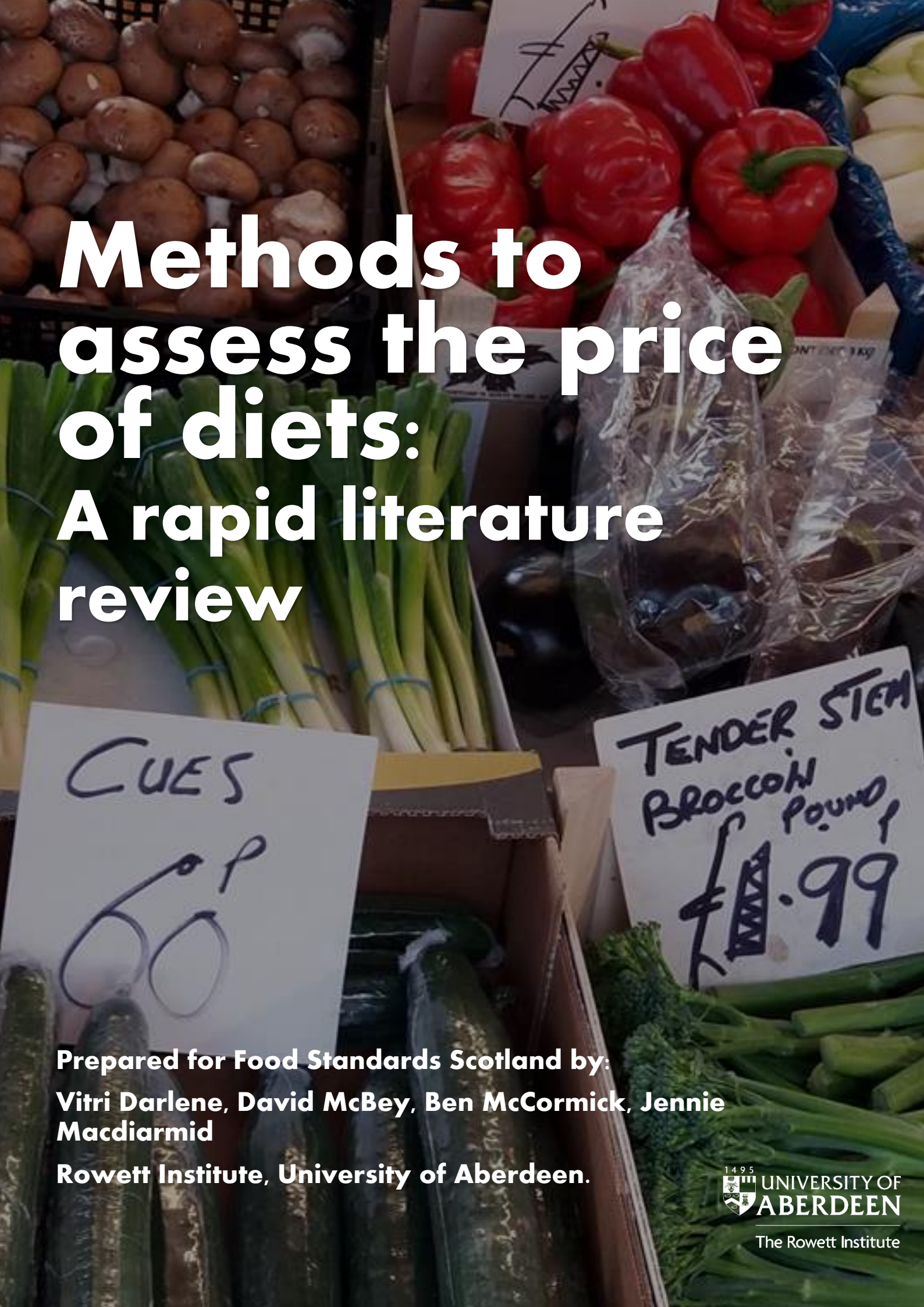

Methods to assess the price of diets: A rapid literature review

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Background

The price[1] of food has been identified as one of the main determinants of dietary choices (1), however work examining the methods used to estimate the price of diets is scarce. Little research has been done in the UK and Scottish context compared to other high-income countries such as the USA and Australia (2), where several studies have demonstrated that the price of healthy and sustainable diets are higher than current diets (3–6). Being able to assess the price of diets is critical to ensure nutritionally adequate and environmentally friendly diets are affordable, especially for low-income households with smaller food budgets. Such households have to sometimes prioritise their spending to cheaper products to get enough food and these are often less nutritious than, for example, fresh fruits and vegetables that tend to be more expensive (7). If the Scottish diet is to become better for human health and the environment, understanding its price, and how this is calculated, is essential. Several approaches have been used to calculate the price of diets that each have implicit, non-trivial, and practical decisions about data collection that affect estimated prices. Decisions can include the outlet(s) that foods are bought from, selection of food items, whether to use the lowest, mean, or median price for an item, usual or promotional prices, or whether a product is branded or not. Often the aim of the study determines many of these decisions such as taking the lowest price to determine healthy diets for low-income groups, but the variation in approaches can make it difficult to make comparisons across studies.

To calculate diet prices in a robust, reliable, and systematic way, it is important to understand more about the methods being used and the implications thereof. Hence, we present a rapid review of the methods used to estimate the price of diets, focusing on methods used in high-income countries.

[1] We use the term 'price' to denote the amount paid for food in supermarkets, takeaways etc. This is distinct from the 'cost' of food, which we take to mean the price plus other expenses such as energy for cooking, transport to purchase etc.

Methods

A rapid review of the published literature was conducted to identify studies that measured the price of diets.

Search strategy

The search was limited to papers published between 2020-23 (inclusive) to build on a systematic review of pricing methodologies by Russell *et al*. that included studies in high-oncome countries published between 2016 and 2021 (2). The Russell *et al.* review surveyed tools (e.g., food baskets, electronic point of purchase data [ePoP]) that have been used to gather diet prices, but we specifically focus on the protocols used to select and price food items, and the steps made to operationalise these approaches. For example, implementing a given approach may or may not include the use of online prices, reflective of the recent increase in online food shopping, but this may have implications for the practicalities and generalisability of gathering price data (8).

