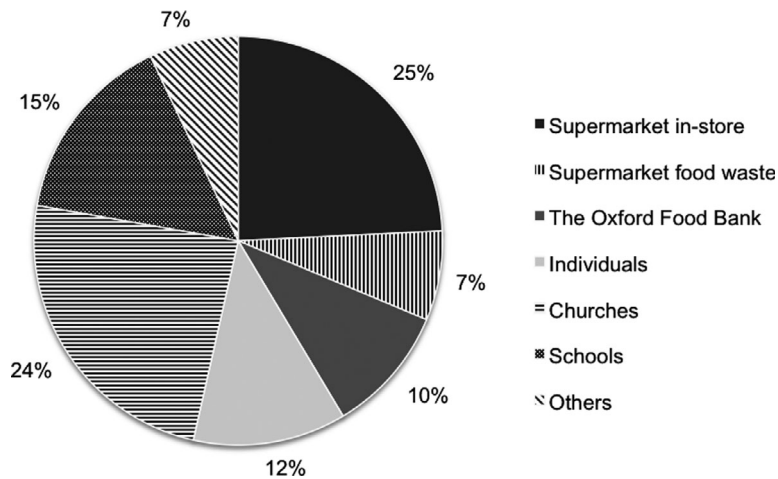
Data are presented as the mean (SD). Data were checked for normality and nonparametric data [fat (g), saturated fat (g), vitamin A retinol equivalents ( $\mu\text{g}$ ), vitamin D ( $\mu\text{g}$ )] transformed using  $\log_{10}$ . To assess whether the energy and nutrient content of a food parcel differed significantly from the UK DRVs, a one-sample *t*-test was used. The TT and independent food banks were compared using independent samples *t*-tests. Data were analysed using STATA, version 14.0 (StataCorp, College Station, TX, USA).

## Results

#### Sources of donations

The source of food donations was provided by all of the food bank organisations ( $n = 10$ ). Supermarket in-store, churches, schools and individuals comprised the majority (>75%) of food donations (Fig. 2). Sources of fresh food items (17% of donations) were supermarket food waste and the Oxford Food Bank (an organisation that redistributes supermarket fresh waste) (<https://oxfordfoodbank.org>), although just 40% ( $n = 4$ ) of the food banks had links with the Oxford Food Bank. The ‘other’ category included unique relationships with local companies and other community groups that were not churches or schools. The TT Bicester had a link with local company (Warburtons, Bicester, UK) that baked loaves of bread for them to collect twice a week. Banbury Salvation Army had links with Kentucky Fried Chicken (Banbury, UK), who donated left over breaded (processed) chicken at the end of each day; these were then fully reheated the next day and served alongside the soup lunch they offered to food bank users.

In addition to the food parcels, some of the food bank organisations also provided recipe cards ( $n = 6$ , 60%), equipment ( $n = 8$ , 80%), cooking advice ( $n = 2$ , 20%),



**Figure 2** Sources of food donations at Food Bank organisations ( $n = 10$ ) in Oxfordshire, UK.

financial advice ( $n = 10$ , 100%) and toiletries ( $n = 10$ , 100%). 'Equipment', offered on a case-by-case basis, included tin openers and pots/pans. Cooking advice comprised verbal advice on how to use/prepare the food items; no food banks offered cooking lessons. Twenty percent ( $n = 2$ ) of the food banks had access to fridges or freezers available to store fresh food.

#### Food bank parcels

The average energy and nutrient content provided by food bank parcels ( $n = 11$ ), excluding sugar and jam, for a single person per day compared to the UK DRVs is presented in Table 1. The mean energy, protein, carbohydrate, sugars, fibre and salt content of a parcel were significantly greater than the DRVs ( $P < 0.05$ ), and displayed large variance. The greatest contributor to energy in the food parcels was carbohydrate (62.2% total energy). For total fat, saturated, poly- and monounsaturated fats (g), there were no significant differences between the DRV and parcels, which provided between 87% and 113% of the DRVs. With the exception of selenium, significant differences were observed for all other nutrients with the majority providing in excess of the DRVs. Retinol and vitamin D were the only micronutrients for which the food parcel did not meet the DRV (27% and 25%, respectively). Inclusion of white refined sugar (>500 g) and jam/marmalade (>400 g) in the nutritional analysis of the food parcels resulted in a total sugar provision per day of 643% of the DRV ( $P < 0.001$ ) (see Supporting information, Table S1), and 71.5% total energy as carbohydrate.

