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RESEARCH

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Nutritional content of supermarket ready meals and recipes by television chefs in the United Kingdom: cross sectional study

 OPEN ACCESS

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Abstract

Objectives To compare the energy and macronutrient content of main meals created by television chefs with ready meals sold by supermarkets, and to compare both with nutritional guidelines published by the World Health Organization and UK Food Standards Agency.

Design Cross sectional study.

Setting Three supermarkets with the largest share of the grocery market in the United Kingdom, 2010.

Samples 100 main meal recipes from five bestselling cookery books by UK television chefs and 100 own brand ready meals from the three leading UK supermarkets.

Main outcome measures Number of meals for which the nutritional content complied with WHO recommendations, and the proportion of nutrients classified as red, amber, or green using the UK FSA's "traffic light" system for labelling food.

Results No recipe or ready meal fully complied with the WHO recommendations. The ready meals were more likely to comply with the recommended proportions of energy derived from carbohydrate (18% *v* 6%, P=0.01) and sugars (83% v 81%, P=0.05) and fibre density (56% *v* 14% P<0.01). The recipes were more likely to comply with the recommended sodium density (36% *v* 4%, P<0.01), although salt used for seasoning was not assessed. The distributions of traffic light colours under the FSA's food labelling recommendations differed: the modal traffic light was red for the recipes (47%) and green for ready meals (42%). Overall, the recipes contained significantly more energy (2530 kJ *v* 2067 kJ), protein (37.5 g *v* 27.9 g), fat (27.1 g *v* 17.2 g), and saturated fat (9.2 g *v* 6.8 g; P<0.01 for all) and significantly less fibre (3.3 g *v* 6.5 g, P<0.01) per portion than the ready meals.

Conclusions Neither recipes created by television chefs nor ready meals sold by three of the leading UK supermarkets complied with WHO recommendations. Recipes were less healthy than ready meals, containing significantly more energy, protein, fat, and saturated fat, and less fibre per portion than the ready meals.

Introduction

Overweight and obesity are major threats to public health globally. One estimate suggests that 1.46 billion adults worldwide were overweight in 2008,[1] and projections suggest that by 2020 over 70% of adults in the United Kingdom and United States will be overweight.[2] This is likely to result in millions of additional cases of diabetes and heart disease and thousands of additional cases of cancer.[2]

In the United Kingdom, chefs who are popular on television programmes often advocate home cooking, and participants in UK studies have cited them as sources of cookery based knowledge.[3 4] Cookery shows often appear in the weekly top 30 viewed television programmes,[5] some cookery books by television chefs are among the all time bestselling non-fiction books in the United Kingdom,[6] and a successful UK commercial television channel, Good Food,[7] is dedicated to cookery.[8] It is possible therefore that television chefs influence many peoples' diets, although the type and degree of this influence is unclear: no simple relation exists between an individual's food based knowledge and their home cooking practices.[9] However, the popularity of television chefs suggests that their recipes form part of the nutritional landscape and yet no study has examined the nutritional content of their meals.

One alternative to cooking meals based on recipes is to use ready meals, more commonly known as "TV dinners" in the United States.[10] The definition of a ready meals is inconsistent, but the food industry sometimes defines it as a preprepared main course that can be reheated in its container, requires no further ingredients, and needs only minimal preparation before

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consumption.[11] According to the food industry, around £9.5bn (€11.4bn; $15bn) worth of ready meals are sold in western Europe each year, representing around 37% of the global market.[12] The United Kingdom represents the largest share of sales of ready meals in Europe, accounting for almost £2.5bn annually.[12 13] In 2003, 77% of households responding to a survey by the UK's Food Standards Agency (FSA) stated that they consumed ready meals at least occasionally, and 28% described using them at least weekly, although a definition for ready meals was not stated.[14] The ready meal market in the United States is less developed than that in the United Kingdom but is expanding, with some European manufacturers moving into the American market.[15 16] As with meals advocated by television chefs, no study has comprehensively examined the nutritional content of ready meals sold in UK supermarkets. A survey by the FSA in 2003 suggested that the salt content of ready meals was high, but the sample was not representative of the market.[17] Although some studies have explored the nutritional content of "convenience foods"[18] they often use a broader definition than ready meals alone.