The Web of Science database was searched using the following terms: 'food price*'OR 'food cost' OR 'food affordability' used in the review by Russell *et al*. (2), omitting the 'food promotion*' term they employed as it was deemed outside the scope of this review. In addition, a Google search identified recently published grey literature from relevant bodies reporting on the price of foods. Our review was completed in May 2023.

Screening of abstracts and titles were completed using the following the following inclusion criteria:

- Studies conducted in high-income countries.
- Studies with a description of methods of measuring prices of diets.
- Studies using quantitative assessment methods.

Data extraction from the literature and reports

The following data were extracted for each study: study objectives, an overview of the method used for assessing the price of diet (e.g., food basket), the number and type of food stores from which data were collected, sources of pricing data (e.g., specific stores or consumer panel data), brand(s) of items included, package sizes of the items, how food prices were selected or calculated, what decisions were made about food substitutes if products were unavailable in a given store, data collection period, type of diet considered, duration over which a diet was recorded, food groups or category, and demographics of the sample (e.g. household composition). Full details of the extracted data are in **Appendix 1**.

Results

From the Web of Science database, 2,113 publications were identified, including 1,800 articles and 258 reviews and 55 book chapters. A further 4 reports were identified from the Google search and added to the screening list. After screening, 27 publications were retained. The selected studies consist of 22 journal articles, 3 reports and 2 reviews. A recent study by Nourish Scotland (9) published in 2023 was included due to its regional and methodological relevance . Review articles were excluded as they did not contain the level of methodological detail from the papers required for estimating the price of diets, leaving 25 sources (Figure 1).

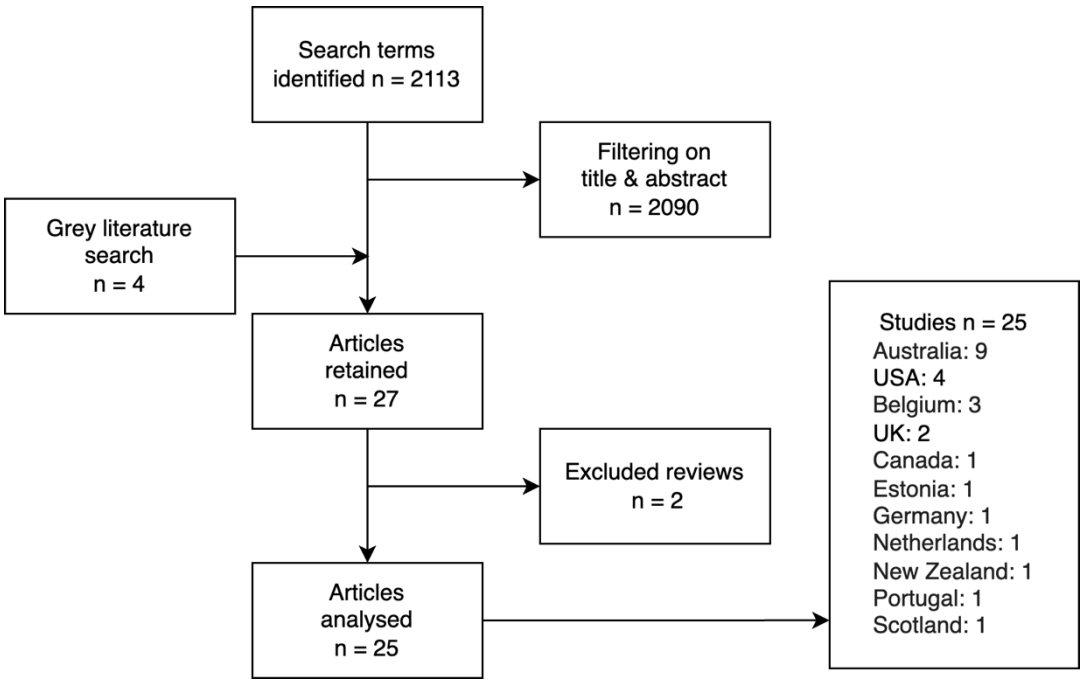

Figure 1: Flowchart of review process

Studies tend to fall into two main methodologies: (i) the use of a typical or ideal food basket that describes a collection of food items that characterise a diet (defined according to the study purpose), or (ii) the use of observed dietary intake data linked to electronic point-of-purchase sale data (ePOP) to characterise the price of what a population currently eats or a hypothetical healthy diet. Food baskets were the most widely used approach, as evidenced by our search (17/25 studies, 68%) and the Russell *et al.* review (2). The papers using food basket studies were, however, often

conducted by the same research groups repeating their standardised methods in different settings and locations.

The practical decision points needed to operationalise collection of price data for both methods are non-trivial and the detail is often missing or incomplete from the description of methods in studies, especially on the selection of food items. We have collated these steps from across all studies, as outlined in Figure 2.

