

Trends in portion sizes in the UK - A preliminary review of published information

Report to the Food Standards Agency

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Executive summary

It has been suggested, particularly in the United States, where there is evidence for an increase in portion sizes, that larger portion sizes may play a role in the obesity epidemic. However, there is a lack of evidence on portion sizes trends in the UK. As part of its Saturated Fat and Energy Intake Programme, and in support of health departments' obesity strategies, the Food Standards Agency has made a commitment to explore with the food industry the increased availability of smaller portion sizes of some products and their uptake by consumers.

To support this work, the Agency commissioned this preliminary review of publicly available information to assess whether there have been changes in portion sizes of foods since the 1990s. Retrospective information was obtained mainly from published books and literature on food portion sizes and sampling reports of nutrient analysis surveys undertaken during the 1990s. Current data was obtained from websites for food manufacturers, foodservice chains and retailers, and direct from food packages, as well as via published analyses from the National Diet and Nutrition Survey (NDNS).

The main findings of this preliminary review are:

- Within product categories, there is a wide range of portion sizes and there are few consistent trends;
- Traditional and standard products continue to dominate the market and, in most cases, the portion sizes of these have remained fairly constant;
- Notable exceptions include individual ready meals and white sliced bread, where there are clear increases in pack size/slice weight. Some, but not all, fast food items have also increased in size compared with the early 1990s;
- Smaller pack sizes are available for many products (e.g. chocolate confectionery, savoury snacks, soft drinks). However, these smaller packs tend to be available in multipacks from larger retailers.

Conversely, comparable standard or regular size packs, purchased as single units, often from smaller or independent retail outlets, tend to be larger than the same product purchased as part of a multipack.

- Larger pack sizes, and in some cases 'sharer type packs', are also available for many products, often for premium products, including luxury cookies, American muffins, luxury ice cream bars, sausages, premium crisps, and chocolate confectionery. From the data sources examined, it is not possible to ascertain when these larger pack sizes became available.

It is recommended that:

- Further research is undertaken into changes in average portions as consumed and energy density of target foods, using dietary survey data from the NDNS;
- The basis of on-pack serving sizes and the use of these values by consumers should be investigated;
- Discussions should be held with the food industry to either verify the retrospective data included in this report, or to provide alternative data;
- Portion sizes should be monitored on an ongoing basis, by extending existing programmes (e.g. NDNS, processed food databank, nutrient analysis surveys) where appropriate.

1 Introduction

1.1 Scope of research

One of the Food Standards Agency's (the Agency's) strategic objectives is to develop and implement a strategy for energy intakes that contributes to achieving a balance between energy intake and energy output. In relation to this and a related objective to reduce population average intakes of saturates, the Agency has recently published its saturated fat and energy intake programme (FSA, 2008). The scope of this programme includes encouraging increased availability of smaller portion sizes for some products and their uptake by consumers, supporting wider initiatives on obesity led by the UK's health departments.

In support of this work and to inform the direction of the programme, the Agency is gathering information on both the evidence relating to portion sizes and their impact on energy intake, and on any changes in the portion sizes of foods over the last 15 to 20 years, covering the period since the 1986/1987 dietary and nutritional survey of British adults (Gregory *et al.*, 1990).

The objective of the current review was to identify whether there has been a change in portion sizes in foods available for retail sale and homemade foods (if information exists) since the 1990s, and, if so, what those changes are.

The scope of the review was as follows:

- To cover the UK only;
- To include only information that is published or publicly available;
- To report both on labelled portion sizes and actual portion sizes consumed/served, where available;
- The primary focus should be retail products but homemade dishes were also of interest, if information was available;
- The key food categories of interest were: bread, pizza, breakfast cereals, biscuits, buns, cakes, pastries, cheese, ice cream/dairy

desserts, fat spreads, meat and meat products, chips, other roasted potatoes and savoury snacks, chocolate confectionery, soft drinks (not low calorie), takeaway and fast food items, ready meals and meal centres, as these are the most influential in terms of saturated fat and energy intakes.

1.2 Existing information on changes in portion size

Although a causal relationship between increasing portion size and obesity rates would be difficult to establish, there has been a substantial amount of research in the United States looking at the influence of portion size on energy intake. Some of this research is summarised at Annex 1.

Although it is widely reported that portion sizes have increased, there appear to be very few published studies to support these reports. In the UK, the results of a study looking at the change in food portion sizes over the last 20 years have just been presented (Wrieden *et al.*, in press). This study reported that there is some evidence of increases in portion sizes in fast food outlets. However, literature searches identified no other UK studies.