Recipes promoted by television chefs are sometimes presented as being healthy: both NHS Choices[19] and Heart UK[20] feature exemplar "healthy recipes" associated with named television chefs, and some hospital trusts have taken advice from television chefs when formulating supposedly healthy hospital meals. This may give the impression that meals cooked by television chefs are, generally, healthy. By comparison, ready meals are often criticised for being unhealthy. NHS Choices claims that "ready-made meals often contain less fruit and vegetables (and more fat and sugar) than the meals you'd cook for yourself."[21] Both the US government's ChooseMyPlate initiative[22] and the UK government's Change4Life initiative[23] advise against frequent consumption of ready meals, despite no study having comprehensively assessed their nutritional content. We compared the energy, protein, carbohydrate, fat, sugar, fibre, and salt content of recipes devised by television chefs with those of standard range ready meals sold by supermarkets and determined whether the nutritional content complied with national and international recommendations.

Methods

We carried out a cross sectional analysis of the nutritional content of 100 main meals as described in recipes by television chefs and 100 standard ready meals sold by supermarkets as their own brand. Sample sizes were pragmatic but sufficient to ensure reasonable confidence limits for estimates (for example, 7.4% difference in energy content at the 5% significance level). We included meals if they were designed to be eaten hot, they were not described as being suitable for special occasions only or for breakfast, they were not soups, they included substantive items from at least two of the EatWell groups of the FSA,[24] and the recommended serving size was at least 225 g.

We chose these inclusion criteria to generate a comparable sample of ready meals and recipes created by television chefs that might be considered as typical main dishes for everyday consumption. We excluded soups because they are not always consumed as main dishes.[25 26] In restricting meals to those dishes including substantive items from at least two of the EatWell groups[24] and with a recommended serving size of at least 225 g we ensured that no items intended as side dishes (for example, prepared mashed potato, bubble and squeak) were inadvertently included—particularly in the ready meals sample.

Selection of recipes by television chefs

A television chef was defined as someone who had hosted at least one series on a UK terrestrial channel and had cooked in the programmes. We accessed recipes linked to these chefs in the most up to date books they had authored. To ensure external validity of the study we used a populist sample of recipe books. On 20 December 2010 we accessed the bestsellers chart through the food and drink category on Amazon (www.amazon.co.uk) and assessed the books for inclusion. We included the top five selling books identified on the cover as a television series tie-in, credited to a single television chef, and containing recipes for main course meals. From those meeting the inclusion criteria we selected a random sample of 100 recipes using randomly generated numbers in proportion to the number of eligible recipes in each book.

Selection of ready meals

For the category of own brand ready meals we included those sold by three large supermarket chains in the United Kingdom. Four supermarkets dominate the grocery market in the United Kingdom[27]: Tesco (30.6% of grocery market), Asda (16.9%), Sainsbury's (15.7%), and Morrisons (11.3%). We excluded Morrisons because its share varied considerably across the country (as low as 6% in some regions).[27 28]

Eligible ready meals were those produced by the supermarkets themselves (own brand), chilled, and bought within the container used for cooking the product. As we thought the term ready meal is commonly understood to imply a short preparation time, the eligible meals also had to have a recommended preparation time of 15 minutes or less (including heating).

Between 6 and 22 December 2010 we accessed online supermarket inventories to determine those ready meals sold by the included supermarkets that were potentially eligible for the study. Using randomly generated numbers in proportion to the number of meals sold by each supermarket we then selected a random sample of 100 ready meals that met the inclusion criteria.

Nutritional content of included meals

For each meal we collected information on the recommended number of servings (taken as the lower end of any stated range) and total energy (kJ), protein (g), carbohydrate (g), sugar (g), sodium (mg), fat (g), saturated fat (g), and fibre (mg) content. We also recorded the weight of each meal: for the recipes we used the total weight of the raw ingredients, whereas for the ready meals we recorded the total weight of the product as sold.