The observation that food parcels provided 138% of the DRV for energy may be attributed to the number of days the food parcel is intended to provide intake for. Table 2 shows the energy content (kcal) per parcel

provided by each of the food bank organisations ( $n = 10$ ) and the recommended number of days the food parcel should be consumed over. The 'ideal' number of days provision was calculated based on the average DRV for energy intake (males and females aged  $\geq 19$ –75 years). These data indicate that, based on energy intake, the food parcels may be used for a greater number of days than advised by the organisations, ranging from 4 to 9 days depending on the food bank and parcel content.

#### Comparison of independent and organisation food parcels

The comparison between energy and nutrient provision of independent ( $n = 9$ ) and TT food parcels are shown in Table 3; data are presented without the inclusion of refined white sugar and jam/marmalade products. With the exception of copper and vitamin D, for which the TT parcel provided significantly less of the nutrient per day than the independent food banks ( $P < 0.05$ ), no significant differences were observed between the TT and independent food bank provision.

#### Discussion

Food bank use has increased significantly over the past decade; the largest cause of referral for food bank use (41.5%) is changes or delays to government benefit payments (e.g. universal credit, jobseeker's allowance, disability living allowance)<sup>(2)</sup>, which can take up to 6 weeks to correct. Therefore, the nutritional value of food bank parcels is increasingly important, especially with further changes planned to the benefit system and the UK being in an uncertain time over Brexit<sup>(21)</sup>. Although food bank parcels distributed in Oxfordshire, UK, exceeded energy requirements, we observed disproportionately high sugar



**Table 1** Mean energy and nutrient content of food bank parcels ( $n = 11$ ), excluding sugar and jam, in Oxfordshire, UK, for a single person food parcel for 1 day compared to UK dietary reference values (DRV)

Nutrient	Mean content per parcel (per day)*	UK DRV <sup>†</sup>	% Needs met	<i>P</i> value <sup>‡</sup>
Energy (g)	2956 (1381)	2148	138	0.025
Fat (g)	78.2 (48.8)	83.5	94	0.226
Fat (%TE)	22.9 (5.3)	35.0	65	<0.001
Saturated fat (g)	29.6 (18.9)	26.3	113	0.978
Saturated fat (%TE)	8.6 (2.3)	11.0	78	0.007
Polyunsaturated fat (g)	29.6 (18.4)	31.2	95	0.903
Monounsaturated fat (g)	12.9 (8.3)	15.5	83	0.506
Protein (g)	110 (33)	50	220	<0.001
Carbohydrate (g)	485 (139)	286	170	<0.001
Carbohydrate (%TE)	62.2 (5.0)	50.0	124	<0.001
Sugars (g)	164 (58)	59.1	277	<0.001
Fibre (NSP) (g)	50.9 (15.4)	18.0	283	<0.001
Salt (g)	10.8 (4.4)	6.0	180	0.005
Sodium (mg)	4316 (1752)	2400	180	0.005
Potassium (mg)	4881 (1142)	3500	139	0.003
Calcium (mg)	1269 (400)	700	181	<0.001
Magnesium (mg)	505 (143)	282	179	<0.001
Phosphorus (mg)	1936 (557)	550	352	<0.001
Iron (mg)	31.2 (10.4)	8.7	358	<0.001
Copper (mg)	3.54 (0.83)	1.20	295	<0.001
Zinc (mg)	12.5 (3.8)	8.0	156	0.002
Selenium ( $\mu$ g)	80.6 (31.6)	66.0	122	0.156
Iodine ( $\mu$ g)	183 (50)	140	131	0.017
Retinol ( $\mu$ g)	171 (134)	640	27	<0.001
Vitamin D ( $\mu$ g)	2.53 (2.29)	10.0	25	<0.001
Thiamin (mg)	3.67 (1.36)	0.82	448	<0.001
Riboflavin (mg)	3.15 (0.84)	1.18	267	<0.001
Niacin (mg)	42.5 (13.1)	13.7	310	<0.001
Vitamin B6 (mg)	3.97 (2.22)	1.28	310	<0.001
Vitamin B12 ( $\mu$ g)	7.25 (3.22)	1.50	483	<0.001
Folate ( $\mu$ g)	544 (235)	200	272	<0.001
Vitamin C (mg)	117 (76)	40.0	293	0.007

NSP, non-starch polysaccharides; TE, total energy.

