Optimising food composition data flow within the UK Food Supply Chain and to external stakeholders.

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Contributors: CH and MBE were responsible for writing of the manuscript. AF and MMR provided significant advice regarding manuscript structure. JB and BM facilitated contact with the IGD and contributed to preparation of the manuscript.

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Abstract

The UK national food composition tables provide reasonable coverage of primary produce and basic raw and cooked foods but it is difficult for them to keep abreast of the fast moving processed and convenience food market. The food industry has an inherent need to generate and share food composition data on food products and therefore much of these data exist within the food industry, embedded in their core Enterprise and Resource Planning (ERP) software. A survey was conducted to explore the current uses and flow of food composition data within the UK food supply chain and identify potential barriers to effective data transfer. Results indicate that providing food composition data is perceived as a frustrating, time consuming task and limitations lie in the lack of commonly agreed systems, processes and standards for the transfer of these data from those that generate it to those that need it. Within logistics and finance functions, industry is moving closer to a completely collaborative model via implementation of the Global Data Synchronisation Network (GDSN) infrastructure and methodology. This approach, if implemented for food composition data, has the potential to enable high quality food composition data to be accessible '*at the push of a button'*.

Key words food composition data, barriers, food industry, processed foods, data transfer

1. Introduction

Recent years have witnessed an increasing burden of diet-related diseases such as obesity, type 2 diabetes and cardiovascular disease, with some reaching epidemic levels (Prentice, 2006). A major contributory factor to the development of these chronic diseases is lifestyle changes that include reduced physical activity and a shift to more energy dense diets (Popkin and Gordon-Larsen, 2004). In response to this public health problem a number of strategies and initiatives have been developed in an attempt to prevent and control these chronic

diseases. One such strategy is the World Health Organisation's Global Strategy on Diet, Physical Activity and Health (2004) which highlighted nutrition as one key 'risk' factor contributing to the growing public health problems. In particular a low intake of vegetables and fruits and increased consumption of foods that are high in fat, sugar and/or salt is seen as detrimental (WHO, 2004). This inevitably focuses attention on the nutrient composition of foods and reinforces the need for accurate, up-to-date data by health professionals and policy makers. The role of the food industry in providing information on food composition to national authorities is highlighted by inclusion in specific recommendations made by the WHO in its global strategy.

Current statistics show that the processed and convenience food market is increasing and that consumers are frequently less likely to prepare their meals from basic raw produce and ingredients. The UK 'ready meals' sector is the most highly developed in Europe in terms of the range of products available and total volume of sales, with the recent market valued at £24.9bn and forecast to reach between £27.3bn and £33.9bn by the end of 2011 (Buckley et al. 2007). Producing and maintaining data on the nutritional composition of these highly processed, often energy dense commercial foods in the national tables is a challenging task, and food composition data providers must consider new and novel approaches to describing this rapidly changing food supply (Gillanders et al. 2002).

Traditionally in the UK the national food composition tables, managed by the Food Standards Agency and commonly known as 'McCance and Widdowson' (FSA 2002), are used as the primary source of food composition data. Initiated in the 1920s the McCance and Widdowson data, traditionally available in paper format and more recently electronically, have been maintained and updated over time in an attempt to reflect the most commonly consumed

foods. Much of the data are derived from laboratory analysis and are driven by the needs of National Diet and Nutrition Surveys. Whilst these tables contain reasonable coverage of the nutrient content of primary produce and basic raw and cooked foods, it is almost impossible for the tables to keep abreast of the fast moving processed and convenience food market, which typically exhibits a high rate of reformulation within its existing product ranges and constant new product introduction programmes. Such issues have also been highlighted in relation to maintaining nutrient databases for nutritional research (Schakel, 2001).

Food composition data are fundamental to many activities within the food manufacturing industry including optimisation of product composition, health claim support and nutritional labelling (Roodenburg and Leenan, 2007). Within the development stages of a typical product, food composition data may be generated by analysis of the actual foodstuff or calculated using data from published tables or ingredient suppliers. Industrial ingredients tend not to be well covered by the published tables and therefore the ingredients suppliers are an important source of data for food manufacturers, particularly Small Medium Enterprises (SMEs) for whom direct analysis is often too expensive.

