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Comparisons between analyzed and calculated nutrient content of fast foods using two consecutive versions of the Danish food composition databank FOODCOMP and FRIDA[1].

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Abstract

The objective of this study was to compare the content of selected nutrients of fast foods found by chemical analysis versus estimated by recipe calculation based on data from two versions of the Danish food composition databank, FOODCOMP and the latest FRIDA. 155 samples of ready to eat fast foods were collected from fast food outlets, separated into their components and weighed. Typical components were bread, French fries, vegetables, meat, and dressings. The fast foods were analyzed and the content of energy, protein, saturated fat, iron, thiamin, potassium and sodium were compared to recipe calculation. When using the FOODCOMP in recipe calculation the error percentage was largest for saturated fat (28%). When using FRIDA the error percentage for saturated fat decreased to 11% and was below 15% for all nutrients. The correlations ranged from 0.49 to 0.89 with both databanks. For the individual fast foods there were both acceptable (<15%) and large differences (>50%). Future challenges for the databank in relation to recipe calculation, could be to include more varieties and a better coverage of foods used as ingredients and inclusion of analytical values of mixed dishes if they are commonly eaten from outlets as fast foods.

Key words: mixed dishes, nutritional composition, recipe calculation, chemically analysis, chemical composition, dietary assessment, food composition, food analysis.

1. Introduction:

Food composition data are used as a cost effective alternative to chemical analysis for among others the assessment of diet and nutritional status at a population level (e.g. National dietary surveys and epidemiological studies); development of therapeutic diets (e.g. managing diabetes and nutritional deficiencies) and of institutional diets (e.g. schools, hospitals, nursing homes); nutrition labelling of processed foods and recipe calculation of mixed dishes (Church, 2015; Gibson, 2005; Schakel et al., 1997). Denmark has a long tradition for producing food composition data, the first data was published as early as 1888. The latest version FRIDA was released in 2015. Since 1981 the compilation of data has been governmentally funded (Møller and Hels, 2008).

A part of dietary intake includes mixed dishes or foods containing foods from two or more food groups commonly used as entrees such as sandwiches, burgers, pizza, pasta or rice mixed dishes, stir-fries, soups, and meat or poultry mixed dishes. Unpublished results from the Danish national survey of diet and physical activity 2011-2013 (DANSDA 2011-13) shows that in Denmark mixed dishes on average account for 15% of energy intake and of this 44% comes from fast food. In comparison mixed dishes accounts for 29% of all energy consumed in the US (Dietary Guidelines Advisory Committee, 2015). The diversity of mixed dishes is extensive and includes foods prepared at home, in restaurant or by the food industry. Furthermore, the abundance of mixed dishes are variable, poorly defined, differ from person to person, and within persons on a day-to-day basis. Therefore limited chemical analysis have been conducted on mixed dishes, and their nutritional compositions are frequently calculated based on recipes and the nutritional composition of each ingredient, taking into account losses (or gains) of water, fat, minerals and vitamins which occur during cooking. Knowing the exact ingredient amount and compositional data is therefore important for the correct estimations of nutrient intakes through dietary assessment and for assessing the adequacy of diets.

However, the food supply is ever changing and the task of providing timely and accurate food composition data is made complex by constant change in food regulations and policy, food choices, public health initiatives, food production, development and processing methods that introduce compositional variability.

Food composition data normally presents the average composition of a class of foods. Therefore, perfect agreement between calculated and analyzed composition for a food item or for a mixed dish should not be expected, even not for up to date data.

Few have investigated the size of bias introduced when calculating the nutrient content of a mixed dish from a recipe compared to conducting chemical analysis. Usually studies only include energy and macronutrients (Vasilopoulou et al., 2003) or are of older date (Matthews R.H., 1988) or have been carried out on carefully designed and produced experimental diets (Heinonen et al., 1997; McCullough et al., 1999; Siebelink et al., 2015). To the authors knowledge none have investigated the bias from a representative sample of mixed dishes exactly as costumers buy and eat them. The error introduced when conducting recipe calculation can have impact on nutrient intake evaluation and the prevalence of inadequate or high intakes. This emphasizes the need to determine the possible extent of such bias, and if the biases can be diminished by using a more timely version of a food composition databank (FCDB).