\*Average for each nutrient from all food bank parcels ( $n = 11$ ) presented as mean (standard deviation).

<sup>†</sup>UK government dietary recommendations have been averaged for male and females aged 19–75+.

<sup>‡</sup>Data were analysed using an independent one-sample *t*-test.

and carbohydrate provision and inadequate vitamin A and vitamin D compared to the UK guidelines. These findings suggest further support (e.g. fresh food distribution, nutrition education) is warranted in Oxfordshire to ensure that food bank users can meet healthy eating guidelines.

The total energy provided by the food parcels exceeded the UK dietary recommendations for an adult, even when energy-dense items were excluded from the analysis (>500 g of refined sugar and a 400 g jar of jam/marmalade). Additional items unlikely to be fully consumed within the intended 3-day period included 500 g of refined white pasta and, in a Dutch food parcel study, it was found that only 39.4% of food bank users consumed the whole parcel contents<sup>(9)</sup>. However, to obtain an

accurate overview of the nutritional impact of food parcels, it was noted that it is important to assess how long the food parcels lasted and what other foods users supplemented them with<sup>(9)</sup>. Based on energy intake alone, we estimated that the food parcels surveyed in the present study would provide sufficient energy for an average of 2.5 days longer than suggested, although using the food parcels over a greater period of time may further compromise micronutrient intake. Excess provision of energy in food bank parcels, according to the recommended number of days of consumption, has been observed previously in the Netherlands<sup>(9)</sup> and Canada<sup>(4)</sup>.

The carbohydrate content of the food parcels surveyed was 62.2–71.5% of total energy (DRV, 50% total energy), depending on whether sugar and jam/marmalade were

**Table 2** Energy content and intended duration of use of food parcels, including jam and sugar, provided by organisations ( $n = 10$ ) in Oxfordshire, UK, for a single person compared to UK dietary reference values (DRV)

Food banks	Energy per parcel (kcal)	Recommended number of days	Energy per day (kcal)	Ideal number of days*
Abingdon	8048	3	2683	4
Banbury Salvation Army	19 240	3	6414	9
Bicester (TT) <sup>†</sup>	10 750	3	3584	5
Oxford Community Emergency Food Bank	15 290	5	3057	7
Faringdon	10 620	5	2124	5
Henley	13 510	3	4502	6
North Oxfordshire	14 330	3	4777	7
Thame	12 200	4	3051	6
Wallingford	12 360	3	4121	6
Wantage and Grove	13 580	3	4525	6

\*Values calculated by dividing total energy (kcal per parcel) by the average UK Government Dietary Guidelines for Energy (including male and female aged  $\geq 19$ –75 years),  $2148 \text{ kcal day}^{-1}$ , rounded to the nearest whole number.

<sup>†</sup>Average of two Trussell Trust (TT) food bank parcels from Bicester.

included in the analysis. The removal of refined white sugar and jam was based on the assumption that these foods would be consumed over a greater period of time ( $>3$  days); however, it is possible that there would be increased reliance on these foods during periods of food insecurity. Nevertheless, total sugar intake still significantly exceeded the UK recommendations (277% of requirement) after removal of these products. Energy imbalance is a key risk factor for obesity<sup>(19)</sup> and excess provision of carbohydrates, especially sugar in food parcels, may have adverse health effects, including increasing the risk of nutrition-related disease. Provision of a whole bag of refined sugar (500 g) in food bank parcels echo's the supply of wartime rations<sup>(22)</sup>, when sugar would have been used to make baked goods, although it may be less useful in the present day. The inclusion of processed, canned foods, such as fruit canned in syrup, is also likely to have contributed to the high sugar content of parcels.

By contrast, the total fat provision (22.9% total energy) of the food parcels surveyed was significantly less than the UK recommendation (35% total energy), although the absolute intake (g) did not significantly differ from the recommendations. This was also observed previously in Canadian and UK food parcels, which contained sufficient energy, excess carbohydrate and reduced energy intake from fat<sup>(6,12)</sup>. University-based food bank parcels in Canada were also found to be very low in fat, despite meeting the recommended minimum food group servings<sup>(23)</sup>. Insufficient dietary fat intake may impair the absorption of fat-soluble vitamins, such as vitamins A and D, which were already lacking in the Oxfordshire parcels. Furthermore, although poly- and monounsaturated fat content did not significantly differ from requirements, the

consumption of the food parcels over a longer period of time may result in insufficiency.