The only other European study identified was a Danish study (Matthiessen *et al.*, 2003), which concluded that portion sizes of commercial energy-dense foods and beverages, and fast food meals rich in fat and/or added sugars appeared to have increased, particularly over the previous 10 years. For example, some popular sugar-sweetened beverages, confectionery and snacks had increased in size by about 20% to 100% since the 1960s, and in particular in the previous 10 years.

In the United States, dietary survey data from the large Nationwide Food Consumption Survey and Continuing Survey of Food Intake by Individuals (CSFII) were used to examine trends in portion size data. Between 1977 and 1996, food portion sizes for a range of food categories (e.g. salty snacks, desserts, soft drinks, fruit drinks, French fries, hamburgers, cheeseburgers,

and Mexican food) both inside and outside the home increased (Nielsen and Popkin, 2003). A similar study, using the same surveys and the National Health and Nutrition Examination Survey, of beverages reported increases in consumption of sweetened beverages and milk between 1977 and 2001 in all age groups (age 2 years and over) (Nielsen and Popkin, 2004). A study using data from the CSFII over a shorter time span (1989-1991 to 1994-1996) also reported increases in portion size for several foods, including soft drinks, coffee, tea and ready-to-eat cereal (Smickilas-Wright *et al.*, 2003).

Concerns about increasing portion size in the United States led to calls for fast food companies to decrease the size of menu items. However, it has been suggested that this had limited success. According to Young and Nestle (2007), who compared portion sizes in 1998, 2002 and 2006, Burger King had introduced a larger size hamburger since 2002. Although McDonalds phased out its largest size items, current (2006) menu items were similar to 1998 sizes and were much larger those offered when the company opened in 1955. The authors also made a general observation that portion size of some menu items in the United States exceed those available in Europe, but that portions in Europe were larger in 2006 than in 1998.

2 Methods

The first stage of the research was to identify relevant published information, and particularly whether any research on this area had been undertaken in the UK. Searches were undertaken on a range of appropriate databases, including PubMed, Scopus, FSTA, CAB abstracts, and BL online. Since the search terms 'portion size(s)' together with 'trends' or similar terms identified few documents, it was necessary to undertake wider searches (i.e. 'portion size(s)', 'serving size(s)', etc. and sift through the results.

Back copies of *Which?* and *Food Magazine* were also consulted. As anticipated, the searches revealed no relevant UK studies, although a limited number of articles were identified that contained information on portion size at a given point in time.

It was agreed with the Agency that the scope of the project could be extended to include information that was publicly available, even if it was not published per se. On this basis and taking account of the literature searches, the following main data sources were identified:

- Paper by Bingham and Day (1987) giving portion sizes based on dietary survey data;
- Food Portion Sizes publications in 1990 (Crawley, 1990) and 1993 (Food Standards Agency, 2002; data unchanged from 1993);
- Sampling reports from MAFF and Agency nutrient analysis projects and mini-surveys;
- Davies and Dickerson (1991) book on nutrient content of food portions;
- Article from *Food Magazine* (Anon, 2004);
- Catering supplier brochures held by the Agency;
- Portion size information collated from National Diet and Nutrition Surveys (NDNS) (Wrieden *et al.*, 2006). It was agreed that raw data from the NDNS would not be accessed.
- Data from food manufacturers, foodservice chains and retailers collated for a FSA project (Wrieden *et al.*, 2006).

- Publicly available information on current serving sizes and pack weights. Thus, information taken direct from food packages and from websites was included, but not other information that might be held by food manufacturers, foodservice chains and retailers.

Further information on some of these data sources, including their limitations are provided at Annex 2.

A list of target foods, based on the key categories requested by the Agency, was agreed. The focus was on foods that had been available in the market over the timescale of interest. Therefore some foods that have been introduced onto the market relatively recently, such as smoothies, were not included.

For each of the target foods, purchase data from TNS, supplied by the Agency, were examined in order to identify the top selling products. Where possible (i.e. where the product was found and portion size information was available), the identified products were included in the review. Although retrospective portion size data on the same brands was sought, in many cases it was not available. (An alternative approach would have been to use brands for which retrospective data was available as a starting point and search for current data on these brands. However, this would have been less representative of current purchasing habits.)

To illustrate the range of portion sizes now available for some of the target foods (e.g. mini flapjack bites, large croissants), some products were also chosen at random. For ready meals, additional products were chosen in order to provide information on children's ready meals as well as current data for a wider range of ready meals for which retrospective data were available. For foodservice products, the choice of products was based on easily accessible data and this information should be considered as indicative only as it is not representative of the wide range of foodservice products available.

The absence of a particular brand means only that it was not included in the review; no further meaning should be read into its absence in the report. In addition, the review is not intended to be exhaustive; the branded products chosen provide only a snapshot of the available products at any given time. It is also important to note that, while the portion sizes presented here were current at the time of this study, food products and their formulations are subject to change.