Fast foods as burgers, sandwiches, falafels, kebabs and hot dogs are universal. The intake of fast foods contributes with a considerable amount of energy. On average7% of energy intake comes from fast foods as burgers, sandwiches and tacos among 4-75 year olds in Denmark (unpublished results DANSDA 2011-13), in the US it is 14% (Dietary Guidelines Advisory Committee, 2015). From 1995 through 2005-08, the caloric intake from fast foods almost doubled in Danish children aged 4-18 years (6% to 11%) (Unpublished results DANSDA 2005-08). Among US children aged

2–18 years caloric intake from fast food increased from 10% to 13% between 1994 to 2006 (Poti and Popkin, 2011). Fast foods are also mixed dishes, excluding side dishes but including more than one food group as a bun, meat (i.e. beef, chicken or fish), condiments (i.e. ketchup, mustard, mayonnaise) which could include vegetables (i.e. lettuce, tomato, onions) and it would normally require a recipe to calculate their nutritional composition. This makes them a relevant food group to investigate.

The aim of the present study was to compare the content of selected nutrients determined by chemical analysis of representative samples of fast foods to the content estimated by recipe calculation based on data from two consecutive versions of the Danish FCDB; the FOODCOMP and the newly updated FRIDA.

2. Materials and methods

2.1. Study design

The present study was based on 155 samples of fast foods representative for the consumption of the Danes. One unit of each sample was separated into its components, which were described and weighed. Another unit was photographed as served as well as ‘opened’ to show the individual components. Several units of each sample were homogenized and analyzed for selected nutrients. The nutrients were selected either because they were critical or indicators of intake.

The recipe calculations used the weights of the individual components from the fast food samples, and the nutrient composition was calculated using similar components/ingredients from

FOODCOMP and FRIDA. The calculated recipe contents for both versions of the database were then compared to the analyzed content of nutrients.

2.2. Food composition data banks

Denmark has had an official FCDB since 1983. The data in the FCDB is continuously being updated, but a release of data is only done occasionally. The data has been available on the internet since 2002, originally at http://www.foodcomp.dk, and now after a major reconstruction in 2015 at http://frida.fooddata.dk. The work with the FCDB strives for getting compositional information on foods marketed in Denmark, and the tables comprise data from local analytical projects supplemented with relevant external data in order to display as much information as relevant on each food entry. The local analytical projects are joint efforts between the Danish Veterinary and Food Administration (DVFA) and the National Food Institute at the Technical University of Denmark (NFI). NFI plans the projects, and within each project supervises the sampling and the analytical part of the project including quality control and the final reporting, while the laboratories at DVFA generally do the actual sampling and analytical work. The number of nutrients analyzed varies by project, but typically involves proximate constituents, including fatty acids, plus vitamins and minerals. Data from the analyses only appears in the published database after a thorough process of compilation and data curation. Likewise, external data may come from several sources, but are included in the database only through procedures ensuring the quality of the data. The internal procedures for handling and presenting data are updated with the newest version, and with the enhanced focus on data consistency the dataset will appear more logical and complete for the end user.

In the updated FRIDA, compositional data for mixed dishes or fast foods were included for the first time. Furthermore, data for iodine and salt in bread, fish and fish products, minced meat, cuts of pork among others were updated since the last version (FOODCOMP 7.01, released 2009). In addition, newly analyzed data on total fat content for several foods were added and fatty acid composition adjusted accordingly if not analyzed.

2.3. Fast food and sampling

The present study defined fast food as ‘ready to eat food’ or ‘street food, no fork or knife needed’. It was based on 155 samples collected from fast food outlets throughout Denmark, at big and smaller cities and at countryside based on a market analysis. Groups of fast foods included burgers, sandwiches, toasts, pork roast and meatball sandwiches, pita, durum wraps, hot dogs and kebab mixes. Examples of the fast food types are illustrated in Table 1. Typical components were bread, French fries, vegetables (lettuce, tomato and cucumber), meat, and dressings.