Once a product has been developed, elements of food composition data are listed on pack to comply with food labelling legislation and used as marketing and advertising tools which are communicated to end consumers via on-pack labelling, leaflets, media and websites. Food composition data are also regularly provided by industry to key stakeholders such as trade organisations, national government bodies, slimming organisations and other commercial organisations that develop and market data management tools for use in the field of food, nutrition and health.

Food composition data on these highly processed foods therefore exists but limitations lie in the lack of commonly agreed systems, processes and standards for the transfer of data from those that generate it to those that need it, often resulting in frustrating, repetitive and time consuming data transfer activities. Limitations also exist with regards to the quality of food composition data available from industry due to the lack of standardised procedures for recipe calculation, sampling and analysis of these very complex foods (Krines and Finglas 2006) and the different strategies employed by the various nutritional analysis software packages in dealing with missing values and cooking losses (Church and Krines 2008).

With the expansion of the European Union and subsequent increases in cross border trade, harmonisation of food composition data, accompanied by the creation of durable and sustainable structures to maintain the viability of such data is a very important issue (Egan et al. 2007). This issue, amongst others relating to the overall development of an effective pan-European food composition data resource, is currently being addressed by the European Food Information Resource (EuroFIR) project, an EU funded Network of excellence. In order to gain an insight into the potential barriers to more effective methods for food composition data transfer from the UK perspective, a survey was conducted within the UK food industry.

2. Materials and Methods

A questionnaire, using both closed and open questions, was developed covering aspects of the typical sources, access and use of food composition data. Respondents were also asked to provide information about specific situations in which they have been approached to provide food composition data on their own products to stakeholders such as national food composition dataset compilers, national government, regulatory authorities and/or trade organisations. In order to ensure access to representatives from the widest range of supply

chain participants the survey was conducted under the auspices of a joint European Food Information Resource Network (EuroFIR)/Institute of Grocery Distribution (IGD) working group facilitated by the British Nutrition Foundation (BNF) .The IGD represents a cross section of the UK food industry with over 500 members spanning retailing, food service, food and drink manufacturing, government bodies and other agencies with an interest in the food sector. The questionnaire was distributed via email in June 2006 principally targeting members of the Industry Nutrition Strategy Group (INSG), a sub-group of the IGD established in 2003 to enable the food and drink industry to play a constructive role in the development of integrated, cohesive and balanced nutrition strategies throughout the UK.

3. Results

A total of thirty-three questionnaires were returned which represents a reasonable response rate bearing in mind that the INSG subgroup consists of around 30 companies. It should be noted that within the responses received, a number of companies with more than one food category division completed a questionnaire for each separate division.

Of the responses received, the manufacturing sector represented over half of the sample (58%). A high proportion of companies described their market as global (61%) and in financial terms 64% reported annual turnover of greater than £5 million.The majority of respondents completing the questionnaires were nutritionists (46%), with others working in regulatory affairs (24%), product development (3%) and a variety of other roles (27%).

Within the survey the primary source of food composition data reported was McCance & Widdowson's Composition of Foods 6th edition (FSA 2002) including its' supplementary publications, with 85% of respondents accessing the data via paper based tables. Other

sources of information included the USDA nutrient databank, commercial nutrition analysis software, in house analytical data and supplier data. Labelling was mentioned most often as the reason for using food composition data, either to provide nutritional information, to calculate the composition of foods or to compare competititve products. Several respondents reported using published food composition data to calculate or verify on pack nutritional information, to estimate the nutritional composition of foods for comparative claims or to calculate the nutritional value of products/meals. Other uses included recipe analysis and new product development.