Methods to assess the price of diets

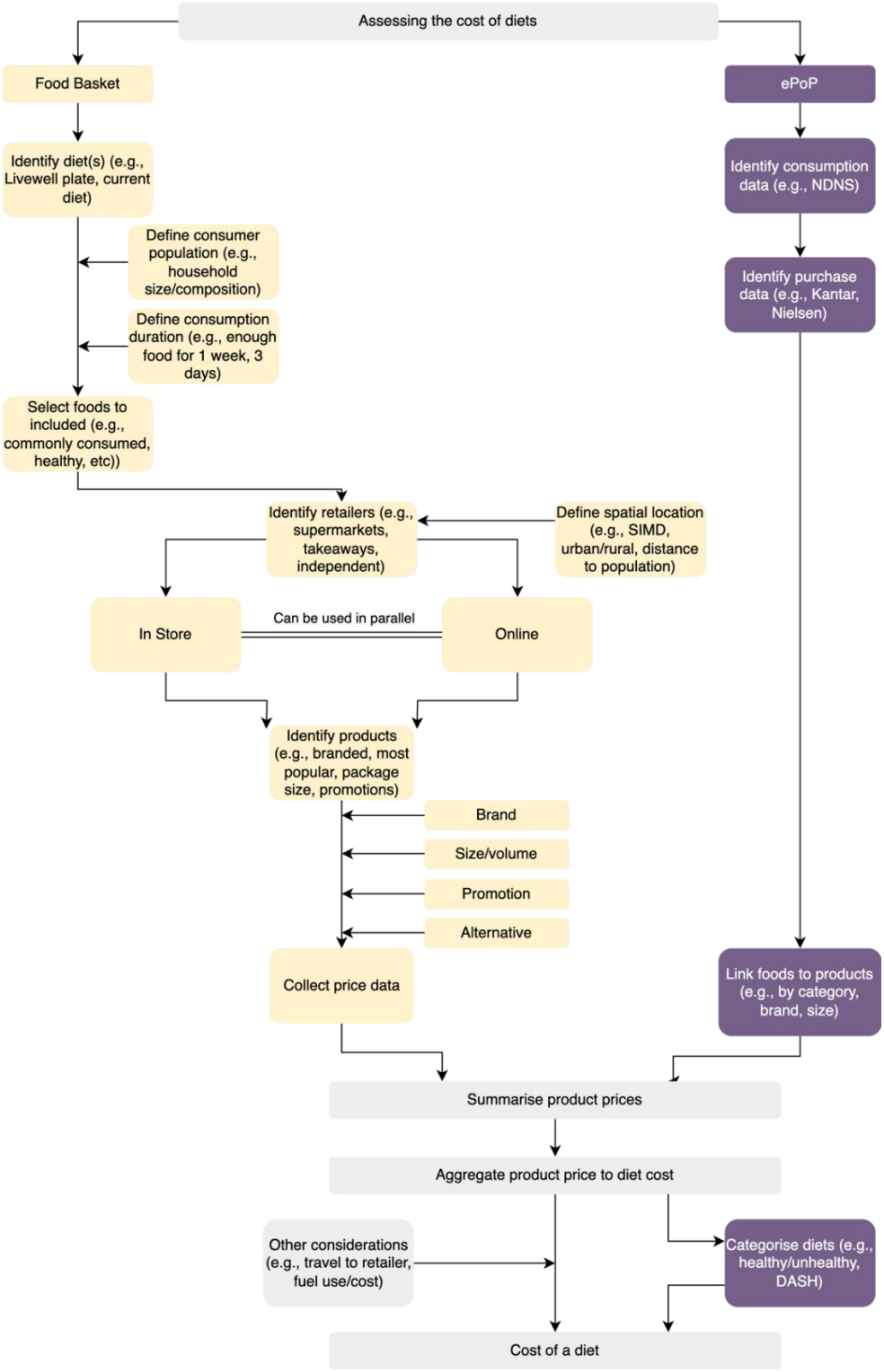

Figure 2: Flowchart depicting the steps in assessing the price of diets. The two broad approaches (food baskets, yellow and electronic point of purchase data (ePoP) data, purple) are shown with common decisions shown in grey.

Food baskets

The use of a 'basket' of food is a long-established technique to measure the price of diets and/or affordability (8). The premise is to describe a collection of food and drink items that characterise an overall diet defined according to some study-specific criteria. There is no one single procedure to determine which foods are included in a basket, and we found many studies don't provide specific detail about why specified food items are included (4,7,10–15). Food baskets comprise many different combinations of food, typically determined by the aim of the study, such as foods that are commonly consumed (e.g., observed in the National Diet and Nutrition Survey [NDNS]), based on expert judgement to meet criteria of healthy, affordable, or match an idealised diet (10,11,16–21). Alternatively, the basket is defined around foods that are nutritionally adequate and socially acceptable (14,22–25), or a combination of all these factors (9). Food baskets have also been modelled diet scenarios such as Mediterranean, vegan and vegetarian diets (4) and the EAT Lancet diet (a reference diet for environmental sustainability) (11), or on specific food groups such as vegetable and fruits alone (7). Some countries or organisations use a standardised food basket or everyday household/food items to monitor trends in pricing of standard diets (e.g. the Australian Standardised Affordability and Pricing (ASAP), the American Thrifty Food Plan, the Canadian national nutritious food basket, the UK Consumer Price Index) and these have been used to compare the price of diets at regional as well as at a national level (19,26,27). Such diets are kept consistent for comparison over time, but are also subject to changes to reflect societal trends (28). A detailed example of a food basket, as used by Goulding *et al.* (11), is included as **Appendix 2** and an example of the rationale for including food items for a basket in a Scottish context (14) is provided in **Appendix 3**.

Having identified the foods in a basket, the quantity of each food basket is tailored (e.g., by calorie requirements) to a given household composition, for example, the number and age of people in a household, and the period that the food basket should sustain them for (e.g., enough food for one week) (9,15,18,25,26,29,30). Portion sizes are calculated to meet the requirements of the target diet. This is an important

consideration as economies of scale may mean that the price of food for a one- or two-person household may in fact be higher per person that those estimated using a four-person household, which tends to be a more common denominator. In general, these studies did not consider the knowledge and equipment required to cook from scratch, which typically requires households to have some basic store cupboard items that are often not included in the cost, the time taken to cook, transport costs, or the need for cooking facilities and utensils. Some studies factored in food eaten out of the home, but this was not universal.

The spatial area(s) in which food prices are collected, and therefore generalisable, tended to be explicitly defined and selected based on criteria such as level of deprivation (14,16–20,27,30,31) or specific geographic areas (26,29). The area sampled will depend on the specific research question, for example a study concerned with the price of food to those on the lowest incomes will likely want to collect data in lower socioeconomic score areas. However, determining the study population has consequence for both data collection and extrapolation.