Using WinDiets software,[29] we calculated the nutritional content of the meals devised by the television chefs based on the raw ingredients stated in the recipes. When no exact matches could be found we substituted for the nearest available alternative—for example, the nutritional content of white rice used as a substitute for basmati rice. We excluded optional ingredients.

Because of the limited published data on the nutritional content of cooked foods we used the nutritional content of raw rather than cooked ingredients. As it is permissible for manufacturers to calculate the nutritional content of supermarket ready meals based on raw ingredients and to put this information on the packaging,[30] this also maximised comparability as far as possible.

We obtained data on the nutritional content of the ready meals from the supermarkets' websites.

Statistical analysis

For each meal we calculated the nutritional content per portion by dividing the total content by the number of portions in the meal. Using the Mann-Whitney test we compared the total content per portion between the ready meals and the recipes.

We calculated the percentage of energy derived from each macronutrient for each meal and used the Mann-Whitney test to compare the differences between the groups of ready meals and recipes. Using χ^2 tests we compared the percentage of energy derived from macronutrients in the meals and recipes with the nutrient intake goals for preventing diet related chronic diseases recommended by WHO.[31]

For each meal in both groups we assigned a "traffic light" colour for the four macronutrients (fat, saturated fat, sugar, and salt) according to a modified version of the 2007 FSA guidance on its recommended labelling scheme[32]; as information on the proportion of sugar derived from such sources was not available we did not use the criterion allowing a higher total sugar content in situations where a high proportion of sugar is derived from natural sources. The traffic light system is used on the front of packaging to help consumers assess at a glance the fat, saturated fat, sugar, and salt content of meals, prompting them to make healthier dietary choices.

We considered comparing specific main course types (for example, chicken based dishes) or specific dishes (for example, lasagne) between the recipes and ready meals. However, it proved difficult to define both main course "types" and specific dishes. A combined approach also better reflected the balance of meals on offer between the two groups. It seems likely that consumers decide on whether to follow a recipe by a television chef or to use a ready meal before choosing the specific meal, making the balance of main courses on offer in each group important.

All statistical analyses were done in Minitab 15 (Minitab, Coventry, UK).

Results

The five included recipe books contained 651 recipes (table 1⇓). Of these, 193 (29.6%) met the inclusion criteria. The supermarkets' websites listed 1404 products in their ready meal sections, of which 234 (16.1%) met the inclusion criteria.

Table 2⇓ summarises the median nutritional content per portion per meal separately for the recipes and ready meals. Per portion, the recipes contained significantly more energy, protein, fat, and saturated fat than the ready meals, and significantly less fibre.

Table 3⇓ shows the median percentage of energy derived from macronutrients as well as fibre and sodium density for each type of meal. No recipe or ready meal met all of the WHO nutrient intake goals for preventing diet related diseases.[31] Table 3 also shows the number and proportion of each meal type that met each nutrient specific WHO goal. More ready meals than recipes met the WHO goals for fibre density (56% *v* 14%, P<0.01) and percentage of energy derived from carbohydrate (18% *v* 6%, P=0.01) and fat (37% *v* 24%, P=0.05), but more ready meals than recipes exceeded the recommended sodium density (96% *v* 64%, P<0.01).

Table 4⇓ shows the number of each traffic light colour assigned to the meals in each group according to FSA labelling criteria.[32] The distribution of colours differed between the two groups. The recipes had more red and the ready meals more amber, but green was almost equal between the groups. The modal colour was red for the recipes and green for the ready meals.