Respondents' principal needs were identified as increased access to additional food composition data and associated documentation. More specifically, respondents highlighted the need for additional nutritional information on ingredients, basic processed food intermediates, phytochemicals, a wider variety of fruits and vegetables as well as some indication of typical variations in the levels of nutrients e.g. seasonal changes in fruits and vegetables. Respondents also reported a requirement for information on the quality of food composition data itself; details on methods of analysis, reproducibility of data and verification of supplier data.

A number of respondents (42%) reported having provided data to National Government bodies such as the Food Standards Agency (FSA) and the Department for Environment, Food and Rural Affairs (DEFRA). Other recipients of food composition data from industry included trade organisations (39%) and various others (55%) such as slimming companies and the media. Ongoing interaction with numerous trade organisations was reported, generally relating to providing data on macronutrient/ micronutrient content per 100g. These data are

used in a variety of ways including updating of food composition tables, ongoing policy development, calculating the nutrient content of recipes, product purchasing decisions in the National Health Service and supporting salt reduction initiatives. Similarly there is regular provision of data on macronutrient content per 100g to slimming organisations and the media. The majority (90%) of respondents envisaged continuing to provide such data in future. The principal reasons given by respondents for not providing data were that there appeared to be no requirement for this information or that they had simply not been asked. The majority of respondents (81%) reported having access to an electronic dataset of the nutrient composition of their own products, and almost all respondents (91%) considered it beneficial to have access to an electronic dataset of the nutritional content of their products.

Barriers or difficulties to providing data externally fell into three broad categories; Resources, Technology and Confidentiality/ intellectual property. Within the 'Resources' category, key barriers were identified as time, cost and expertise. Providing data is perceived as a time consuming task particularly as data are only accurate at the time of transfer. Particular reference was made to the difficulties associated with maintaining accuracy of this type of data for large multinational companies as their recipes change, new product lines are developed and other products may be withdrawn. Issues with technology relate to incompatibility between database software, formatting of data and the extent of nutrient coverage. The issues relating to confidentiality of data generally refered to protection of recipes and any associated competitive advantage and not specifically to the sharing of nutrient composition data.

4. Discussion

It is clear that maintaining accurate up-to-date composition data on processed commercial foods in a national dataset is a challenging task. The survey results reported here provide an overview of the current sources, uses and provision of food composition data within a cross-section of the UK food industry. The results also give an insight into both the flow of food composition data within this sector and the barriers to transfer of data, highlighting the need for a more effective method for capture and maintenance. They further highlight the need to improve the availability of data between organisations in order to enhance the quality and availability of the data each subsequently provides on their own finished products.

It is important to recognise that the food industry is a complex supply chain often initiating in agriculture (primary produce) and terminating with the consumer. Food composition data are generated and utilised at almost every stage of the supply chain and data are frequently transferred or shared between the chain participants (Figure 1). Primary producers frequently provide food composition data on their products to processed ingredient suppliers, the food manufacturing sector and also to food service providers. Using these data, combined with other published sources and possibly data derived from chemical analyses, food manufacturers generate food composition data on their finished products. Typically these data are then provided to other members of the supply chain including food service providers, retailers, and finally the end consumer.

The UK national food composition data tables (McCance and Widdowson 6th edition) appear to be the primary source of data for the food industry however, the limitations of these tables necessitates the use of other sources such as the USDA nutrient databank and other commercial software that typically include food composition data on processed ingredients

and more complex foods to a greater extent. Data also appear to be regularly shared across the supply chain and sometimes provided to the National Government bodies such as the Food Standards Agency (FSA), Department for Environment, Food and Rural Affairs (DEFRA) and the Department of Health (DoH).With the increased focus on obesity and other nutrition-related diseases and the current changes in legislation relating to nutrition claims on foods, requests for the provision of accurate food composition data are likely to increase thus emphasising the need for robust systems and processes for data transfer throughout the supply chain.