Most studies using a food basket collected price information from supermarkets in-store and/or online from in-person surveillance or surveys (4,5,9,11,15–20,25–27,29–32). Food prices tended to be collected from a range of food retailers, including major or chain supermarkets, budget supermarkets, convenience stores or other food retail outlets (e.g., liquor stores, take-aways). The identification and selection of these stores, however, was study dependent. The eight studies (seven in Australia, one in New Zealand) adopting the ASAP (33) protocol used Google Maps to identify all food outlets within their defined study area, and pick one example from each retailer (e.g., one representative store from each supermarket chain, one exemplar from each of the fast-food outlets), while other studies chose only supermarkets and specifically sought retailers for those that covered ≥65% of the domestic market (29), or chose supermarkets with no stated rationale (15). The identification and selection of stores has critical implications for reproducibility and interpretation given that individual chains may or not have uniform coverage within a given population.

Recent studies have collected supermarket price data exclusively online (15,25) or using a combination of in-store and online prices (9,30), which coincides with recent growth in online grocery shopping (34). Zorbas *et al.* (31) compared the prices collected in-store and online and found that for supermarkets there was 94.2% agreement for price and 87.5% agreement for fast-food outlets. This suggests that where online sources are available, they are comparable to data collected instore and this may be a quick and effective method to collect real-time data. However, many smaller retailers and food outlets do not have online purchasing and therefore this can constrain the range of prices available within a population. Table 2 summarises studies using food baskets and supermarket price (in-store visits, online or both).

A challenge of pricing food baskets is the variability in prices of food items. The price can vary by the place it is purchased (i.e., the store type and location), but also the size of items (e.g. 0.5 litre versus 2 litre carton), whether branded or not, which 'tier' of supermarket branding such as the lowest price, mid-range and high end product) (e.g., Asda's 'Extra Special' vs. 'Just Essential'), and if it is on promotion. How studies deal with these questions will often be study specific, but it is important that a detailed protocol is developed and described prior to data collection to standardise and simplify the collection of pricing data. Some food basket studies contained a detailed description of how prices were collected when visiting supermarkets or other stores (9,16–21,27,30,32,33), including the size and/or brand of food items, and which price in the store to record (e.g., the non-discounted or 'usual' price, lowest price), and how to identify substitutions if a given food item in the food basket was not available on the day of data collection.

When multiple prices are found for a given item, they need to be summarised in some fashion. For example, studies exploring how to achieve an affordable basket for low income groups focus on the lowest available price for an item (1,4,5,11,26). The Food Foundation's basket tracker report two scenarios of food basket price: the usual price (i.e. when items are not discounted) and the price available to consumers using a membership card (Tesco's Clubcard), which aims to compare prices with or without promotion. Weekly data to October 2023 suggests a small (generally less than £1 on

a £40-50 basket) difference in price when looking at Clubcard vs. non-Clubcard baskets (25) A study of healthy versus current diets in New Zealand found that, although price promotions tend to be more frequently applied to unhealthy foods, the impact on overall diet pricing was minimal (31).

An example of a comprehensive methodology and detailed protocol for collection and collation of price data for a food basket is the ASAP protocol (33), which was developed in consultation with stakeholders from academia, governmental bodies, and NGOs. As well as outlining the geographical boundaries and stores that should form the sampling frame, it also provided step-by-step guidance for data collectors on which foods should be included, their sizes, prices to record, and what should be done in the event of missing items. Their guidance and data collection forms are included as **Appendix 4**.

A more recent example of an especially thorough and detailed methodology was developed by Nourish Scotland (9). Community advisors (members of the community) were enlisted from various stakeholder groups to co-create four fictitious families and build realistic weekly shopping lists, based on lived experiences, that would be "a good fit for their lives, enjoyable, and healthy 'enough'". Their aim was to create not just a healthy diet (which can be subjective), but one that might realistically be followed given constraints of time, kitchen equipment, tastes etc. These shopping baskets (i.e., lists) included food bought from a supermarket, with prices obtained from Tesco online, and takeaway foods such as pizza or local fish and chip shops. Decisions such as which branded (or unbranded) items, which takeaways to include, package sizes and form (e.g., fresh, frozen, tinned) were made in consultations between community advisors, public health professionals and the project steering group. Clear instructions on swaps, if the shopping list items weren't available were provided: the item with the closest pack size (to avoid waste and account for limited cupboard space in homes) or when the brand was not specified the second cheapest item was selected.

Table 2. Summary of studies measuring the price of a food basket using food store price data (in store, online data or both).

Studies	Country of study	Price data collection	Sampling approach	Type of stores	Basket Composition	Brand	Size of item considered	Food price selection	Promotions/ sales	Food substitutions
(16,17, 19,20,27)	Australia/New Zealand	In-store	Stratified random sample in each location classified by the socioeconomic index.	Stores surveyed included one outlet each for each supermarket major chains (e.g. Coles, Woolworths, Independent Grocers Australia (IGA), Supabarn and ALDI), popular fast-food/take-away outlets (e.g. McDonald's, Pizza Hut, fish and chips shops) and the two liquor outlets closest to the geographical centre of each suburb or other administrative unit. Supermarket chains reflect most used for food purchases.	As per the ASAP protocol, which is built from consumption data in the Australian Health Survey 2011-12, and the Australian Guide to Healthy Eating and the Australian Dietary guidelines.	Unbranded for fresh fruit and vegetables and branded for other groups. Brands selection by the most popular item based on consumption data.	Yes	Usual (non-discounted) price Except Lewis, M *et al* (16) record lowest price	No, unless it was the only price available.	Varies between food groups. If size not available, choose larger whenever possible. If the brand not available, choose cheaper brand.
(18)	Australia	Online and phone calls								
(30,31)	Australia	In-store and online								

(11)	Australia	Online	For each of the seven states in Australia, three urban areas with different socioeconomic index were chosen. Areas were selected by ranking the postcode and the median ranked were selected.	Online price data from major/chains supermarket (Coles), using the respective postcode of each survey area. If Coles was not present in that survey area/postcode, the nearest comparable retailer was chosen.	Current diet based on a previously developed food basket. Healthy and sustainable diet constructed from PHD reference diet, based on EAT-Lancet.	Any brand	Yes	Lowest price	No	Similar item. If similar item is not available in that store then price taken from closest store.

