

Methodological issues using household budget survey expenditure data for individual food availability estimation: Irish experience in the DAFNE pan-European project

S Friel^{1,*}, M Nelson², K McCormack³, C Kelleher¹ and P Thriskos⁴

¹National Nutrition Surveillance Centre, Department of Health Promotion, Distillery Road, National University of Ireland, Galway, Republic of Ireland: ²Department of Human Nutrition and Dietetics, Kings College London, Franklin–Wilkins Building, Stamford Street, London, UK: ³Central Statistics Office, Skehard Road, Cork, Republic of Ireland: ⁴Department of Hygiene and Epidemiology, School of Medicine, University of Athens, Mikras Asias Street, Athens, Greece

Abstract

Objective: Irish participation in the EU-supported DATA Food NETWORKING (DAFNE) project required compliance with the overall aims and objectives. The Irish Household Budget Survey (HBS) expenditure data had to be transformed into a format compatible with the collaborative effort, by converting them into quantities of foodstuffs available per person per day.

Setting: The Irish 1987 HBS expenditure data on all commodities for 7705 households in the Republic of Ireland, collected using a 14-day diary kept by all members of the household aged 15 years and over.

Design: Following identification of 188 food items in the HBS dataset, retail prices per unit weight were sought for each food. Adjustment of prices, collected from a number of different sources, was made to those of 1987 using the Consumer Price Index. Simple models were used to estimate household food availability through application of the adjusted retail prices per unit weight to the expenditure data. The household level data were converted to food availability per person per day. An internal validation of quantities estimated using the retail prices was made using the 12 foodstuffs for which the Irish HBS collects expenses and quantities.

Results: The comparison of quantities published by the Irish Central Statistics Office for 12 foodstuffs in the Irish 1987 Household Budget Survey with the quantities estimated using equivalent expenditure data and corresponding retail prices showed agreement, with less than a 10% margin of error for 10 of the foods.

Conclusion: In spite some difficulty in converting HBS food expenditure data into food availability per person per day, the DAFNE approach is potentially useful for Irish nutrition surveillance purposes and for facilitating comparisons of the Irish HBS food data with those of other European countries.

Keywords
Nutrition surveillance
Household budget survey
Ireland

There are a variety of techniques used in nutrition surveillance to record and describe the usual food consumption habits of populations. Evaluation of national and regional patterns of household expenditure on food, and household studies of food purchases and consumption at home and out of home, are part of the classical approach to nutrition surveillance¹. As in many European countries, the Irish Household Budget Survey (HBS) is the only regular source of food information collected under governmental jurisdiction. As far back as 1979 the Irish Food Advisory Committee suggested a collaborative approach to nutrition surveillance in conjunction with the Household Budget Survey². At the European level,

development of new statistical methods and models for food aggregation was proposed through the DATA Food NETWORKING (DAFNE) initiative. An objective of this initiative was to identify and address problems associated with HBS data in order to improve comparability of food and nutrients at population and individual level in different countries³.

Objectives

The overall objective of the DAFNE EU-supported project was to develop a consistent method for comparable nutrition information retrieval, as well as to facilitate the

*Corresponding author: Email Sharon.Friel@nuigalway.ie

integration, modularity and standardisation of equipment and terminology, allowing nutrition information of all types to be shared, combined and compared⁴.

Irish participation in this project required compliance with its aims and objectives. HBS data were collected for the first time in Ireland in 1951 and now, at the turn of the millennium, the seventh survey is in process. The data are used as an economic measure mainly to determine the pattern of household expenditure at a specific time in order to update the weighting basis of the Consumer Price Index (CPI). Extensive household detail is recorded including socio-demographic and economic information as well as expenditure on all commodities.

This paper reports on the transformation of the Irish 1987 HBS data into a format compatible with the DAFNE databank. Emphasis is on the methods used to bring the Irish food data to a state conducive to the collaborative effort, specifically the conversion of expenditure into quantity.

Methods

Conversion from expenditure to quantity

Price sources

Irish household budget survey participation requires the completion of a 14-day expenditure diary within which the amount of money spent on all commodities including foodstuffs is recorded by each member of the household aged 15 years and over. Whilst other DAFNE countries record the quantity of foodstuff brought into the household, Ireland is different, with only expenditure recorded except for 12 basic food commodities for which both expenditure and quantity are recorded. Following the identification of all individual food items in the Irish data, conversion of household expenditure on these foods into the respective amount of food available was possible once the unit retail prices were known. In total, 188 individual food items were identified in the Irish 1987 HBS dataset for which retail prices per unit weight were required.