Providing compositional data both within the supply chain and to external stakeholders is perceived as a time consuming, costly task fraught with difficulties that include incompatibility between software packages, non-standardised formatting of data and differences in the extent of nutrient coverage. In addition, self-generated food composition data for the large multinational companies are often embedded in electronic format within the internal Enterprise and Resource Planning (ERP) systems of the organisation concerned. Over the past decade, ERP solutions have been widely adopted by both large and small organisations as a way to integrate the data and processes of the organization into a single system (Gupta and Kohli, 2006). As a result of this, food composition data generally require significant manipulation to suit the formatting requirements of the requesting party before they can be transferred. This is often an onerous and repetitive task and the resulting data file is simply a snapshot of the data, only accurate at the time of issue and very quickly superseded by ongoing reformulation or new product introduction. The data recipient is then left with the dilemma of either attempting to maintain and update the data themselves, an almost impossible task without a robust change control process in place, or alternatively requesting a repeat dataset at a later date and attempting to identify changes therein. Overall

this research suggests that the food industry might be willing, and in many instances eager, to share up-to-date food composition data on their products. This is reinforced by the fact that many have reformulated products to reduce salt content in the recent past and are frustrated by the knowledge that it may take some considerable time for this to be reflected in the various national food composition tables across Europe.

In order to find a solution, it may be necessary to look outside the food composition data arena and more widely at how the food supply chain manages transfer of other types of technical data on their products. Industry is moving ever closer to a completely collaborative model, where companies increasingly share the critical in-house information they once protected with their suppliers, distributors and customers (Loizos, 1988). Within the logistics process, for example, a vast amount of data such as pack size, weight, case size etc. for each traded item is regularly transferred across the supply chain. Historically the transfer of data within the logistics process had been marred by similar issues to that of food composition data but significant progress has been made in recent years by the GS1 Global Data Synchronization Network (GS1). GS1 is a not-for-profit global organisation originally created by manufacturers and retailers to improve the efficiency of the food and consumer goods supply chain. The generation and implementation of GS1 standards provide a framework for interoperability ensuring accurate and up-to-date product data are available throughout the supply chain. Data can be readily accessed by trading partners via synchronised data pools and a central registry which ensures that accurate up-to-date information, maintained by the product owner, is always available. Core business information relating to a product is specified by the 'Business Message Standard' and 'Data Extension' standards are implemented as appropriate for the different product sectors e.g. foods, pharmaceuticals, electrical goods etc.

Based on requirements from the food sector a data extension standard specifically for ‘Food and Beverage' has been developed by GS1 which specifies a wide range of food related information including nutritional and ingredient declarations, preparation method, allergen and dietary information and other usage instructions, ultimately enabling this type of data to be uploaded into the synchronized data pools. A pilot of the data extension was launched in the autumn of 2006 in the UK however, unlike the core business data, uploading of the food and beverage extension data is likely to be optional. It is interesting to note however that this approach appears to be quite strongly endorsed by some of the larger UK Food Service providers and retailers as they increasingly need this type of information for menu planning and nutritional declarations, especially when providing catering services within the care or educational sectors. In parallel to the above initiative, a proposal combining the work within the EuroFIR consortium and the GS1 initiative was accepted in July 2008 by the European Committee for Standardisation (CEN). The resultant ‘Project committee – Food composition data’ (CEN/TC 387) led by the Swedish Standards Institute (SIS) consists of a core group of experts one of which is GS1-Sweden. This initiative aims to provide a framework that facilitates the compilation of high quality data on the identification and description of foods, food components and compositional values. Given that GS1-Sweden are participating, it would be reasonable to assume that this work is likely to result in some level of standardisation of the pre-existing GS1 Food and Beverage extension with whatever European standard emerges.

5. Conclusions

The food industry has an inherent need to share nutritional composition information within its own supply chain and also with external customers and stakeholders. For the majority of food manufacturers, food composition data for their own products are embedded in their ERP software alongside all their other critical business data including that on manufacturing, logistics and finance. The success of the GS1 approach for the sharing of high quality core logistics information could provide a model for effective transfer of up-to-date food composition information within the existing supply chain infrastructure. Application of the 'Food and Beverage' extension, underpinned by a European Standard for food composition data currently under development, will further extend the possibilities for effective exchange of high quality information on foods. This approach has the potential not only to satisfy the needs of the participants within the food supply chain by minimizing duplication of effort with respect to data transfer activities, but also to ensure that accurate food composition data are captured in a 'real time' pan-European manner. Data might then be accessed '*at the push of a button'* by national database managers, regulatory bodies and other key stakeholders if access to the central registry and/or synchronized data pools can be successfully negotiated.