(15)	Estonia	Online	Not stated	Three major/chain supermarket websites (i.e. Maxima, Ecoop, Selver).	Three dietary baskets built based on data from Estonian national dietary guidelines: the lowest price diet, the nutritionally adequate diet, the health-promoting diet.	Not stated	Not stated	Median price for each food type	Not stated	Not stated
(4)	Germany	In-store	All data collected in Berlin, with predominantly average-to-low income households	Stores in low-income area in Berlin, consist of major/chain supermarket and budget	Baskets designed for seven dietary patterns, with	Branded	Not stated	Lowest price	No	Not stated

				supermarket in Berlin (i.e. ALDI Nord, Edeka, Kaufland, LIDL, Netto, Netto plus, Norma, Penny, Spar, Real, REWE and Metro).	meals variations for each one. Dietary patterns varied from highly processed omnivorous to low-fat low-protein vegan.					
(26)	USA	In-store	Survey area was defined as towns within each jurisdiction. 1-6 towns for each jurisdiction were included depending on the number of food retail stores available.	Stores (n=74) consists of major and budget supermarkets and convenience stores, the number of stores in each area would depend on the availability of the stores. Convenience stores were included if	USDA Community Food Assessment Toolkit food list	Unbranded/ generic or store brand	Yes	Lowest price	No	Similar item and if not available then price left blank.

				supermarkets were unavailable.						
(29)	Portugal	In-store and online	Five supermarket chains in the Lisbon Metropolitan Area.	Supermarket chains that account for 65% of total Portuguese market share.	3591 baskets built using consumption data from Portuguese National Food, Nutrition, and Physical Activity Survey.	Not stated	Yes	Lowest price	No	Not stated
(10)	Australia	In-store	Five suburbs representing low, medium and high socio-economic areas.	Chain supermarket, butchers, and local greengrocers in each area.	The Illawara Healthy Food Basket, containing 57 items: 10 breads and	Branded	Yes	Usual price	Not stated	Closest alternative, details not stated.

					cereals, 3 dairy foods, 15 vegetables, 6 fruits, 10 meats, fish, poultry, eggs, nuts and 13 extra foods.					
(12)	USA	In-store and online	768 individuals from three counties differing in sociodemographic composition.	Safeway stores	FFQ data was used to measure consumption, and each item's price was collected.	Not stated	Yes	Lowest price	Not stated	Closest alternative, details not stated
(25)	UK	Online	Supermarket online prices	Tesco website (collected weekly)	Single Woman's and single man's baskets based on	Branded	Yes	Usual price and discounted price (Clubcard price)	Yes, for Tesco Clubcard price but not multibuy offers/me	If item not available that week, price of previous

					the Minimum Income Standard Basket.				al deal/ bundle.	week is used.
(9)	Scotland	Online and in-store (takeaways)	Supermarket online prices and takeaway outlets	Tesco website and takeaway outlets	Four fictitious families created, and for each a basket reflecting a diet that is "A good fit for their lives, enjoyable, healthy 'enough'"	Both branded and unbranded	Yes	Price on Tesco website that week	Not used, and Tesco Clubcard prices not used	Closest in size, second cheapest available.

Electronic point of purchase data

A less common method for assessing the price of diets is to use existing ePoP datasets (3,6,7,13,35,36) such as those available from Kantar World Panel (KWP), Good for Knowledge (GfK), USDA's Fruit and Vegetable Price Data, or Nielsen. These datasets, often longitudinal or regularly collected data, are constructed from large samples of households who recorded purchases (e.g. using a barcode scanner) over some period of time (e.g., weekly or annually). Price information is included for products that were available and purchased by a given population and this can then be linked to consumption data (e.g., the NDNS) to define the diet characteristics. This approach can be used to approximate the price of observed rather than idealised or hypothetical diets. The diets can be more precisely categorised to sub-groups, e.g., in accordance with the Dietary Approaches to Stop Hypertension (DASH) diet, according to purpose or to reflect sub-populations of interest.

A UK-based example of this method was conducted by Jones *et al.* (36). The study matched all foods consumed (as per NDNS data) with products in KWP data, assuming a 'one-to-many' approach (i.e., generic foods in the NDNS data could match multiple products in the KWP, each with different prices) that captured different permutations in retailer and therefore price. Within the KWP dataset, the prices used were already normalised prices across brands and package sizes by Kantar to give a generalised price. The median price for each product was used within the dietary price calculation. As Jones *et al.* (36) describes, matching products is a subjective exercise, and so team-based decisions were used to ensure consensus. In their study, the final step was to score the observed diets against national dietary guidelines, and in accordance with the DASH diet. For the latter, foods were categorised as belonging to one of the five food groups people were encouraged to eat and three discouraged food groups and scored accordingly.

As noted in the example above, the price data provided may already be generalised or estimated. This simplifies the collection of data, but also accepts the assumptions of the data provider, especially syndicated providers that have variable coverage of the consumer population, retailers or brands. As with any empirical data, future diets

may not be represented in the current data. Although these methods can give a robust snapshot of what people currently do, they may be less appropriate to extrapolating to the price of a hypothetical diet.

Summaries of studies using ePoP data are presented in Table 3.

Table 3. Summary studies using electronic point of purchase (ePoP) data

Studies	Country of Study	Price data sources	Dietary data sources	Brief	Brand	Size of item considered	Food price selection	Promotions/sales	Food substitute
(13,35,37)	Belgium	GfK	Food Consumer Survey	FCS (2 days dietary recall). GfK dataset (>2000 type of foods) obtained from scanned weekly purchases of 5,000 households. Datasets were linked to produce price.	Branded and unbranded	Yes	Mean price of every sub-type of foods (e.g fresh/frozen/ canned, full fat/semi-skimmed/ skimmed).	Include promotion prices	Missing price was substituted with price of most nutritionally similar food
(6)	Canada	Nielsen	Three online 24hr dietary recalls (n = 1849)	Mean price for each food group was calculated. The dietary recall data was then used, and price per kg of food consumed was matched to food group price data.	Branded and unbranded	Yes	Mean price of food group	Not stated	N/A