Samples were bought at the outlets aiming at getting the samples prepared in the usual way and thereby getting usual amounts of e.g. salt and dressings. About five units were collected of each fast food sample and brought to the analyzing laboratory. One unit was intended for separation into individual components at the laboratory, and if estimating that a later separation of the sample would be impossible, these components were collected separately in plastic cups (e.g. dressing for a sandwich, cheese for burgers that would otherwise melt down into the meat).

2.4. Selected nutrients and analyses

The fast food samples were analyzed for contents of proximate constituents, fatty acids, selected vitamins and minerals. The contents of energy, protein, saturated fat, vitamin B1, sodium, and potassium found by chemical analysis and by recipe calculation were then compared.

The nutrients were selected either because they were critical nutrients or indicators of intake. Fast foods contribute with significant amounts of energy, saturated fat and salt to the diet, nutrients that should all be limited in the general diet. Iron is a critical mineral for 53% of Danish women who have an intake below Average Requirement (AR) (Hindborg, 2015), and vitamin B1 was chosen to include a vitamin where bread, cereals and meat are the main source, since fast foods often include these foods. Protein and potassium were chosen because they are indicators of meat and fruit and vegetable intake, respectively.

When arriving at the laboratory one of the five collected units of each sample was separated by trained laboratory technicians into individual components to describe and collect the weight of each component. Another unit was photographed as served as well as ‘opened’ to show the individual components. Preparing for chemical analysis of selected nutrients approximately 3 units, or at least 400 g, were weighed individually before aliquots were homogenized and stored in plastic bags at ÷20 °C until analysis. In short, the nutrient analyses were performed by the following principles: Energy (kJ) was calculated from contents of protein, fat, and total carbohydrate using the factors 17, 37 and 17, respectively (Nordic Council of Ministers, 2014) to allow for conversion to kilojoules. Protein was determined as nitrogen by the Kjeldahl procedure and protein calculated with factor 6.25 (Nordic Committee on Food Analysis, 2003). Fat and fatty acids were determined by boiling the sample with hydrochloric acid, filtering, drying, and extracting the lipids with diethylether and petroleum ether (Bysted et al, 2009). For fat determination, an aliquot was evaporated to dryness and the remaining fat was weighed after drying to constant weight. Fatty acid methyl esters (FAME) were prepared from another aliquot and following extraction with n-heptane the methyl esters of the fatty acids were determined by capillary GLC (Bysted et al, 2009). Carbohydrate content was calculated from amounts of dry matter, protein, fat and ash (Nordic councils of Ministers, 2014). Content of dry matter was determined by drying an aliquot under vacuum at 70 °C to constant weight (Nordic Committee on Food Analysis, 2002). Ash content was found by gravimetric determination after sample degradation at 525 °C (Nordic Committee on Food Analysis, 2005). Acid hydrolysis and enzymatic degradation followed by reverse phase HPLC and fluorometric detection after post column reaction (Jakobsen, J. 2008). Iron, potassium, and sodium were determined by ICP-OES after digestion of the sample by nitric acid in a microwave oven, like indicated by the European Committee for Standardization (CEN, 2014 and CEN, 2016).

All nutrient parameters were analyzed accredited, according to the ISO standards. Contents were found by single determinations and continuous monitoring the quality of the analyses, by including reference materials, duplicate determinations, recoveries etc. in the analytical series. The quality assurance showed that the quality of the analyses was satisfactory.

2.5. Recipe calculations

The recipe calculations used the weights of the individual components obtained from the fast food samples and the photographs were used to help estimating dressing portions if not collected separately and where it had been difficult to weigh the dressing because of mixing with other components. The recipes were calculated using data for similar “ready to eat” food components in either the FOODCOMP or FRIDA. The General Intake Estimation System Version 1.000 i5 - 2014-09-10 developed at the Danish National Food Institute were used to perform the calculations, all in agreement with the harmonization of recipe calculation suggested by EuroFIR (Reinivuo et al., 2009).