Retail prices were sought from various sources including national statistics, food organisations, retailers, consumer surveys and media. The retail price index and CPI sections of the national statistical office supplied retail prices for some foods but were at a broad, generic level and were largely unsuitable for our purposes. Requests were sent to all national retail groups detailing the need for retail prices per unit weight for the list of foodstuffs identified in the Irish HBS dataset. Since the data being used in the project were collected in 1987, the request was made for prices from that year but if not possible it was indicated that current prices would suffice.

Prices for some foodstuffs were taken from a consumer survey carried out in 1990 and trade figures were obtained from the Central Statistical Office. Due to a lack of response

from some retail units, fieldwork was undertaken to collect the required retail prices of foods that were otherwise unobtainable. In the summer of 1996, a third-level student employed in the Department of Health Promotion visited the four main supermarkets in Galway city with a survey form indicating the specific food items for which prices were sought and an introductory letter to be given to the manager of the outlet. The student surveyed the shelves in each supermarket, taking note of the retail price per unit weight for all requested foods. Where a number of brands existed for a particular food item, the average price was calculated. In the case where the food category covered a number of specific items, for example *other tinned vegetables*, a price per unit weight was obtained for a variety of tinned vegetables, not individually assessed, and an average over the number of types of vegetables was calculated. An average retail price per unit weight over the four outlets was calculated for each food item. There were a few cases where the item was not stocked by any of the supermarkets but was in the health food store adjoining one of the supermarkets. This price was noted.

Standardisation of prices to year of HBS data

Since collection of the retail prices per unit weight was made using various sources from differing years, adjustment had to be made to equivalent prices for the year of HBS data being used, which was 1987. Conversion was made using the CPI, which is an aggregation of 495 sub-indices relating to all consumables and is operated by the Consumer Price section of the Irish Central Statistics Office. Each sub-index is designed to include several types of commodity, making the CPI descriptions generic, whereas the food items required for the DAFNE project were sometimes more specific. When this was the case the sub-index closest was chosen. For example, when the price for olive oil needed adjustment, the sub-index of vegetable oils was used.

Converting from expenditure to quantities

Simple models were devised into which the expenditure data and retail prices per unit weight were fitted and resulted in the estimated quantity of food item available in each household per week.

Singular food item in HBS data. In the case of a singular food item coded in the HBS data, the conversion from expenditure to quantity is straightforward, using model A below.

Model A:

$$Q_H = E(\pounds) \times U(\text{g}) / P_{UW}(\pounds),$$

where Q_H = quantity of food available in household per week, E = weekly expenditure (Irish pounds), U = retail unit weight (grams) and P_{UW} = retail price (Irish pounds per unit weight).

Food group in HBS data. In some instances whilst expenditure on food items was collected, the data were recorded and reported at food group level. When converting from expenditure to quantity it was firstly necessary to identify the percentage contribution each food item made to the corresponding food group. Once this was estimated, the proportion of expenditure on each food item was calculated. The conversion from expenditure to quantity could then be performed for each food item through Model A above. Thus for data recorded and reported at food group level, model B was used.

Model B:

$$E_X = C\% \times E_T, \quad (1)$$

where E_X = weekly expenditure of individual food item X , $C\%$ = % contribution to food group and E_T = weekly food group expenditure;

$$Q_X = E_X(\pounds) \times U_X / P_{UWX}(\pounds), \quad (2)$$

where Q_X = quantity of individual food item X available in household per week, E_X = weekly expenditure on individual item X (Irish pounds), U_X = retail unit weight of item X (grams) and P_{UWX} = retail price of item X (Irish pounds per unit weight);

$$Q_H = \sum Q_X \quad (X = 1, 2, 3, \dots, n), \quad (3)$$

where Q_H = quantity of food group into household per week and Q_X = quantity of individual food items, X .