(38)	UK	UK supermarkets price comparison website	2008-2011 National Diet and Nutrition Survey (NDNS)	Food matched at the sub-food group level in NDNS. The 1 or 2 most frequently consumed foods in each sub-group were selected as indicators of that group, with 204 foods matched to prices in the food price database.	Not stated	Yes	Mean	Not stated	Items with missing prices or sizes were removed from analysis
(7)	USA	USDA Fruit and Vegetables Prices data	2015-2016 National Health and Nutrition Examination Study.	3000 simulated baskets of fruit and vegetables (based on dietary recommendations). These simulations contained mixes of differently priced and number of items.	N/A	Yes	Mean price for each item. Items standardised in to price-per-cup equivalent, then placed in quintile ranges.	Not stated	N/A
(39)	USA	USDA Center for Nutrition Policy and Promotio	2005-2016 National Health and Nutrition Examination Survey	Food price data matched to USDA CNPP at the ingredient level. Consumer Price Index was used to inflate	Not stated	Yes	Mean price	Not stated	N/A

		n (SCNPP) Food Prices Database (2001-2002)		food prices from 2001-2002 levels.					
(5)	Netherlands	Dutch food price database	Dutch National Food Consumption Survey	Using the DIETCOST algorithm, with a 4 person reference household, shopping baskets were created for both existing and healthy diets. Average prices of the simulated current vs. healthy diets were then compared.	Not stated	Not stated	Lowest price	Not stated	Not stated

Conclusions

Using a food basket is a well-established method to estimate the price of a diet and was used by majority of the papers reviewed. Broadly they comprise a pre-selected list of foods tailored to a specific diet and commonly consumed foods, generally derived from surveys or population-level consumption datasets. This method allows assessment of multiple types of baskets or diets, exploration around food affordability and accessibility, and monitoring trends when the same items are included.

The price of food is still largely collected from in-store surveys of retailers, however online data collection is increasingly viable and used. This may be a more cost-effective alternative to collecting in-store data and the pricing in-store and online are comparable, but a major limitation is that not all smaller retailers have online purchasing facilities, including the popular discounters such as Lidl and Aldi. Hence, it does tend to restrict pricing to major supermarkets that may not be accessible to the study population. Collecting price data from stores is, however, resource intensive and was often associated with geographically restricted studies, for example, those looking at a defined population in which all stores (or a representative sample) could be surveyed. Nationally representative use of in-store data (e.g., the food contributing to the consumer prices index), requires greater consideration of how to balance practical issues of collecting data with representation of different retailers.

The other main method employed for collecting dietary prices is the use of pre-existing sales data. ePoP data can provide detailed information on what consumers currently purchase and this can be linked to consumption datasets to give a comprehensive understanding of the current price of diets, and the impact of changes to alternative dietary patterns. These data often collect information from the same households or individuals over time, giving longitudinal assessments of purchasing patterns and temporal fluctuations in prices. However, there are implicit assumptions about the coverage of retailers (e.g., limited to one store's loyalty

scheme or all shops visited by panel members) and pre-processing (e.g., summary aggregation of pricing information across brands) of these purchase data that vary between the data providers.

Regardless of where the data are collected, decisions need to be made for the reproducible and efficient collection of price data. The challenges to assessing the price of diets predominantly arise from the selection of each food item. Practically, these extend to how foods are sold as products and therefore whether they are branded or unbranded, variation in the package size, whether it is on promotion or not and what to do about either selecting alternatives (food basket) or matching foods and products (ePoP data), as shown in Figure 2. Examples of good practice, for example, the ASAP protocol, exist and clearly articulate the step-by-step identification of price data.

Last, prices must be aggregated into a summary statistic. The choice of summary function depends on the purpose of the study, for example if the aim is to choose the cheapest versus an average diet. Any summary function, for example, the mean, median or lowest price available, will mask the variability encountered by consumers but this is unavoidable. Again, the Australian ASAP methodology (Appendix 4) provides an example of a robust protocol.

In addition to the price of the food, there are several other costs that could be considered to assess the full cost of a diet, which include the cost of fuel to cook and prepare food, costs associated with travelling to/from the food retailer, and food wastage.

Overall, this review highlights the decisions that are needed at the outset to robustly and reproducibly price diets and the implications that follow for interpreting that price.

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Appendix 1: Details of all papers included in the review

See Excel file: Methods of assessing cost of diets – supporting data table.

Appendix 2: Example food baskets for Planetary Heath Diet and a typical weekly Australian diet for a household (two adults, a teenager and a pre-school child) from Goulding *et al*. (2020) (10).

Planetary Health Diet basket		Typical Australian Diet basket[41]	
Basket item	**Amount**	**Basket item**	**Amount**
Whole grains		**Vegetables**	
Rice, brown, uncooked	1323 g	Carrots (pre-packed)	225 g
Bread, mixed grain & seeds, wholemeal, extra grainy, other seeds, fresh	185 g	Cauliflower (pre-packed)	487.5 g
		Potatoes (pre-packed)	352 g
Rolled oats, uncooked, plain, unfortified	1191 g	Tomatoes (pre-packed)	720 g
Pasta, wholemeal, dry	1191 g	Lettuce (pre-packed)	1800 g
Barley, uncooked	1058 g	Mushrooms (pre-packed)	296 g
Quinoa, uncooked	1191 g	Onion (pre-packed)	315 g
Tubers or starchy vegetables		Frozen mixed veg	1160 g
Potato, plain, other, other, unpeeled, raw	1323 g	Pumpkin	70 g
Vegetables - dark green		Sweet potatoes (pre-packed)	560 g
Broccoli, fresh, raw	556 g	Tinned green beans	1980 g
Kale, raw	476 g	Zucchini (pre-packed)	1179 g
Baby spinach, raw	318 g	**Fruit**	
Cabbage, savoy, raw	397 g	Green apples (pre-packed)	624 g
Lettuce, cos	212 g	Peaches (pre-packed)	1240 g
Capsicum, green, fresh, raw	212 g	Red apples (pre-packed)	1480 g
Zucchini, green, fresh, unpeeled, raw	265 g	Tinned fruit salad	1020 g
Cucumber, common, unpeeled	212 g	Dried sultanas	340 g
Vegetables - red and orange		**Grain (cereal) foods**	
Capsicum, red, fresh, raw	265 g	Cornflakes	594 g
Carrot, regular, fresh, unpeeled, raw	582 g	Muesli	2880 g
Pumpkin, butternut, fresh, raw	529 g	White bread (pre-packed)	6080 g
Sweet potato, orange, plain, unpeeled, fresh, raw	132 g	Turkish bread (pre-packed)	340 g
		White rice	8200 g
Tomato, common, raw	1138 g	White flour	33.6 g
Vegetables - other		White pasta	520 g
Mushroom, fresh, common, fresh	1879 g	**Meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans**	
Onion, mature, brown, raw	714 g		
Garlic, fresh, raw	53 g	Chicken breast	680 g
Fruits		Beef steak	400 g
Banana, fresh, cavendish	1323 g	Lamb chops	368 g
Apple, fresh, pink lady, unpeeled	1323 g	Minced beef	400 g
Kiwifruit, green (hayward), unpeeled	794 g	Sliced ham	210 g
Mandarin, fresh	1191 g	Eggs	472 g
Strawberries, fresh	529 g	**Milk, yoghurt, cheese and/or their alternatives**	
Avocado, raw	132 g		