2.6. Statistics

Paired sample T-test, Wilcoxon signed rank test, Pearson's and Spearman's correlations were used to compare nutrient values between recipe calculations using the two versions of FCDB's and chemical analysis.

Furthermore, the bias of recipe calculation was estimated in relation to chemical analysis as the difference between calculated nutrient content and chemical analysis, and as an error percentage: (Calculated content – Chemical analysis)/ Chemical analysis x 100.

The statistical analysis was carried out with the SPSS statistical package (SPSS, version 23, 2015).

3. Results

Table 2 illustrates that for fast foods overall differences were found between the chemical analysis and the recipe calculations when using FOODCOMP for energy, protein, saturated fat and iron, but not for vitamin-B1, potassium and sodium ($P>0.05$). The error percentage was largest for saturated fat (28%) and smallest for sodium (-1%), potassium (1%) and energy (-4%). Correlations ranged from 0.49 for iron to 0.89 for potassium. When using FRIDA there were differences for energy, protein and saturated fat ($P<0.05$), but not for vitamin B1, potassium, iron or sodium ($P>0.05$). The error percentage for saturated fat decreased to 11%. The error percentages were still smallest for sodium (-3%) and potassium (-1%) and for vitamin B1 (2%) which all were smaller than energy (-6%). The correlations ranged from 0.50 to 0.87, and were at the same levels with both composition databanks.

Looking at the different types of fast food (Table 2) especially sandwiches/ toasts and pitas/durum wraps had large error percentages for saturated fat (48%-63%) using both versions of the FCDB. The mean difference in saturated fat between the recipe calculation and analysis, however, became smaller for all types using the FRIDA, except for pork roast/meatball sandwiches (5% to -12%) and hot dogs (both values -3%). With a few exceptions the error percentages and correlations for other nutrients were at the same level using both databases.

Hamburger/meatball sandwiches, hot dogs and sausage/kebab mix also had high error percentages for iron ranging from -25% (sausage/kebab mix) to 49% (hot dogs), and protein was underestimated in pitas/durum wraps and sausage/kebab mix with up to 30% using both versions of the FCDB.

In general, energy, protein and sodium were underestimated in recipe calculations with both versions of the FCDB, with the exception of energy and sodium in sausage/kebab.

For the different fast food types, significantly differences were found for 1-4 out of the7 nutrients. For burgers there was only one significant difference in iron (P=0.29) content when using the FOODCOMP. There were significant correlations for 4-6 nutrients out of 7 for all fast food types using both FCDB's, except for hot dogs and sausage/kebab mix that only had 1-2 significant correlations, and the mix had negative correlations for iron.

4. Discussion

For fast foods overall we found acceptable differences for 7 nutrients between calculated and analyzed nutrient values. Average differences between calculated and analyzed values did not exceed 13% when using the newest FCDB FRIDA.

For fast foods overall using FRIDA compared to the former version, reduced the error percentages for saturated fat from 28% to 11% and the iron content was no longer significantly different compared to the analyzed reference. FRIDA reduced the error percentage for saturated fat for all types of fast foods except for the hamburger/meatball sandwich type and for hot dogs where the content was equal for both versions. An older Finnish study also showed improvement in calculated fatty acid values when using an updated FCDB (Heinonen et al., 1997).

Food policies might also influence contents of nutrients in foods, e.g. the regulation of trans fatty acids in 2004 in Denmark, stating that contents of industrially produced trans fatty acids in foods must not exceed 2 g per 100 g of oil or fat. This had implications for the content and composition of fat/fatty acids for many foods. Consequently, the values for fatty acids were recalculated in the FRIDA and this improved the accuracy of the calculated values.

For the individual fast foods the picture was more mixed, and even though there were acceptable differences between nutrient content (less than 15%) (Siebelink et al., 2015) also much larger differences of up to 60% for saturated fat (pitas/durum wraps) were found even when using FRIDA, the newest release of the FCDB. For these products, however, it was especially difficult to always weigh dressings and spreads when these were absorbed into the other components, in particular bread, and these had to be estimated from the photographs of the separated products.