There are some products for which 'published' portion size data are not available. In particular, this includes in-store bakery products sold at supermarkets (e.g. bread rolls, doughnuts, cookies) and products sold by independent bakers and sandwich bars (e.g. pasties, sausage rolls), as well as takeaway and restaurant foods. These products would need to be purchased and weighed; it was agreed that this was outside the scope of this project.

For both current and retrospective data, it was often necessary to derive the portion size based on pack information, for example:

- Total pack weight and number of units (e.g. sausage rolls);
- Total pack weight and number of portions (e.g. half pizza, one-sixth slice of gateau);
- Energy content per 100g and per portion.

This final derivation can only give an approximate portion size owing to, for example, rounding errors and, in some cases, a lack of clarity regarding the basis of the label nutritional data (i.e. as sold or as served). Portion sizes derived in this way are shown in italics in the Annex tables.

3 Results and discussion

Tables 1 to 16 summarise pack and serving sizes for each of the 16 categories examined. Where information on more than one brand was found, the different portion sizes available are listed. In these cases, 'average' values are not given, since taking a straight average of the available portion sizes would not provide a representative value, particularly where one or two brands dominate the market. It is also important to be aware that the extent to which serving sizes presented on packaging influence the portion size actually consumed is not known. Many factors will affect the latter, including individual taste and appetite, the eating occasion and the number of individuals present at the eating occasion.

The brand level data on pack size and serving size that were used to compile the summary tables are listed in Annex 3.

3.1 Bread

There is some indication that portion weights for white bread slices have increased, particularly for medium sliced bread (30g in 1990; 36g in 1993; 40g in 2008) (Table 1). Thin sliced bread is less common now, while the availability of extra thick sliced white bread (e.g. Hovis at 67g per slice) again suggests that portion sizes may have increased. There was a lack of current pack information on bread rolls, but based on branded products, there may have been an increase in portion weight. Croissants are an example of a product for which the portion weight of standard products has remained similar at about 50g, but for which premium/large products (approximately 70g) are now available. For naan breads, again, portion weights have not changed substantially (approximate range 130g to 170g). However, in this case, the own-brand products examined indicated a serving size of half a naan (about 70g to 80g).

During the last 15 to 20 years, the availability of specialist breads has increased. These specialist breads, including continental breads, often have a higher energy density compared with standard bread.

3.2 Breakfast cereals

It has been suggested that pack serving sizes for breakfast cereals are not necessarily indicative of consumer eating habits. Further, Agency analyses (personal communication) based on mean portion sizes, suggested an increase between the 1986/7 and 2000/1 adults surveys. However, based on the data compiled for this review, which do indicate the range of intakes, it is difficult to determine trends in portion size (Table 2). One of the reasons for this may be the different basis of the data sources; in particular, the basis of the values provided in the Food Portion Sizes publications is not clear. For some cereals (e.g. cornflake-type, muesli), median portion size taken from the 2000/2001 Adults survey is less than the medium average serving in the 1990 Food Portion Sizes book but similar to that in the 1993 edition and to current on-pack portion weights.

3.3 Biscuits

Traditional biscuits, such as digestives, rich tea, cream sandwich biscuits and chocolate-covered biscuits are still among the market-leading products, and there have been minimal changes in the weight of these biscuits (Table 3). The same is true of cereal bars, and the weight of one of the leading full-coated chocolate biscuits (Penguin) appears to have decreased slightly, from 24g in 1990 to 22g now.

Premium/luxury cookies, including those available in foodservice outlets, are, however, now more commonly available, leading to an increase in the range of portion sizes. For example, traditional cookies (e.g. Maryland cookies) weigh about 10g to 12g, while a luxury cookie from a foodservice outlet (e.g. Starbucks) might weigh about 110g. Premium and luxury products are also likely to be more energy dense compared with some of the traditional biscuits.

However, it is also of note that median portion sizes from the 2000/2001 Adults survey suggest that more than one of the more traditional biscuits is consumed at a sitting (e.g. biscuit weight of digestives ranges from 14g to 16g, but the median portion size is 26g).

3.4 Buns, cakes and pastries

There was limited information on some products, such as Chelsea buns and doughnuts, for which packs do not contain weight or nutritional data, and it is therefore not possible to identify trends in these products.

As for biscuits, traditional cakes, including cake slices, are among the market-leading products and portion sizes for some of these have changed little (Table 4). Based on the small number of brands selected for this survey, there is some indication of an increase in unit weights of hot cross buns (from 50g in 1990 to about 70g in 2008) and scones (48g in 1990 to nearer 60g now), but in both cases the median portion size reported in the 2000/2001 Adults survey is lower than the current unit weight, possibly owing to the range of product weights available (e.g. from economy to premium versions).