The figure⇓ shows simulated front of package labels for an average recipe and an average ready meal using a design based on FSA guidelines.[32] For each macronutrient in this figure, the traffic light colours shown are the modal colour within each meal group, and the figures stated are the median value within each meal group. A similar approach to summarising the data has been used in previous studies.[38]

Discussion

Recipes devised by television chefs and own brand ready meals sold by three leading UK supermarket chains both tended to be high in protein, fat, saturated fat, and sodium, low in carbohydrate, and within the recommended range for sugar according to World Health Organization nutritional guidelines for the avoidance of diet related diseases.[31] Meals based on television chef recipes were less healthy than ready meals, as significantly fewer were within the recommended ranges for fibre density and percentage of energy derived from carbohydrate and fat, and per portion they contained significantly more energy, protein, fat, and saturated fat and significantly less fibre. The recipes were also more likely to achieve red traffic light labels according to the criteria of the UK Food Standards Agency (FSA).[32] Despite reported efforts from industry to reduce the salt content of meals,[39] only 4% of the ready meals met the WHO recommendation.

Strengths and weaknesses of the study

This study is the first to explore the nutritional content of recipes created by television chefs and to examine comprehensively the nutritional value of own brand ready meals sold by supermarkets with the highest share of the grocery market in the United Kingdom.

To increase the external validity of our findings we used a populist sampling frame to identify both the recipes and the ready meals. However, the nutritional content of recipes varied substantially between individual recipe books (data available from the author), suggesting that a different selection process may have led to different findings. Selecting books that were bestsellers in the run-up to Christmas may have influenced the selection of recipes, and the transient nature of bestseller charts may challenge the representativeness of the sample. The size of the sample prevented subgroup analyses comparing individual chefs or supermarkets.

Although we designed the methods to ensure good comparability between the groups, it is difficult to assess the impact of the differing data sources used for the selection of the ready meals and recipes. In the United Kingdom, the published nutritional data used for analysis of ready meals is permitted by law to vary by 20% from the true macronutrient values.[30] Systematic variation from the true macronutrient value of the foods could be a source of bias in this study. However, our analyses were based on the most accurate data currently available to the public.

We may have systematically underestimated the values for salt within the recipe group. As salt was often listed as an optional ingredient to be added "to taste," we excluded it from our analyses. Therefore the findings for salt should be interpreted with caution. Research evidence is lacking as to whether consumers typically season ready meals with salt in the same way as they do for home cooked meals.

We did not examine the micronutrient content of the ready meals or recipes or the presence of artificial preservatives, flavours, colourings, or stabilisers. These may be additional important aspects to consider when judging the overall healthiness of a

food. Although micronutrients do not feature in the FSA traffic light labelling, they do appear in alternative labelling schemes such as that suggested by Bittman.[40] Inclusion of this information could be considered as the government revises the standards for traffic light labelling.[41] Furthermore, the WHO standards used are based on average intake over time rather than on individual meals, and it is not necessarily the case that one main course should meet these standards. However, in the absence of international criteria for the nutritional content of individual meals, these standards are the best currently available and have been used previously for assessment of individual products.[42 43]

Comparison with other studies

The levels of salt found in ready meals in this study are comparable to those of another study carried out in 2008.[44] However, both sets of results contrast noticeably with an investigation by the FSA in 2003,[17] which found high salt levels in 83% of ready meals sold by supermarkets. Six products appear both in the FSA sample and in the sample in this study. In the survey by the FSA, all six products contained over 2.4 g of salt per portion, which represents 40% of the recommended daily allowance of salt.[17] In this study, carried out seven years later, only two exceeded this threshold. This provides some evidence that reformulation since 2003 may have had an impact on the salt content of supermarket ready meals, although only 4% of ready meals met the WHO recommendation on sodium density.

Unanswered questions and future research

This study's external validity is limited by the inclusion of items from only three supermarkets and five recipe books. Although our samples were intended to be populist, they may not reflect the market as a whole. A comprehensive examination of the nutritional value of all ready meals sold in UK supermarkets and a wider selection of recipe books would help to shed further light on the nutritional state of foods sold generally.