The protein content of food parcels in the present study met the UK recommendations for adults, although concerns regarding the quality and bioavailability of proteins and amino acids in food parcels have been raised previously<sup>(6,23)</sup>. Exploration of protein sources in food bank parcels may be warranted to further establish whether users' needs are being met. There was no significant difference in energy and macronutrient intake between the TT and independent food banks surveyed, which is perhaps unsurprising given that some of the independent food banks reported using the TT food list as a basis for their parcels.

With the exception of vitamins A and D, micronutrient provision in the food bank parcels surveyed exceeded UK government guidelines. In addition, TT food parcels provided significantly less vitamin D than those provided by independent banks. Previous evaluation of food parcels ( $n = 126$ ) in two different food banks in southwest UK found reduced levels of vitamin C, calcium, magnesium, potassium and zinc<sup>(12)</sup>; it was suggested that 1 L of UHT milk, potatoes and pulses be added to each parcel to address this insufficiency. In French food aid users, 85.6% had vitamin D deficiency and a small proportion met the requirements for fruit and vegetables (1.2%) and dairy products (9.2%)<sup>(24)</sup>. Top sources of vitamin A and vitamin D in UK adults aged 19–64 years are cheese, vegetables, oily fish, eggs and fortified cereals, respectively; all of these were lacking in the food parcels that we surveyed<sup>(25)</sup>. An inadequate consumption of fruit, vegetables, milk and meat or meat alternatives has been observed previously in food bank users using 24-h diet recall<sup>(26–29)</sup>.



**Table 3** Comparison of average energy and nutrient of food bank parcels, including sugar and jam, provided by The Trussell Trust ( $n = 2$ ) and independent ( $n = 9$ ) food banks in Oxfordshire, UK, for a single person food parcel for 1 day

Nutrient	Mean content per parcel (per day)*		<i>P</i> value†
	The Trussell Trust	Independent	
Energy (kcal)	2927 (139)	2963 (1141)	0.929
Fat (g)	63.1 (20.7)	81.6 (53.5)	0.622
Saturated fat (g)	27.3 (12.5)	30.1 (20.6)	0.964
Protein (g)	110 (10)	109 (37)	0.937
Carbohydrate (g)	513 (23)	478 (155)	0.543
Sugar (g)	184 (3)	160 (64)	0.305
Fibre (NSP) (g)	52.5 (1.9)	50.5 (17.2)	0.749
Salt (g)	9.9 (1.1)	11.0 (4.9)	0.574
Sodium (mg)	3973 (439)	4693 (1944)	0.574
Potassium (mg)	4549 (361)	4955 (1257)	0.434
Calcium (mg)	1621 (424)	1191 (374)	0.364
Magnesium (mg)	434 (71)	520 (153)	0.322
Phosphorus (mg)	1757 (93)	1976 (614)	0.334
Iron (mg)	33.7 (0.4)	30.6 (11.6)	0.455
Copper (mg)	1.93 (0.13)	2.67 (0.86)	0.036
Zinc (mg)	10.5 (0.2)	13.0 (4.1)	0.104
Selenium (µg)	73.8 (5.7)	82.1 (35.1)	0.518
Iodine (µg)	198 (23)	180 (55)	0.498
Retinol (µg)	157 (76)	174 (148)	0.926
Vitamin D (µg)	0.75 (0.47)	2.93 (2.36)	0.031
Thiamin (mg)	4.39 (0.47)	3.51 (1.45)	0.185
Riboflavin (mg)	3.49 (0.05)	3.07 (0.92)	0.219
Niacin (mg)	42.9 (0.6)	42.4 (14.6)	0.931
Vitamin B6 (mg)	6.38 (4.19)	3.44 (1.49)	0.499
Vitamin B12 (µg)	9.65 (6.01)	6.71 (2.59)	0.614
Folate (µg)	577 (19)	538 (263)	0.673
Vitamin C (mg)	188 (78)	101 (70)	0.332

NSP, non-starch polysaccharides.

\*Average for each nutrient from food bank parcels presented as the mean (SD).

†Data were analysed using an independent samples *t*-test.