Acknowledgements

This work was completed on behalf of the EuroFIR Consortium and funded under the EU 6th Framework Food Quality and Safety Programme (FOOD-CT-2005-51394). The authors acknowledge helpful comments and suggestions from other EuroFIR partners in the preparation of this article.

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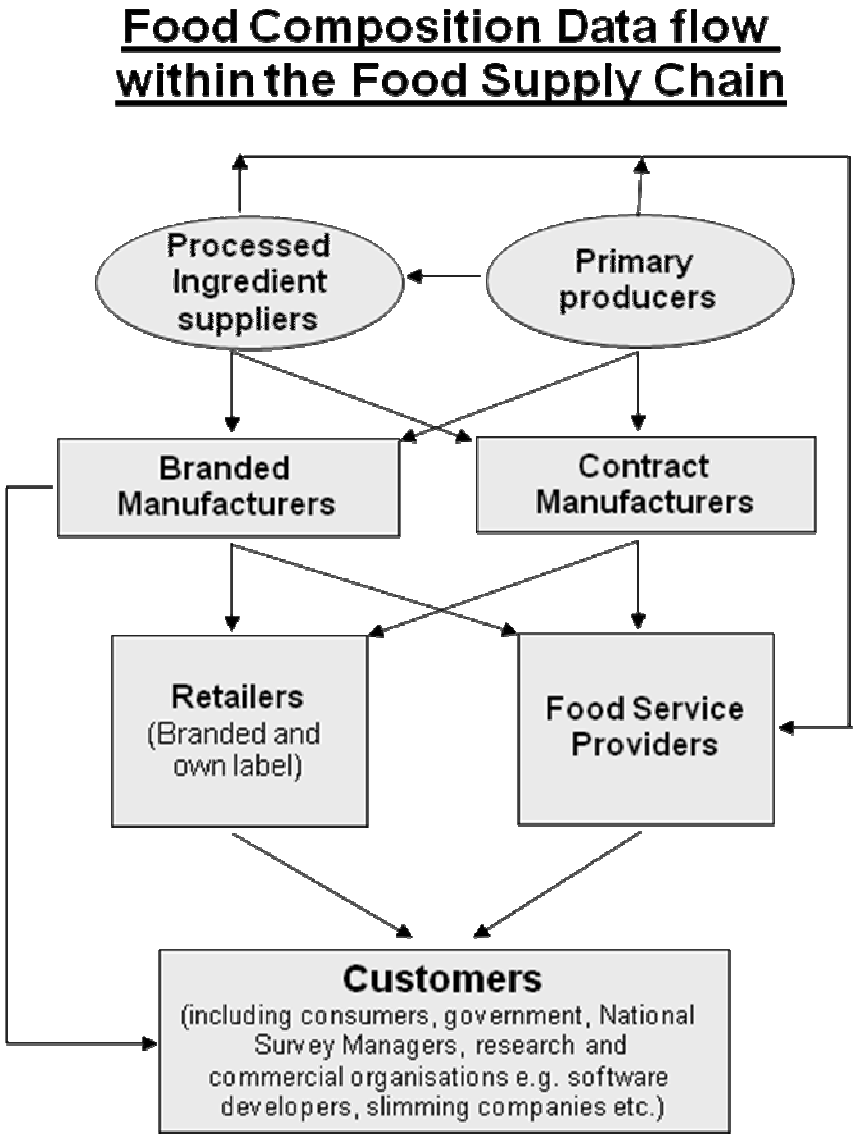

Fig. 1. Food composition data flow within the food supply chain.