Although television chefs are one source of recipes and information about home cooking, their meals are not representative of all home cooking practices. Personal home cooking practices are complex[9]: people may cook without recipes, use recipes in older books or from other sources, or prepare meals containing both preprepared and freshly cooked elements. Studies examining people's actual food preparation and eating habits could provide clearer data on the comparative nutritional value of preprepared and freshly cooked items actually consumed in the population.

Meaning of the study and implications

This study shows that neither recipes created by popular television chefs nor ready meals produced by three leading UK supermarket chains meet national or international nutritional standards for a balanced diet. The recipes seemed to be less healthy than the ready meals on several metrics. Maximum nutritional benefit is likely to be derived from home cooking of nutritionally balanced recipes primarily using raw ingredients, rather than relying on ready meals or recipes by television chefs. Further reformulation of ready meals in line with international nutritional guidelines, and collaboration with television chefs to improve the nutritional quality of their recipes, may also help consumers to achieve a balanced diet.

In the United Kingdom advertisements of foods classified as high in fat, salt, or sugar are prohibited during programming likely to appeal to children,[45] and a 9 pm watershed for advertising such foods has been advocated.[46] No restrictions apply to the content of programmes with television chefs. For consistency, the nutritional content of all food portrayed on television, including that in programmes with television chefs, should be considered. Inclusion of consistent nutritional information that is easy to understand in recipe books, similar to that advocated for labelling on the front of food packaging,[32] should also be considered.

Practitioners should take care when advising patients on improvements to their diet. Recommendations to cook from scratch rather than eat ready meals needs to be set in the context of detailed nutritional advice.

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Contributors: SH conceived the study, collected and analysed the data, and drafted the manuscript. All authors contributed to the study design and interpretation of results and commented on successive drafts of the manuscript, and will act as guarantors.

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Ethical approval: Not required.

Data sharing: The full dataset is available from the corresponding author at simonhoward@nhs.net.

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What is already known on this topic

Supermarket ready meals and recipes devised by television chefs may have an impact on dietary intake

The nutritional content of ready meals and recipes by television chefs have not been assessed comprehensively

What this study adds

Recipes devised by popular television chefs contained significantly more energy, protein, fat, and saturated fat and less fibre per portion than ready meals

Most cookery books do not provide nutritional information on recipes, which could help to inform consumers

Consideration should be given to regulation of the recipes demonstrated by television chefs similar to that limiting advertisement of foods classified as high in fat, salt, or sugar

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Tables

Table 1| Number of recipes and supermarket meals assessed for eligibility and included in analyses

Sources of meals	No of recipes/meals	No (%) eligible	No (%) included
Television chef recipes:			
30 Minute Meals, Jamie Oliver[33]	50	49 (98.0)	25 (51.0)
Baking Made Easy, Lorraine Pascale[34]	110	13 (11.8)	7 (53.8)
Ministry of Food, Jamie Oliver[35]	154	43 (27.9)	22 (51.2)
Kitchen, Nigella Lawson[36]	145	48 (33.1)	25 (52.0)
River Cottage Everyday, Hugh Fearnley-Whittingstall[37]	192	40 (20.8)	21 (52.5)
Total	651	193 (29.6)	100 (51.82)
Own brand ready meals:			
Asda	410	78 (19.0)	33 (42.3)
Sainsbury's	514	58 (11.3)	25 (43.1)
Tesco	480	98 (20.4)	42 (42.9)
Total	1404	234 (16.7)	100 (42.7)

Table 2| Nutritional content per portion of 100 recipes created by television chefs and 100 supermarket ready meals, United Kingdom, 2010