In comparison to the present study other studies have looked at chemical analysis and calculated energy and macronutrient contents of diets or recipes. In a Dutch study from 2015 (Siebelink et al., 2015) calculated and analyzed energy and macronutrient content of 25 duplicated intervention diets were performed over a period of 10 years. The calculations used different releases of the Dutch FCDB. Similar differences were found for energy (6% vs. -6%) and saturated fat (10% vs 11%), but lower differences for protein (0.4% vs. -13%) compared to the present study (latest version FCDB).

In the present study there were somewhat higher correlations for energy (0.83 vs. 0.57), but lower correlations for saturated fat (0.70 vs 0.92) and protein (0.64 vs. 0.96) compared to the Dutch study. However, in the Dutch study they planned the recipes and made up the diets from the recipes. They analyzed important foods in advance, and used these analyzed values for planning the diets. In the present study, the recipes were constructed from the prepared and analyzed food, which involved some uncertainties especially conducting accurate weighing of dressings, and fat spreads, because they might stick to or mix with other components of the food. Furthermore, we did not have analyzed values for the exact same components of the fast foods, but chose what we considered the best representation for a similar component from the FCDB. The availability of foods in FCDB has its limits and it was not always possible to choose a good representation of the component/ingredient in the recipe. In an American study from 1999 menus of intervention diets (n=36) were analyzed and compared to calculated values performed with 4 different nutrient databases. In this study they compared 13 nutrient values and in common with the present study energy, saturated fat, potassium, iron and sodium. They found as in the present study that several calculated values deviated significantly from analyzed values, but overall the differences were small (<10%) (McCullough et al., 1999). This is in accordance with an older American study which, however, found greater discrepancies for vitamins and minerals (>20%). In the study of McCullough et al, 1999 they calculated the diets on a brand name level. This is different from the present study which used generic food composition data from the FCDB. However, the generic level in the FCDB is based on representative samples on the market.

In a Greek study from 2003, investigators compared analyzed and calculated values of energy and macronutrients of five Greek traditional mixed dishes. The study found error percentages for energy from -10 to 1%, for protein from -22 to 2% and for saturated fat from -10 to 25% for the mixed dishes (Vasilopoulou et al., 2003). This is in agreement with the present study that showed similar variability in the results for individual mixed dishes/foods.

The reasons for discrepancies between analyzed and calculated values could be many. Other than food policy as in the case of saturated fat in the present study, public health initiatives may also have impact. A whole grain recommendation was instituted in Denmark in 2008 and since then manufacturers have developed and reformulated breads to contain more whole grain, even white flour and fast food breads. This may cause discrepancies in the analyzed and calculated values of vitamin B1 and Iron. In addition one should remember that the FCDB presents the average composition of a class of foods. Therefore, perfect agreement should not be expected. There may also be differences for products on the retail and catering market e.g. for the fat content and other constituents in meat patties used in burgers, fast food breads and dressings. Therefore it may be important to include analyzed values of mixed foods such as fast foods in FCDB if they are commonly bought from fast foods outlets. Many databases include the most commonly consumed composite foods and dishes at retail level (Church, 2015), the same should apply on catering level.

The FCDB contains values from chemical analysis of the foods as well as other non-analytical values calculated via conversion factors. This may also contribute to some inaccuracy.

The limitations of this study are that it was not always possible to weigh dressings precisely. Furthermore we did not have the actual recipe of ingredients. However, the large sample of different fast foods representing fast foods exactly as the consumers buy and eat them from outlets on the market in Denmark is a strength. The study therefore represents a realistic situation and realistic results in relation to dietary assessment where participants have eaten a prepared food and report the portion sizes of the recipe/components.

5. Conclusion

This study indicated that for fast foods overall it was possible to find the contents of the seven tested nutrients by recipe calculations based on data from the latest version of the Danish Food Composition Databank. Acceptable differences between calculated and analyzed values were found for the 155 fast foods overall, and average differences did not exceed 13% when using the latest FCDB. For fast foods overall using the updated FRIDA compared to the older FCDB reduced the error percentages for saturated fat from 28% to 11 %.