In addition, the range of unit weights for some products (e.g. scones and American muffins) is substantial, particularly for those available at foodservice outlets. For example, a standard retail American muffin is likely to weigh about 70g (and mini muffins would weigh less) while a large retail muffin might weigh 110g and a muffin purchased from a coffee bar up to 140g. Similarly, standard retail scones are likely to weigh up to 60g, while those purchased from foodservice outlets might weigh up to 150g. It is not possible to ascertain from the data whether this is a recent trend. Some muffins (e.g. double and triple chocolate) are also likely to be more energy dense compared with more traditional cakes.

3.5 Yoghurts, fromage frais and chilled desserts

The range of portion sizes for yoghurts and fromage frais has remained fairly constant and, for standard low fat fruit yoghurts, some pot sizes have decreased slightly (from 125g to 120g) (Table 5). Premium yoghurts (150g) and split yoghurts (150g or 175g) tend to be available in larger pots (150g), but this was also the case in 1990. Smaller pots (i.e. 120g and 125g) tend to be sold mainly in the form of multipacks, while the larger pots (150g, 175g, 200g) are more likely to be sold individually, as well as in multipacks.

Fromage frais tubes are now popular amongst children; these tend to have a lower unit weight compared with small pots (e.g. 40g per tube but 50g to 60g for small pots). However, some brands of fromage frais indicate that a serving is two small pots (e.g. 120g). There has been little change in pack weights for individual dairy desserts (e.g. chocolate desserts, trifle), although larger pack sizes are available (e.g. 100g for chocolate desserts and 150g for trifle).

3.6 Ice cream and frozen desserts

There is some indication that portion weights of ice cream cones and bars have decreased (Table 6). For example, the unit weight of Cornetto-type ice cream cones has decreased from 74g in 1990 to 60g or 63g now, a change that might be partly explained by their increased availability in multipacks. However, traditional choc ices are less commonly available now, and premium ice cream bars, which may be more energy dense as well as being larger, may be consumed in their place.

Miniature versions of many products have also been introduced. For example, miniature Cornettos are available in multipacks and have a unit weight of 19g. Smaller versions of ice cream bars recently launched include Celebrations (e.g. mini Mars ice cream weighing 17g, compared with a multipack bar at 41.8g) and Magnum snack size (50g compared with 86g for

Magnum classic). It might be speculated that miniature versions may have the potential to encourage increased frequency of consumption.

For frozen desserts such as cheesecake and chocolate gateaux, there are no consistent trends, but, again, the range of portion sizes is substantial, particularly when those from foodservice outlets are taken into account. For example, based on the small number of products examined in this study, a slice of retail cheesecake might range from 75g to 105g, while that from a foodservice outlet might range from 100g to 190g.

3.7 Cheese

In general, average portion sizes based on dietary survey data for cheese have changed little (e.g. median portion size of 40g in the 2000/2001 Adults survey) (Table 7). However, pre-packed Cheddar slices (20g to 30g) tend to have a lower unit weight compared with reported 'average' portions for a sandwich (45g, Food Portion Sizes).

Conversely, there appears to be a trend towards increasing unit weight of processed cheese slices; in 1990 and 1993 a 20g unit weight (slice) was reported, whereas the slice weight of the leading brand is now 25g.

The unit weight of standard cheese triangles (e.g. 14g or 17g) has not changed, although a leading brand suggests a serving size of two triangles (28g). The unit weight of larger triangles appears to have decreased (e.g. from 28g in 1990 and 25g in 1993 to 20g now), and it is interesting to note that one brand no longer has the 'chunky' descriptor.

3.8 Fat spreads

Pack information on the portion size of fat spreads is not likely to be meaningful, owing to the variation in consumer uses and tastes. Information from Food Portion Sizes and the NDNS of adults aged 19-64 years is presented in Table 8.

3.9 Cheese and tomato pizza

Suggested serving sizes for pizzas are highly variable, even when the different pizza sizes are taken into account (Table 9). Foodservice data tend to be expressed per slice, but the number of slices consumed will vary according to the consumer and the eating occasion. Overall, the sizes of whole pizzas and, for thin crust, half pizzas appear to have remained at similar levels. A comparison of average portion sizes between the 1986/7 and 2000/1 adults surveys would be particularly useful for this food category, in order to assess whether consumers' portion sizes have changed.