	Median (interquartile range)			
Nutritional content	Recipes	Ready meals	Total	P value*
Energy (kJ)	2530 (2027-3240)	2067 (1716-2563)	2285 (1776-2817)	<0.01
Protein (g)	37.5 (26.7-50.0)	27.9 (23.3-30.0)	31.6 (24.0-40.2)	<0.01
Carbohydrate (g)	49.5 (23.5-68.1)	51.1 (41.9-67.4)	50.8 (34.3-67.6)	0.06
Sugar (g)	8.3 (5.0-12.6)	6.8 (4.2-10.9)	7.6 (4.5-12.0)	0.09
Sodium (mg)	658 (369-1035)	800 (607-1000)	780 (508-1000)	0.05
Fat (g)	27.1 (16.8-40.4)	17.2 (12.3-23.7)	21.6 (14.0-31.0)	<0.01
Saturated fat (g)	9.2 (4.9-15.9)	6.8 (3.8-11.6)	7.9 (4.3-13.6)	<0.01
Fibre (g)	3.3 (2.0-5.7)	6.5 (4.8-8.5)	5.1 (2.9-7.6)	<0.01

*Mann-Whitney test comparing recipes with ready meals.

Table 3| Median percentage energy derived from macronutrients, and sodium and fibre density, of 100 television chef recipes and 100 supermarket ready meals, United Kingdom, 2010

	Recipes (n=100)		Ready meals (n=100)		All items				
Nutritional content	Median (interquartile range)	% within WHO range	Median (interquartile range)	% within WHO range	Median (interquartile range)	No (%) within WHO range	WHO range	χ^{2*}	P value*
Macronutrient (% energy):									
Protein	23.8 (18.8-33.9)	7	22.7 (18.2-27.3)	9	22.9 (18.5-30.5)	16 (8)	10-15	0.27	0.60
Carbohydrate	31.6 (19.0-42.1)	6	42.9 (37.0-52.5)	18	38.7 (28.9-48.4)	24 (12)	55-75	6.82	0.01
Sugars	5.3 (3.3-8.8)	81	5.7 (3.8-8.7)	83	5.5 (3.3-8.8)	164 (82)	<10	0.14	0.71
Fat	42.2 (30.1-54.0)	24	32.4 (25.9-39.2)	37	35.6 (27.9-45.9)	61 (31)	15-30	3.99	0.05
Saturated fat	14.9 (9.0-20.9)	33	13.9 (7.8-18.7)	34	14.0 (8.0-19.8)	67 (34)	<10	0.02	0.88
Fibre density (g/MJ)	1.4 (0.8-2.6)	14	3.2 (2.4-4.4)	56	2.5 (1.4-3.7)	70 (35)	>3.0†	38.77	<0.01
Sodium density (g/MJ)	0.2 (0.1-0.4)	36	0.4 (0.3-0.5)	4	0.4 (0.2-0.5)	40 (20)	<0.2‡	32.00	<0.01

*χ^2 tests with one degree of freedom comparing proportion of recipes with proportion of ready meals in World Health Organization range.

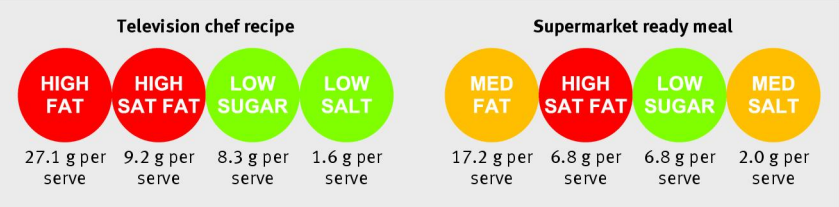
†Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily fibre intake of >25 g.

‡Based on 8.4 MJ/day (2000 kcal/day) diet and recommended daily sodium intake of <2 g.

Table 4| **Traffic light assessment according to modified Food Standards Agency guidelines[32] for 100 recipes by television chefs and 100 supermarket ready meals, United Kingdom, 2010**

	No for recipes			No for ready meals		
Macronutrients	**Red**	**Amber**	**Green**	**Red**	**Amber**	**Green**
Sugar	17	0	83	11	0	89
Fat	68	17	15	37	39	24
Saturated fat	71	1	28	56	1	43
Salt	31	28	41	30	60	10
Totals	187	46	167	134	100	166

Figure



Simulated front of package labels for an average recipe created by a television chef and an own brand supermarket ready meal, based on guidelines from the FSA[32]