However, results for the individual fast food types provided a more ambiguous picture showing acceptable as well as large differences between analyzed and calculated values. This indicates that regular updates of FCDB are important for accurate dietary assessment including recipe- and nutrient calculation and subsequent evaluation of inadequate and high intakes. Analyzed values for somewhat standardized foods such as fast foods usually eaten from fast food outlets and more varieties of foods used as ingredients could improve future FCDBs further.

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Conflict of interest

The authors declare no conflict of interest.

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Table 1. One example of each of the different fast foods types that were chemically analyzed for selected nutrients which were then compared to recipe calculation using the weights of their components. Illustrated as served and open faced

Fast food type	EAs served	E Open faced
Burgers		
Sandwiches/toas t		
HPork roast/meatball sandwiches		
Pitas and durum wraps		

Hot dogs		Not separated further
Sausage/kebab mix		Not separated further

Table 2. Comparison of analyzed and calculated nutrient values of fast foods (n=155) using two consecutive versions of the Danish food composition databank FOODCOMP and the latest version FRIDA.

	Mean weight g/portion (range)	Analyzed reference values		Calculated values FOODCOMP				Calculated values FRIDA			
		Mean	SD	Mean[1]	SD	Mean difference %	Paired correlation[2]	Mean[1]	SD	Mean difference %	Paired Correlation[2]
All fast foods (n=155)											
Energy (kJ/100 g)		982	203	940**	220	-4	0.83**	919**	201	-6	0.83**
Protein (g/100 g)		9.9	2.8	8.9**	2.8	-10	0.68**	8.6**	2.9	-13	0.64**
Saturated fatty acids (g/100 g)		2.7	1.5	3.5**	1.9	28	0.76**	3.0*	1.3	11	0.70**
Vit.B1 (mg/100 g)		0.13	0.08	0.12	0.07	-6	0.71**	0.13	0.08	2	0.78**
Iron (mg/100 g		0.90	0.38	0.96*	0.29	8	0.49**	0.93	0.29	4	0.50**
Potassium (mg/100 g)		224	92	227	109	1	0.89**	221	92	-1	0.87**
Sodium (mg/100 g)		493	147	490	175	-1	0.67**	477	166	-3	0.67**
Burgers (n=36)	286 (90-419)										
Energy (kJ/100 g)		973	113	953	108	-2	0.64**	932**	125	-4	0.72**
Protein (g/100 g)		10.8	2.5	10.7	2.5	-1	0.67**	10.2	3.0	-6	0.47**
Saturated fatty acids (g/100 g)		2.9	1.0	3.1	1.0	7	0.81**	2.9	0.9	0	0.83**
Vit.B1 (mg/100 g)		0.07	0.01	0.08	0.04	11	0.27	0.08*	0.03	10	0.28
Iron (mg/100 g		1.02	0.36	1.10*	0.28	8	0.80**	1.08	0.32	6	0.83**
Potassium (mg/100 g)		212	34	224	37	6	0.34*	219	46	3	0.17
Sodium (mg/100 g)		447	110	413	85	-8	0.34*	390*	83	-13	0.16