3.10 Meat, meat products and pies

Average portion sizes, based on dietary survey data, of roast meats and steaks do not appear to have increased, and many burgers and sausages are sold at a standard weight (Table 10). However, for both burgers and sausages, premium products are now available, which have a higher unit weight. For example, at the point of purchase, a thin sausage is likely to weigh about 25g to 28g and a thick sausage about 50g to 57g, while a premium sausage is likely to weigh about 67g or 76g. It is not known whether the number of sausages consumed by individuals is lower for the premium sausages compared with, say, the more traditional thick sausages. For sausages in particular, many of these premium products are amongst the top selling products. Breaded chicken portion sizes appear to have decreased slightly (e.g. from 160g or 170g for a chicken kiev to 142g now).

There is substantial variation in slice weights of hams and cooked meat. Weights of wafer thin (e.g. 8g/slice) and standard (e.g. 25g to 27g) slices, which are the top selling products, have remained broadly similar. However, slice weights of premium products tend to be higher, at up to 45g per slice.

Individual meat pies have generally remained broadly similar in weight at about 130g to 160g, although, again, some individual products are much

larger (e.g. Ginsters pies at 250g). The same is true for sausage rolls, for which a range of different sizes have been available for many years (from mini sausage rolls at about 15g to large versions at up to 150g), and standard Cornish pasties at about 150g. Based on limited information, large Cornish pasties tend to be slightly smaller now (e.g. 227g for a leading brand now compared with 260g in 1990/1993), but this does exclude products from sandwich bars, pasty shops and other foodservice outlets, which might be larger. For pork pies, mini pork pies are now popular and the unit weight of many of these appears to have increased (e.g. from 50g in 1990/1993 to about 75g or 80g now), but the Food Portion Sizes books do include buffet pork pies at 75g per unit.

3.11 Ready meals and meal centres

Table 11 includes three main types of information about portions of meat and other dishes:

- Average portion from dietary survey records (which will be a combination of homemade and ready-prepared dishes) or from larger packs of ready meals;
- Single-serve ready meals;
- Foodservice portions.

Looking at average portions, trends are not consistent amongst those dishes examined (i.e. the top sellers). For example, average portions of beef lasagne ranged from 230g to 450g in the early 1990s to 315g in the 2000/2001 Adults survey and 400g to 475g based on current larger (multi-portion) ready meal pack serving sizes.

Based on very limited foodservice data, there is some suggestion that portion sizes may have increased in some cases (e.g. Brakes individual portions appear to be higher now compared with the mid 1990s).

The trends for individual servings of ready meals are more apparent. There has been a clear increase for several dishes, particularly beef lasagne (from 250g in 1990 and 290g in 1993 to 320g to 500g now) and pasta ready meals (e.g. tagliatelle carbonara, macaroni cheese; from 235g in 1993 to 400g to 430g now)), where the change is across all brands. For chicken curry and spaghetti Bolognese, there has been an increase across most brands, with the exception of Weight Watchers products.

It is, however, interesting to note that current pack sizes for lasagne ready meals are similar to *average* portion sizes (420g, 450g) listed in the *Food Portion Sizes* books during the early 1990s. In addition, smaller portions of a few ready meals are now being introduced (e.g. Asda mini classics, 'a complete meal for the small appetite or a light snack for those in a hurry'). Further, there is no information on how the weights of the components of ready meals might have changed. For example, in a chicken curry with rice, the change in portion weight could be the result of an increase in the carbohydrate (i.e. rice) component, or in the meat/sauce component, or both.

3.12 Prepared sandwiches

Weights of commercial sandwiches vary widely, but those purchased from retail outlets are likely to be more standard. Based on limited information on some of the most popular sandwiches, pack weights have remained broadly similar (Table 12). However, no account is taken of larger sandwiches, such as club sandwiches, subs or packs that include three, rather than two, sandwiches.

3.13 Fast food

'Supersizing' of fast food attracted widespread media attention about four years ago, and it is interesting to look at the portion size trends in this context (Table 13). Portion sizes of McDonalds standard hamburgers and chicken nuggets (both at about 104g now) have changed little, while the size of Big Macs (204g in 1993; about 216g now) and McChicken sandwich (159g in

1993; about 170g now) have increased since the early 1990s. McDonalds quarterpounder with cheese, at about 195g, is now at the same level as 1993, but it has decreased from a peak within the last few years (e.g. 206g reported by Wrieden in 2006). The sizes of the Burger King hamburgers examined have, however, all increased since 1993, albeit very slightly in some cases. For example, a Whopper has increased from 258g in 1993 to 274g now and a double Whopper with cheese from 359g to 380g in the same timescale.

Sizes of small, regular, medium and large portions of French fries have changed little since 1993 (e.g. medium McDonalds fries 110g in 1993, about 114g now; Burger King regular fries 116g in 1993, 110g now). However, both chains introduced super size portions of fries (174g for Burger King, 183g for McDonalds). McDonalds has now withdrawn these, but Burger King still has this menu option.

Milkshakes and carbonated soft drinks are discussed at section 3.16.