Conversion of household level data to quantities available per individual

All retail prices per unit weight were supplied to the co-ordinating centre in Athens, where weekly household quantities were estimated following application of the collected retail prices per unit weight to each household's expenditure data, as described above. A crude estimation of mean food availability per person per day was made by dividing the household availability of specific food items by the number of persons in the household and then estimating the weighted mean individual availability, with the weight being the number of persons in the household. More sophisticated analyses, using linear regression models, were also carried out at the co-ordinating centre in Athens which took into account the age and gender distribution of a household.

Internal validation – expenditure and quantities

There were 12 foodstuffs for which both expenditure and quantity information was available in the Irish Central Statistics Office published documents⁵. These foods were used to assess the agreement of the estimated household level food availability.

Results

Retail prices per unit weight were recorded for 188 food items identified in the Irish HBS data. An example of retail prices for cereal products as identified using the various sources and the resulting prices for 1987 (after adjustment, when needed, using the CPI) is shown in Table 1.

The weekly household availability as estimated using the retail price conversion of household expenditure data and the published quantity of 12 foodstuffs is shown in Table 2. There were only two foods that showed significant divergence, namely cooking fats and potatoes. All other foods were within a 10% margin of error.

Discussion

Most European countries conduct household surveys in which data on food expenditure and, in most instances, food quantities are collected. The DAFNE project, supported by the European Commission FAIR programme, has developed a systematic approach to exploit HBS data as an effective tool for nutrition surveillance through its ability to estimate food availability at a household and individual level in many European countries⁶.

A basic problem with the Irish HBS data for the purposes of DAFNE is that they are recorded mainly as expenditure, which for food availability estimation requires conversion and hence retail prices per unit weight. This proved a very difficult requirement to fulfil. Retail organisations were not forthcoming with prices even when assured of the non-commercial use of such information. It is possible that prices requested from 10 years ago were difficult to retrieve but current prices, which would presumably be kept on a computerised database, were also frequently unavailable. Using various price sources and specially conducted fieldwork, retail prices for all foodstuffs were eventually obtained but for varying years. Conversion to the year of the study data, 1987, was done using the national CPI.

Evidently, to reach the point where 1987 retail prices per unit weight of all 188 food items were known involved various stages where errors could be incurred. The various sources used to obtain the prices themselves employed different ways of collecting their prices. The 1987 retail price index scheme used a regional quota sample of the different types of retail organisation and calculated a weighted average price. The 1990 Consumer Association Survey reports median prices across the different regions and the 1996 in-house fieldwork was carried out only in Galway city in the four main multiple stores. However, regional variations in median price were checked for through the consumer association with no substantial differences found, thus increasing the confidence in using 1996 prices which were recorded only in Galway.

Table 1 Irish HBS data – retail prices per unit weight of cereals

Food item	Unit	1996 source (£)	1990 source (£)	1987 source or 1987 adjusted (£)
Breakfast cereals	100 g		0.20	0.16
White bread	800 g			0.715
Other bread				
Vienna	440 g	0.80		0.72
French	480 g	0.69		0.62
Croissants	100 g	0.139		0.125
Soda bread	560 g	0.88		0.79
Brown bread	800 g	0.49		0.44
Oatmeal	1 kg	0.89		0.79
White flour, plain	2 kg			0.84
White flour, self-raising	2 kg			0.834
Wholemeal flour	2 kg			0.879

The price applied to each foodstuff may be an average based on different brands. Different socio-economic status households may spend substantially more or less on any one food item depending on brand name and retail outlet pricing policy. Therefore, application of an average price could overestimate or underestimate the true equivalent quantity of a foodstuff bought into a household. Just as there may be variation in expenditure based on the socio-economic status of a household, the same may be true for locality. Skewed distribution of either the expenditure or quantities of these food items across the sample households highlights the necessity of investigation of food intake across subgroups of the population for nutrition surveillance purposes.

The Central Statistics Office of Ireland published the percentage of households purchasing each food in the 1987 HBS⁵. This varied significantly between foodstuffs. Thus, application of a national average retail price may not be appropriate to all foodstuffs. The conversion of prices obtained for each foodstuff back to that of the year of survey data, 1987, was made using the CPI. Generic indices used in the CPI may not be sufficiently sensitive to price differentials of the individual food items and hence may result in over- or underestimation of quantities from the expenditure data.