Basket item	Amount	Basket item	Amount
		Cheddar cheese	630 g
Dairy foods			
Milk, cow, ready to drink, regular fat, regular	6422 mL	Milk, whole	8250 mL
Protein sources - animal		Yoghurt	3200 g
Beef, diced, untrimmed, raw	185 g	**Allowance for unsaturated spreads and oils**	
Pork, diced, raw	185 g	Margarine	144 g
Eggs, chicken, whole, raw, regular	344 g	**Discretionary food choices**	
Fish, salmon, raw, atlantic	741 g	Butter	320 g
Chicken, breast, with skin, raw	767 g	Chicken stock	15 g
Protein sources - plant		Coca Cola	2400 mL
Lentils, red, dried	926 g	Frozen fish sticks	320 g
Beans, red kidney, dried, uncooked	132 g	Frozen meat pie	1520 g
Beans, cannellini, dried	132 g	Frozen pizza	1040 g
Peas, split, uncooked	265 g	Ice cream	899 mL
Tofu, firm	132 g	Lamington biscuit	300 g
Nuts, peanut, raw, unsalted	1058 g	Mayonnaise	240 g
Tree nuts		Orange juice drink	3626 mL
Nuts, almonds, raw, with skin	53 g	Potato chips	88 g
Nuts, cashews, raw	265 g	Sugar, white	28 g
Seeds, sunflower	344 g	Tinned spaghetti	1590 g
Added fats		Tomato soup	880 g
Oil, coconut	196 mL	Jam	104 g
Oil, olive, extra virgin	1151 mL	Popcorn	135 g
Lard	132 g	Worcester sauce	20 g
Added sweeteners			
Sugar, raw, regular	820 g		

Appendix 3: Example of rationale for including different food items from Dawson *et al* (2008) (13)

Food Group	Food item	Frequently in previous models	Nutrient score	NDNS (% consumers)	Scottish	Convenience	Healthfulness	Price	To increase variety in food group
Bread, cereal and potatoes (n = 9)	Brown rolls		-2	12					Yes
	Porridge oats		-4	9	Yes				
	Potatoes	Yes	-2	94					
	Potatoes (oven chips)		0	24		Yes			
	Rice (brown)		-2	1			Yes		
	Rice (white)		0	21					Yes
	Spaghetti (dry)	Yes	-5	39					
	Weetabix	Yes	-6	13				Yes	
	Wholemeal bread	Yes	-3	23				Yes	
Fruits and vegetables (n = 17)	Apples	Yes	-5	28					
	Bananas	Yes	-1	48					
	Grapes		-2	11					Yes
	Oranges	Yes	-6	13					
	Orange juice	Yes	-4	20				Yes	
	Pineapple (canned)		-3	6		Yes			
	Berries (frozen)		-5	11	Yes				
	Baked beans	Yes	-6	31					
	Broccoli	*	-10	8					
	Carrots	Yes	-8	20					
	Cucumber	Yes	-5	36					
	Lettuce	Yes	-6	36					
	Onions	Yes	-5	13					
	Peas (frozen)	Yes	-14	20		Yes			
	Peppers (red)		-6	29					Yes
	Sweet corn (canned)	*	2	18		Yes			
	Tomatoes	Yes	-6	66					
Dairy (n = 3)	Semi-skimmed milk	Yes	0	43				Yes	
	Skimmed milk		-2	13			Yes		
	Low-fat yoghurt	Yes	0	14					
Meats, fish, etc (n = 5)	Beef mince (lean)	Yes	0	13			Yes		
	Birds Eye Lasagne		0			Yes			
	Chicken breast	Yes	-4	18					
	Haddock fillets (no coating)	*	-4	10	Yes		Yes		
	Salmon fillets	*	-2	16	Yes				
Fatty and sugary foods (n = 1)	Low-fat PUFA spread	Yes	10	37					

Appendix 4: Australian Standardised Affordability and Pricing data collection protocol and recording sheets from Lee *et al.* 2018 (32).

1. Record the usual price of an item, i.e. do not collect the sale/special price unless it is the only price available (if so, note in comment column)
2. Look for the specified brand and specified size for each food item, and record the price
    a. If the specified brand is not available: Choose the cheapest brand (non-generic) available in the specified size. Note this brand in the "Your brand" column
    b. If the specified size is not available: Choose the nearest larger size in the specified brand. If a larger size is not available, choose the nearest smaller size. Note this size in the "Your size" column
    c. If both the specified brand and specified size are not available: Choose the cheapest in the nearest larger size of another brand (non-generic). If a larger size is not available, choose the nearest smaller size
    d. If multiple brands are specified, record the price of the cheapest one and note brand in the "Your brand" column
    e. If the item is only available in a generic form (e.g. Home Brand, Coles, Woolworths Select, Black and Gold) choose the most expensive generic item in the specified size. If the specified size is not available, choose the nearest larger size. If a larger size is not available, choose the nearest smaller size. Note the generic name in the "Your brand" and the size in the "Your size" columns
3. Loose produce: choose the usual cheapest price per kg of the variety not on special. If the only variety available is on special, record the special price and note in comments column
4. Peanuts: choose the branded packet size closest to 250 g. If packaged, roasted, unsalted peanuts are not available, record the price of the loose 'bulk scoop & weigh' roasted, unsalted peanuts per 100 g
5. Check all data are collected and recorded as above, before leaving store