3.14 Potato products and savoury snacks

There are no consistent trends in portion sizes for chips and roast potatoes, based on limited data, but NDNS data illustrate the wide variation found (Table 14). For example, the median portion size for oven chips in 2000/2001 was 131g but the 25th percentile was 99g while the 75th percentile was 176g.

For potato crisps and savoury snacks, there have been two main changes:

- Multipack crisp sizes are generally lower than individual packs sold separately (e.g. 25g (pack from multipack) compared with 34.5g standard bag for Walkers crisps). Thus, although smaller pack sizes are available, it is necessary to buy a multipack to access them.
- Larger pack sizes (e.g. 150g to 400g) have been introduced for many products, particularly premium crisps and tortilla chips. These are marketed as 'sharing packs'.

3.15 Chocolate confectionery

The trends for chocolate confectionery (Table 15) are similar to those for crisps and savoury snacks, i.e.

- Multipack sizes of standard or regular packs are generally lower than comparable individual packs sold separately (e.g. 54g for a Mars bar from a multipack, 62.5g for a standard Mars bar). Thus, although smaller pack sizes are available, it is necessary to buy a multipack to access them.
- Larger pack sizes have been introduced for many products. Many of these are marketed as 'sharing packs' (e.g. Mars duo (85g)), but descriptors such as 'king size' (e.g. Twix king size (85g)) are still in use, despite criticism.

In addition, for most products, there is a much wider choice of pack size, with 'treat size' (e.g. Cadburys dairy milk treat size (15g)) and 'snack size' (e.g. Toffee Crisp snack size (30g)) descriptors often used. (These products are again sold in the form of multipacks.)

It is interesting to note that it has been reported (Anon, 2008) that sales of the '99-calorie' dairy milk bar launched by Cadburys steadily declined, suggesting that this approach has not yet become popular among consumers.

3.16 Beverages

There are no consistent trends for milkshakes and flavoured milks, although, for the latter, smaller portion packs are now available (Table 16). For retail soft drinks, there is a wide range of pack sizes for both bottles and cartons, and it is difficult to assess trends. However, the range of 'single serve' pack

sizes has increased, with both smaller (e.g. 250ml bottles sold in multipacks) and larger (e.g. 1.25l bottles) packs now available.

The impact of 'smoothies', which can have a higher energy density compared with other beverages, cannot be assessed owing to their relatively recent entry onto the market, but this is an area worthy of further investigation.

Looking at foodservice outlets, it is now commonplace for many, particularly those popular with families, to offer 'unlimited refills' of carbonated soft drinks and squash. In addition, both McDonalds (750ml) and Burger King (900g) introduced 'super' or 'super size' portions, although, as for fries, McDonalds have now withdrawn these.

4 Conclusions

In its saturated fat and energy intake programme (FSA, 2008), the Agency indicates that it will explore with the food industry the development of smaller portion sizes and the scope to standardise portion sizes for some products. It is proposed that the focus of the work will include the types of food that are pre-packed to provide individual servings (e.g. snacks, confectionery, ready meals, soft drinks, etc).

The retrospective data used in this report have a number of limitations, particularly a lack of documentation. Owing both to these drawbacks and to the very limited amount of directly comparable data, it is difficult to ascertain consistent trends for many food categories.

Overall more traditional and standard products continue to feature among the market leaders and, in most cases, the portion sizes of these have remained fairly constant. Notable exceptions include sliced white bread and individual ready meals, where there are clear increases in slice weight/pack size. (Whilst an increase in slice weight for bread is consistent with Agency advice to consume more starchy carbohydrates, for ready meals, it is not known, from the data sources used in this study, whether there has been an increase in the proportion of some (e.g. carbohydrate components, vegetables) or all components.) Some, but not all, fast food items have also increased in size compared with the early 1990s.

However, there does appear to be a clear increase in the range of portion sizes/pack weights available for products such as confectionery, ice creams and savoury snacks. For example, miniature versions or packs of biscuits, cakes, snacks and confectionery are widely available. Such 'mini packs' also meet the consumer demand for convenient and portable snacks. However, often these smaller packs are only available in multipacks from large retail outlets, while packs available at smaller outlets, and those likely to be purchased as an 'impulse buy', are usually standard or larger size.

Another trend seen across a range of food categories is the presence of larger or, in some cases, 'sharer' type packs, often for premium products, which tend to be energy-dense in addition to being larger in size. Examples include luxury cookies, American muffins, luxury ice cream bars, sausages, premium crisps, and chocolate confectionery. However, from the data examined in this study, it is not possible to determine whether this is a recent trend, or, indeed, to confirm whether or not such products were available 15 to 20 years ago. (It is possible that some were available but were not included from the data sources examined, such as the Food Portion Sizes publications.)