Analyzed vs. calculated nutrient content

Sandwiches and toasts (n=47)	211 (86-359)										
Energy (kJ/100 g)		950	166	930	146	-2	0.60**	923	147	-3	0.63**
Protein (g/100 g)		10.1	2.0	9.3**	2.4	-8	0.76**	9.1**	2.4	-9	0.77**
Saturated fatty acids (g/100 g)		2.1	1.2	3.2**	1.7	53	0.72**	3.1**	1.6	48	0.76**
Vit.B1 (mg/100 g)		0.13	0.05	0.14	0.05	6	0.70**	0.14*	0.05	8	0.73**
Iron (mg/100 g		0.79	0.30	0.80	0.11	1	0.06	0.80	0.11	1	0.10
Potassium (mg/100 g)		172	39	159**	25	-7	0.79**	160**	26	-7	0.79**
Sodium (mg/100 g)		533	128	522	138	-2	0.64**	518	140	-3	0.64**
Pork roast and meatball sandwiches (n=24)	281 (157-368)										
Energy (kJ/100 g)		1006	102	885**	93	-12	0.63**	880**	96	-12	0.62**
Protein (g/100 g)		11.3	3.3	10.5	2.6	-7	0.60**	10.3	2.5	-9	0.60**
Saturated fatty acids (g/100 g)		3.0	0.9	3.2	1.6	5	0.70**	2.7*	1.0	-12	0.75**
Vit.B1 (mg/100 g)		0.20	0.13	0.19	0.11	-3	0.81**	0.23*	0.15	18	0.86**
Iron (mg/100 g		0.87	0.37	1.17**	0.27	34	0.89**	1.12**	0.30	29	0.90**
Potassium (mg/100 g)		213	31	221	46	4	0.35	229	44	7	0.49*
Sodium (mg/100 g)		454	79	379**	52	-17	0.29	376**	52	-17	0.27
Pitas and durum wraps (n=24)	335 (212-605)										
Energy (kJ/100 g)		758	188	651**	141	-14	0.77**	650**	142	-14	0.77**
Protein (g/100 g)		7.8	3.5	5.7**	1.2	-27	0.54**	5.6**	1.2	-28	0.56**
Saturated fatty acids (g/100 g)		1.5	0.7	2.4**	0.9	63	0.53**	2.3**	0.9	60	0.51*
Vit.B1 (mg/100 g)		0.09	0.02	0.10	0.03	5	0.21	0.10	0.03	10	0.27
Iron (mg/100 g		0.78	0.44	0.77	0.37	-1	0.50*	0.76	0.37	-3	0.50*

Potassium (mg/100 g)		214	65	191	45	-11	0.43*	192	46	-10	0.44*
Sodium (mg/100 g)		366	124	356	75	-3	0.76**	358	72	-2	0.75**
Hot dogs (n=8)[3,4]	170 (146-223)										
Energy (kJ/100 g)		1143	101	1147	139	0	0.88**	1129	139	-1	0.81*
Protein (g/100 g)		9.3	1.0	8.1*	1.1	-13	0.79*	8.1*	1.1	-14	0.83*
Saturated fatty acids (g/100 g)		4.4	0.4	4.3	0.6	-3	0.48	4.3	0.8	-3	0.43
Vit.B1 (mg/100 g)		0.22	0.05	0.09*	0.01	-56	0.67	0.11*	0.01	-49	0.57
Iron (mg/100 g		0.78	0.07	1.15*	0.11	47	0.14	1.16*	0.11	49	0.62
Potassium (mg/100 g)		177	25	182	35	3	0.17	184	35	4	0.17
Sodium (mg/100 g)		711	74	684	68	-4	-0.08	684	74	-4	-0.08
Sausage and kebab mix (n=16)[3,4]	292 (181-508)										
Energy (kJ/100 g)		1313	136	1348	115	3	0.18	1231*	107	-6	0.46
Protein (g/100 g)		8.4	2.1	6.7*	1.3	-20	0.22	5.9**	1.3	-30	0.25
Saturated fatty acids (g/100 g)		5.1	1.6	7.3**	1.2	45	0.43	4.4	1.2	-13	0.55*
Vit.B1 (mg/100 g)		0.15	0.05	0.10**	0.01	-34	0.77**	0.13*	0.02	-16	0.23
Iron (mg/100 g		1.18	0.43	0.97	0.13	-18	-0.56*	0.89	0.14	-25	-0.50*
Potassium (mg/100 g)		460	41	515*	51	12	0.05	452	42	-2	0.06
Sodium (mg/100 g)		616	169	840**	96	36	0.40	783**	97	27	0.47

[1]Paired samples T-test

[2]Pearsons correlation coefficient

[3]Wilcoxon

[4] Spearman correlation coefficient

*<0.05 tested against reference

**<0.01 tested against reference

Analyzed vs. calculated nutrient content