Given that it is difficult to meet vitamin D recommendations from food intake alone, the Scientific Advisory Committee on Nutrition has advised that individuals consider taking a daily vitamin D supplement of 10 µg in autumn and winter<sup>(30)</sup> (when it is not possible to synthesise vitamin D from sunlight). It would be useful to explore whether food bank users are following this guidance. Improved cold storage facilities at food banks, which are frequently cited as a key barrier to acquisition and storage of fresh foods<sup>(31–33)</sup>, would help to further address the observed deficiencies.

The food banks surveyed had a wide variety of donations and limited resources for distributing fresh food or providing cooking skills; ‘advice’ only provided by 20% of food banks; all of which are likely to impact the nutritional value of the food parcel. Previously, US clients have expressed concern over the nutritional quality of foods in pantries<sup>(34)</sup>; a systematic review of the role of food banks in addressing food insecurity identified

inadequate staff training on nutrition as a key barrier to resolving clients’ needs in the USA and Canada<sup>(17)</sup>. Just 40% of food banks surveyed in the present study had links with the fresh food distributor, the Oxford Food Bank, and all food banks expressed interest in having more storage space for fresh food. Furthermore, despite 60% of food banks giving out recipe cards, managers indicated that users might not have the cooking skills or equipment to use the food contained in the parcel effectively. Recent ethnographic research identified a number of barriers to healthy food practices in food bank users, including limited access to cooking facilities or appropriate storage facilities, associated with housing crises and reliance on temporary accommodation<sup>(35)</sup>. A lack of resources has previously been identified as a key challenge in improving food insecurity and distributing healthy foods in the USA<sup>(32)</sup> and Canada<sup>(31)</sup>. In Mexico, implementation of practical nutrition workshops and education alongside food parcel distribution to mothers ( $n = 5253$ )

increased consumption of fruit and vegetables by 6% and 10%, respectively<sup>(36)</sup>. In the UK, TT offers a 6-week budgeting and cookery course, 'eat well spend less', at 26% (110 out of 428) of its food banks<sup>(37)</sup>; however wider implementation is restricted by facilities.

The strengths of the present study include a robust methodology and the countywide survey of both TT and independent food banks, which enabled wider characterisation of the content and nutritional value of food parcels. Food basket audits are also more likely to represent the quality and quantity of parcels compared to 24-h recalls conducted at service users' initial visit to a food bank<sup>(17)</sup>. Study limitations include visual verification of just 20% of data entries, as opposed to double data entry; comparison of the food parcels contents with the UK dietary reference values, as opposed to assessing the dietary intake and requirements of actual food bank users; and sampling of a single parcel at each food bank. This resulted in the necessity for use of assumptions regarding the use of certain food items (e.g. sugar and jam); similar limitations were noted for a Dutch food bank study<sup>(9)</sup>. A further limitation was that we did not know how long the food parcel lasted, an issue frequently cited in this field<sup>(4,6,9)</sup>, nor whether the entire contents were consumed or whether the food was shared with others. We were also unable to compare sugar and fibre contents to the most up-to-date UK recommendations, which are based on free sugar and Association of Analytical Chemists fibre intakes<sup>(19)</sup>, as a result of a lack of relevant information in the nutrient database. Further research should explore how food bank parcels are utilised by service users, including the number of days over which the foods in the parcels are consumed, and whether parcels are routinely supplemented by additional foods including perishable items (e.g. butter, cheese and fresh fruit and vegetables). In the USA, allowing users to choose their own food items (client-choice pantry), in combination with motivational interviewing, and targeted referrals significantly improved food security and intake of fruits and vegetables<sup>(38)</sup>; a similar intervention could be trialled in the UK.

## Conclusions

Overall, our data show that food parcels from food banks in Oxfordshire do not align with UK government dietary recommendations. The energy, carbohydrate, sugar, protein and fibre provided greatly exceed the recommendations, although this could be explained by an underestimation of how many days the food within the parcel was consumed. Vitamins A and D failed to meet users' requirements and may be attributed to food banks lacking adequate resources to provide fresh food. To

improve the nutritional value of food parcels, food banks should be encouraged to make links with organisations that distribute fresh food where possible. However, there are fundamental restrictions on resources (e.g. refrigeration facilities) that can only be changed with greater awareness and support for food banks.

## Acknowledgments

We thank Yianna Chatzidiakou for assisting with the data collection; Hannah Fenton from Good Food Oxford for identifying and facilitating contact with the food banks; and the Oxfordshire independent food banks and The Trussell Trust for their participation in the study.