Based on the findings of this preliminary survey, it is recommended that further analysis and monitoring of portion sizes be considered. Further details are provided in Annex 4.

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Research on portion size and energy intake

It has been suggested, particularly in the United States, that larger portion sizes may play a role in the obesity epidemic (e.g. Ledikwe *et al.*, 2005; Rolls *et al.*, 2005; Young and Nestle, 2002). This suggestion has arisen because during the same period when obesity rates have risen, in the United States at least, there also appears to have been increases in portion sizes of many foods and an increased prevalence of eating away from the home. There is also interest in the effect of energy density on energy intake, either independently or combined with portion size (Kral and Rolls, 2004; Kral *et al.*, 2004).

A causal relationship between increasing portion size and obesity rates would be difficult to establish, owing to the many confounding factors. In spite of these difficulties, there has been a substantial amount of research in the United States looking at the influence of portion size on energy intake. Many of these studies have looked at specific populations in the United States (often university students) and have small sample sizes. Nonetheless, there does appear to be a substantial body of evidence linking portion size and energy density with energy intake. When considering these studies, the differences in eating habits between the United States and Europe need to be borne in mind. For example, it has been suggested that French people consume less than American people but eat over a longer period of time and that French portion sizes are smaller in comparable restaurants (Rozin *et al.*, 2003).

For example, a study of undergraduate students found serving larger amounts of soup, pasta, breadsticks and ice cream resulted in the consumption of greater amounts (Levitsky and Youn, 2004). The portion size of a sandwich increased lunch energy intake among adults in a university setting (Rolls *et al.*, 2004a).

One potential area of concern highlighted has been the consumption of soft drinks. A small study of adults concluded that serving a larger portion of a caloric beverage (cola) at a meal resulted in increased beverage consumption and energy intake from the beverage (Flood *et al.*, 2006).

Snack foods are another category of interest. A study looking at the amount of food and package unit size of four snack foods (potato crisps, cheese crackers, cookies and confectionery) in college-age men and women reported that the amount of food provided was associated with energy intake (Raynor and Wing, 2007). However, no effect of package unit size was found. This latter finding is in contrast with another study, which reported that short-term energy intake increased with increased packaging size of a snack (potato crisps) (Rolls *et al.*, 2004b).

Looking at foodservice settings, a study of 180 adults reported that those who chose a large portion pasta entrée had a higher energy intake both from the entrée and for the entire meal, compared with those who chose a standard portion entrée (Dilberti *et al.*, 2004).

In addition to the immediate effects of increased portion size on energy intake, research on longer term intake has also been undertaken. When portion sizes were increased (by 50%) for 11 days in a small group of men and women, daily energy intake increased, the increase being sustained for 11 days (Rolls *et al.*, 2007). A small study of the effect of two different size lunch box meals, each provided for one month, found that daily energy intake was higher during the period when the larger (and more calorific) lunch box was provided (Jeffrey *et al.*, 2007).

Amongst children, a French study (Lioret *et al.*, 2007), looking at a representative sample from a food consumption study, found some evidence of an association between portion size of some foods and overweight. For example, overweight in children aged 3 to 6 years was positively correlated to portion sizes of croissant-like pastries and other sweetened pastries.

While most studies have looked at the effect of increased portion size, there has also been some research into the effect of reduction in portion size. For example, one study reported that reductions in portion size and energy density over 2 days independently resulted in decreased ad libitum energy intake among women (Rolls *et al.*, 2006).

Data sources and their limitations

1. *Bingham and Day (1987)*

This paper includes data on portions (average, range, standard deviation) weighed by 63 adult respondents in a dietary survey in Cambridge, UK, in 1977. Foods were weighed as they were about to be consumed; corrected for inedible and edible waste. There was a very large range between individuals and small numbers of consumers for some foods.

2. *Food Portion Sizes publications* in 1990 (Crawley, 1990) and 1993 (Food Standards Agency, 2002; data unchanged from 1993)

Documentation for the 1990 edition is no longer available and is very limited for the 1993 edition, so data sources can mostly not be verified. A substantial amount of information at the brand level was obtained direct from food manufacturers and foodservice chains. It is believed that 'average portion' data for generic foods as consumed was derived from the 1986/7 Dietary and Nutritional Survey of British Adults (Gregory *et al.*, 1990). However, some of these data changed between the 1990 and 1993 editions, suggesting that either the Adults' data was reanalysed or that other data sources were also used. In the case of breakfast cereals, from the available documentation, it is clear that a manufacturer requested a change to some of the 'average' portion sizes for the 1993 edition. However, the manufacturer does not indicate the rationale for the change.

3. *Davies and Dickerson (1991)* book on nutrient content of food portions.