Basic errors can also occur at data entry stage. Some of

the difference between published and estimated quantities may be due to use of more than one unit of measurement, such as pints and litres, which caused confusion at the data entry stage. The current household budget survey in Ireland uses only metric units. As with expenditure data, the recording of quantities for the 12 foodstuffs in the Irish household budget survey is subject to measurement error and this must be borne in mind when assessing the results.

The comparison of quantities published by the Irish Central Statistics Office for 12 foodstuffs in the Irish 1987 Household Budget Survey with those estimated using equivalent expenditure data and corresponding retail prices showed good agreement for 10 foods. Conversion of expenditure data to quantities available for consumption involves a number of stages. As with all dietary assessment methods, various errors may be incurred and should be taken into account when interpreting final availability. Compliance with the Irish survey requires that everyone in the household over the age of 15 years complete a 14-day expenditure diary. This requires substantial effort and the 60% achieved response of complete diaries is satisfactory, although food habits in the non-compliers may differ. It is recognised that there are problems with under- and over-reporting in self-completion methodologies such as this, especially with

Table 2 Expenditure – estimated and published quantities

	Published quantity (grams per household per week)	Estimated quantity (grams per household per week)	% Difference between quantities
White bread	3030.1	2912.6	3.88
White flour	640	658.0	-2.81
Self-raising flour	142	147.8	-4.11
Wholemeal flour	163	170.6	-4.65
Fresh milk (litres)	10.75	11.73	-9.81
Eggs	10.54	11.20	-6.35
Butter	629.89	579.21	8.05
Margarine	287.05	283.76	1.15
Lard/cooking fats	59.86	82.15	-37.24
Potatoes	7394.0	5629.5	23.86
Sugar	1080	1077.2	0.26
Oatmeal	135	123.65	8.41

alcohol and certain foodstuffs. It is hoped that since the Irish household budget survey requires only a person's expenditure, unlike nutrition surveys where people are asked to estimate consumption, this error will be minimised.

Conclusions

The Irish 1987 Household Budget Survey recorded expenditure of all people in the household over the age of 15 years and is therefore a source of information of food patterns for approximately 27 000 people. Overall it has been shown that the household budget survey data can be used to estimate food availability for populations, particularly when the survey data are recorded in quantities. In the case of the Republic of Ireland, where the data are recorded mainly in household expenditure, quantity estimations from expenditure data using retail prices showed good agreement for most foodstuffs when validation with statistical office published quantities was made. Besides the basic issues in using HBS data to estimate the food intake of an individual, such as how to account for wastage, spoiled or food given to pets, there are other additional challenges when the initial data are recorded in household expenditure. These challenges, and ways to address them, have been focuses of this paper.

If HBS expenditure data are to be genuinely used as a nutrition surveillance and epidemiological tool, they need to be further investigated. It is necessary to identify, and if possible measure, the errors accompanying the various

processes required to bring the survey information from that of an economical measure to one of food availability at an individual level. At a policy level the development of the household budget survey must be made in collaboration not only with statisticians and economists but also nutritional epidemiologists.

Acknowledgements

The work presented in this paper was supported by the 'Agriculture and Agro-Industry, including Fisheries – FAIR' programme of the European Commission.

References

- 1 James WPT, Ralph A. What is nutritional surveillance? *Proc. Nutr. Soc.* 1991; **50**: 653–9.
- 2 Food Advisory Committee. *Recommendations for a Food and Nutrition Policy in Ireland*. Dublin, Ireland: Department of Health, 1979.
- 3 Trichopoulou A. Monitoring food intake in Europe: a food data bank based on household budget surveys. *Eur. J. Clin. Nutr.* 1992; **46**(Suppl. 5): S3–8.
- 4 Trichopoulou A, Kanellou A, Lagiou P, Zintzaras E. and DAFNE I Group. Integration of nutritional data based on household budget surveys in European countries. *Proc. Nutr. Soc.* 1996; **55**: 699–704.
- 5 Central Statistical Office (CSO). *Household Budget Survey 1987. Volume 1: Detailed Results for All Households*. Dublin, Ireland: CSO, 1987.
- 6 Vassilakou A, Trichopoulou A. Overview of household budget surveys in 18 European countries. *Eur. J. Clin. Nutr.* 1992; **46**(Suppl. 5): 137–53.