Food	Specific brand	Your brand	Specific size	Your size	Your cost	Comments
Fresh Fruit						
Apples, red, loose			per kg			
Bananas, cavendish, loose			per kg			
Orange, loose			per kg			
Fresh Vegetables						
White potato, loose, brushed/washed			per kg			
Broccoli, loose			per kg			
Cabbage, white			½ cabbage or per kg			
Lettuce, iceberg, whole			Whole			
Carrot, loose			per kg			
Pumpkin, Jap, Kent, or Butternut			per kg			
Brown onion, loose			per kg			
Tomato, loose (not vine-ripened)			per kg			
Tinned Foods						
Tinned sweet corn, kernels, no added salt	Edgell		420g			
Tinned 4 bean mix	Edgell		420g			
Tinned tomatoes, diced/chopped in tomato juice	Ardmona		400g			
Fruit salad, canned/jar in juice	Goulburn Valley		700g			
Tinned steak & vegetables	Harvest		425g			
Tinned baked beans, in tomato sauce	Heinz		420g			
Tinned chicken & vegetable soup, ready to eat	Campbell's Country Ladle		505g			
Tuna, canned in vegetable oil, unflavoured	John West, Greenseas or Sirena		185g			
Pantry Foods						
Wholemeal Bread						
White Bread	Tip Top Sunblest		700g			
Muffin, commercial, un-iced, any flavour, single or multipack	Supermarket		Record weight			
Rolled oats, whole, Traditional (not quick oats)	Uncle Toby's		1kg			
Cornflakes	Kellogg's		725g			
Weet-bix	Sanitarium		375g			
Spaghetti (white)	San Remo		500g			
White rice, medium grain	SunRice		1kg			
2 Minute noodles, chicken, single or 5/6 pack	Maggi or Fantastic		Record weight			
White Sugar	CSR		2kg			
Cream-filled biscuit	Arnott's Monte-Carlo		250g			
Chewy Choc Chip Muesli Bar	Uncle Toby's		185g			
Water Crackers, plain	Arnott's		125g			
Savoury flavoured biscuits	Arnott's BBQ Shapes		175g			

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Food	Specific brand	Your brand	Specific size	Your size	Your cost	Comments
Peanuts – roasted, unsalted peanuts	Cheapest branded		250g			
Mixed nuts, (incl. peanut), salted	Nobby's		375g			
Mint confectionary	Allen's Minties		150g			
Dairy milk chocolate, block	Cadbury		200g			
Chips/crisps, original, salted	Smith's or Thins		170g			
French Dressing, regular fat	Praise		330mL			
Tomato sauce, regular (not ketchup)	Heinz Big Red or Masterfoods		500mL			
Sunflower oil	Crisco		750mL			
Olive oil, Traditional (not extra virgin)	Moro		1 Litre			
Meats						
Lean/4 star beef mince (not heart smart)	Pre-pack(not vacuum)		per kg			
Lamb loin chops	Pre-pack		per kg			
Beef rump steak	Pre-pack		per kg			
Beef Sausages, 6-8 pre-pack	Supermarket		per kg			
Refrigerated Items						
Cheddar cheese, regular fat	Cheer (Coon)		250g			
Cheddar cheese, reduced fat	Cheer (Coon)		250g			
Butter, original, salted (foil pack)	Western Star		250g			
Canola Margarine, regular fat	Meadow Lea		500g			
Full cream milk, fresh	Paul's or Dairy Farmers		2L			
Reduced fat milk, fresh (not skim)	Paul's Trim or Dairy Farmers Lite		2L			
Chocolate Milk, regular fat	Breaka, Big M, Oak or Paul's		600mL			
Orange Juice, Australian Grown (Fresh, chilled)	Berri		2L			
Plain Yoghurt, natural, Greek, regular fat (~4% fat)	Jalna		1kg			
Yoghurt, vanilla/flavoured, reduced fat (~1% fat)	Jalna		1kg			
Leg Ham, pre-pack	Don's		250g			
Eggs, dozen, Free Range	Sunnyqueen Farms		700g			
Drinks						
Bottled water, still	Mt Franklin		600mL			
Soft drink, Cola	Coca Cola		1.25L			
Diet soft drink, Cola	Coca Cola		1.25L			
Frozen Foods						
Frozen mixed vegetables	Heinz, Birdseye or McCain		500g			
Frozen peas	Edgell, Birdseye or McCain		500g			
Beef lasagne, frozen	McCain		400g			
White crumbed fish fillet, frozen	Birds Eye		425g			
Vanilla Ice cream, regular fat	Nestle Peters Original		2L			
Other Items						

Food	Specific brand	Your brand	Specific size	Your size	Your cost	Comments
Whole Barbeque Chicken, cooked - Large/ Family	Supermarket		Whole			
Pre-made Sandwich (Preferably chicken & salad on wholemeal bread)	Supermarket or, if unavailable, at closest garage/service station		2sl bread + filling (triangle pre-pack)			

Items from other stores: _____

Food	Store	Your store	Specific size	Your size	Your cost	Comments
Cooked hot potato chips	Independent Fish & Chip shop		1 serve			
Beef hamburger (Big Mac)	McDonald's		1 burger			
Beef Pie, single serve, full pastry	Independent Bakery		1 pie			
Supreme Pizza, thin base	Pizza Hut		1 large pizza			

Liquor Store Name: _____

Food	Specific brand	Your brand	Specific size	Your size	Your cost	Comments
Beer	VB		6 x 375mL			
Sparkling white wine	Yellow		750mL			
Whisky	Johnny Walker Red Label		700mL			
Red wine	Penfolds Koonungara Hill Shiraz		750mL			