"All foods were purchased and either used as such or made up according to standard recipes quoted in tables of food composition. To estimate portion size, three different people were asked independently to serve what they considered to be a small, medium and large portion. Appropriate serving vessels, for example dinner plates, soup bowls or mugs, were used for this

procedure so that the size of the portion was judged in its 'normal serving environment'. All weighings were recorded on scales accurate to the nearest gram. Nine weights – three small, three medium and three large – were obtained for each food item; the small and large portions were used to validate the medium-sized portion. The mean value of the medium-sized portion was used in the tables. When foods purchased were already in the form of a unit, such as one pork chop, one jam doughnut, three different brands were obtained and the mean value taken as the weight of the item. For items such as biscuits, three different people were asked to judge small, medium and large portions in order to assess whether one or more units constituted a medium-sized portion."

"The whole question of food portions is highly controversial and a definition of what constitutes a 'standard' or 'average' is unlikely to be generally acceptable. The food portions used in these tables are considered as estimates and should be interpreted as such."

4. *Sampling reports* from MAFF and Agency nutrient analysis projects and mini-surveys;

The Agency, and previously the then Ministry of Agriculture, Fisheries and Food, undertake analytical surveys to determine the nutrient content of foods. Information on the samples analysed for these surveys is provided in sampling reports. In some cases, it was possible to use this information to derive portion size, although it was not generally available for the full range of samples analysed.

Further details of the MAFF nutrient analysis surveys and FSA mini surveys can be found via the FSA website (www.food.gov.uk). Sampling reports are held by the Nutrition Division of the FSA.

5. Report of *FSA project* collating portion size information from National Diet and Nutrition Surveys and data from food manufacturers, foodservice chains and retailers (Wrieden *et al.*, 2006)

Median portion size for adults aged 19-64 years, together with 25th and 75th percentiles, to illustrate the range of portion sizes, were extracted. For categories such as meat products and ready meals, the portion size reflects both homemade dishes and retail products. The data are derived from the National Diet and Nutrition Survey of Adults aged 19-64 years (Henderson *et al.*, 2002), which was undertaken in 2000/2001.

Data obtained directly from food manufacturers, foodservice chains and retailers and from their websites is also included.

6. *Websites containing current data* for food manufacturers, foodservice chains and retailers

Some food manufacturers, retailers and foodservice chains now provide product and nutritional information (of the type found on food packages: see below), mainly for consumer use. In many cases, this could be used to derive portion information. The majority of information on current portion sizes was derived from such websites.

Owing to the rapidly changing nature of the food market, information obtained from websites may not take account of very recent changes in formulation or pack size.

7. *Food packages*

Where the relevant information was not available from websites, packs were purchased direct from retail outlets. Portion size was derived as described in section 2 (Methods).

Recommendations

Based on the findings of this preliminary survey, it is suggested that the following areas be considered:

- An analysis of median portion sizes in the 1986/7 Adults' survey is undertaken for the target food categories and compared with the same data from the 2000/1 NDNS of adults aged 19 to 64 years. This would provide an insight into any changes in average portion sizes of foods as consumed. For ease of comparison, it is suggested that the methods employed by Wrieden and colleagues (2006) should be used for the analysis. The analysis could be undertaken for the same food categories included within this study, but priority areas include pizzas and breakfast cereals, for which, more so than for other foods, on-pack serving sizes may not reflect the portions consumed by individuals.
- Given the reported association between energy density and energy intake, and the implications for obesity, it is recommended that a comparison of the energy density of target food categories between the two adults' surveys is undertaken. This information could also easily be included for products currently on the market, but would be difficult to obtain retrospectively.
- The basis for serving sizes included on food packages is not transparent and more information in this area would be helpful.
- In addition, it is recommended that research is commissioned into whether and how consumers use serving sizes included on food packages.
- The retrospective data used in this report have a number of limitations, particularly a lack of documentation. It is therefore suggested that further information, both on pack weights and on the availability of a range of pack sizes over the last 15 to 20 years, is sought from relevant food manufacturers and retailers, who may be able to verify the data presented here, or provide alternative data from their own records.

- Finally, portion sizes should be monitored on an ongoing basis, not least to assess the success of any portion control strategies agreed. The use of existing monitoring programmes (e.g. NDNS, processed food databank, nutrient analysis surveys) should be considered in this context. In particular, where food samples are being purchased for the processed food databank and nutrient analysis surveys, the Agency should ensure that sample information collected is sufficiently detailed and specific to enable portion size data (e.g. pack weight, unit weight) to be derived. For products that do not include pack or unit weights (e.g. instore cookies and doughnuts in the forthcoming survey of buns, cakes, biscuits and pastries), it is recommended that products are weighed and the appropriate information recorded.