## Conflict of interests, source of funding and authorship

The authors declare that they have no conflicts of interest. No funding declared.

All authors contributed to the research protocol. RF, JN, AW and JAL designed the study. JN and AW collected the food bank data. JN, AW and RF analysed data and drafted the manuscript. All authors have read and approved the final version of the manuscript submitted for publication.

## Transparency declaration

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The reporting of this work is compliant with STROBE guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

## References

1. Taylor A & Loopstra R (2016) *Too Poor to Eat. Food Insecurity in the UK*. London: Food Foundation. Available at: <https://foodfoundation.org.uk/wp-content/uploads/2016/07/FoodInsecurityBriefing-May-2016-FINAL.pdf> (accessed December 2019).
2. The Trussell Trust (2018) "*Benefit Levels Must Keep Pace with Rising Cost of Essentials*" as Record Increase in Foodbank Figures is Revealed. Available at: <https://www.trusselltrust.org/2018/04/24/benefit-levels-must-keep-pace-rising-cost-essentials-record-increase-foodbank-figures-revealed> (accessed November 2018).
3. Forsey A (2016) *Britain's Not-so-hidden Hunger: A Progress Report from the All-Party Parliamentary Group on Hunger*. Available at: <http://www.frankfield.co.uk/upload/docs/>

- 437488\_TSO\_Britain%27s%20not-so-hidden%20hunger.pdf (accessed November 2018).
4. Teron AC & Tarasuk VS (1999) Charitable food assistance: what are food bank users receiving? *Can J Public Health* **90**, 382–384.
  5. Irwin JD, Ng VK, Rush TJ *et al.* (2007) Can food banks sustain nutrient requirements? A case study in Southwestern Ontario. *Can J Public Health* **98**, 17–20.
  6. Jessri M, Abedi A, Wong A *et al.* (2014) Nutritional quality and price of food hampers distributed by a campus food bank: a Canadian experience. *J Health Popul Nutr* **32**, 287–300.
  7. Akobundu UO, Cohen NL, Laus MJ *et al.* (2004) Vitamins A and C, calcium, fruit, and dairy products are limited in food pantries. *J Am Diet Assoc* **104**, 811–813.
  8. Hoisington A, Manore MM & Raab C (2011) Nutritional quality of emergency foods. *J Am Diet Assoc* **111**, 573–576.
  9. Neter JE, Dijkstra SC, Visser M *et al.* (2016) Dutch food bank parcels do not meet nutritional guidelines for a healthy diet. *Br J Nutr* **116**, 526–533.
  10. Simmet A, Depa J, Tinnemann P *et al.* (2017) The nutritional quality of food provided from food pantries: a systematic review of existing literature. *J Acad Nutr Diet* **117**, 577–588.
  11. Greger J, Maly A, Jensen N *et al.* (2002) Food pantries can provide nutritionally adequate food packets but need help to become effective referral units for public assistance programs. *J Acad Nutr Diet* **102**, 1126–1128.
  12. Turnbull L & Bhakta D (2016) Is UK emergency food nutritionally adequate? A critical evaluation of the nutritional content of UK food bank parcels. *Proc Nutr Soc* **75**, E8.
  13. Darmon N & Drewnowski A (2008) Does social class predict diet quality? *Am J Clin Nutr* **87**, 1107–1117.
  14. Seligman HK, Laraia BA & Kushel MB (2010) Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr* **140**, 304–310.
  15. Laraia BA (2013) Food insecurity and chronic disease. *Adv Nutr* **4**, 203–212.
  16. Ramsey R, Giskes K, Turrell G *et al.* (2012) Food insecurity among adults residing in disadvantaged urban areas: potential health and dietary consequences. *Public Health Nutr* **15**, 227–237.
  17. Bazerghi C, McKay FH & Dunn M (2016) The role of food banks in addressing food insecurity: a systematic review. *J Community Health* **41**, 732–740.
  18. The Committee on Medical Aspects of Food and Nutrition Policy (COMA) (1991) *Dietary Reference Values for Food Energy and Nutrients: Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy*. London: HMSO. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/743786/Dietary\\_Referece\\_Values\\_for\\_Food\\_Energy\\_and\\_Nutrients\\_for\\_the\\_United\\_Kingdom\\_\\_1991\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/743786/Dietary_Referece_Values_for_Food_Energy_and_Nutrients_for_the_United_Kingdom__1991_.pdf) (accessed November 2018).
  19. Scientific Advisory Committee on Nutrition (SACN) (2015) *Carbohydrates and Health*. London: The Stationary Office. Available at: <https://www.gov.uk/government/publications/sacn-carbohydrates-and-health-report> (accessed November 2018).
  20. Public Health England (2016) *The Eatwell Guide*. London. Available at: <https://www.gov.uk/government/publications/the-eatwell-guide> (accessed November 2018).
  21. Bhui K (2016) Brexit, social division and discrimination: impacts on mortality and mental illness? *Br J Psych* **209**, 181–182.
  22. Richardson M (2015) *The Hunger War: Food, Rations & Rationing 1914–1918*. Barnsley: Pen and Sword Military.
  23. Willows ND & Au V (2006) Nutritional quality and price of university food bank hampers. *Can J Diet Pract Res* **67**, 104–107.
  24. Castetbon K, Mejean C, Deschamps V *et al.* (2011) Dietary behaviour and nutritional status in underprivileged people using food aid (ABENA study, 2004–2005). *J Hum Nutr Diet* **24**, 560–571.
  25. Public Health England (2018) *NDNS: Results from Years 7 and 8 (combined): Data Tables*. National Diet and Nutrition Survey. Available at: <https://www.gov.uk/government/statistics/ndns-results-from-years-7-and-8-combined> (accessed August 2019).
  26. Starkey LJ, Gray-Donald K & Kuhnlein HV (1999) Nutrient intake of food bank users is related to frequency of food bank use, household size, smoking, education and country of birth. *J Nutr* **129**, 883–889.
  27. Bell M, Wilbur L & Smith C (1998) Nutritional status of persons using a local emergency food system program in middle America. *J Am Diet Assoc* **98**, 1031–1033.
  28. Duffy P, Zizza C, Jacoby J *et al.* (2009) Diet quality is low among female food pantry clients in Eastern Alabama. *J Nutr Educ Behav* **41**, 414–419.
  29. Starkey LJ & Kuhnlein HV (2000) Montreal food bank users' intakes. *Can J Diet Pract Res* **61**, 73–75.
  30. Scientific Advisory Committee on Nutrition (2016) *SACN Vitamin D and Health Report*. Available at: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/537616/SACN\\_Vitamin\\_D\\_and\\_Health\\_report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537616/SACN_Vitamin_D_and_Health_report.pdf) (accessed December 2017).
  31. Loopstra R & Tarasuk V (2012) The relationship between food banks and household food insecurity among low-income Toronto families. *Can Public Policy* **38**, 497–514.
  32. Rochester JS, Nanney MS & Story M (2011) Assessing Foodshelves' ability to distribute healthy foods to Foodshelf clients. *J Hunger Environ Nutr* **6**, 10–26.
  33. Campbell EC, Ross M & Webb KL (2013) Improving the nutritional quality of emergency food: a study of food bank organizational culture, capacity, and practices. *J Hunger Environ Nutr* **8**, 261–280.

34. Cooksey-Stowers K, Martin KS & Schwartz M (2019) Client preferences for nutrition interventions in food pantries. *J Hunger Environ Nutr* **14**, 18–34.
35. Thompson C, Smith D & Cummins S (2018) Understanding the health and wellbeing challenges of the food banking system: a qualitative study of food bank users, providers and referrers in London. *Soc Sci Med* **211**, 95–101.
36. Cambron SAB, Guzman N, Munoz-Osorio V *et al.* (2016) P187 Healthier habits: nutrition education through food banks in Mexico. *J Nutr Educ Behav* **48**, S81.
37. The Trussell Trust (2017) *Eat Well Spend Less: Our Six-Week Budgeting and Cookery Course*. Available at: <https://www.trusselltrust.org/what-we-do/more-than-food/eat-we-ll-spend-less/> (accessed 15 December 2017).
38. Martin KS, Wu R, Wolff M *et al.* (2013) A novel food pantry program: food security, self-sufficiency, and diet-quality outcomes. *Am J Prev Med* **45**, 569–575.

### Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Table S1.** Average provided energy and nutrient of food bank parcels ( $n = 11$ ), including sugar and jam, in Oxfordshire, UK, for a single person food parcel for 1 day compared to UK dietary reference values (DRV).