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What's on the menu? A review of the energy and nutritional content of US chain restaurant menus

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Abstract

Objective: The present study aimed to (i) describe the availability of nutrition information in major chain restaurants, (ii) document the energy and nutrient levels of menu items, (iii) evaluate relationships with restaurant characteristics, menu labelling and *trans* fat laws, and nutrition information accessibility, and (iv) compare energy and nutrient levels against industry-sponsored and government-issued nutrition criteria.
Design: Descriptive statistics and multivariate regression analysis of the energy, total fat, saturated fat, *trans* fat, sodium, carbohydrate and protein levels of 28 433 regular and 1833 children's menu items.
Setting: Energy and nutrition information provided on restaurant websites or upon request, and secondary databases on restaurant characteristics.
Subjects: The top 400 US chain restaurants by sales, based on the 2009 list of the *Restaurants & Institutions* magazine.
Results: Complete nutrition information was reported for 245 (61 %) restaurants. Appetizers had more energy, fat and sodium than all other item types. Children's menu specialty beverages had more fat, saturated fat and carbohydrates than comparable regular menu beverages. The majority of main entrées fell below one-third of the US Department of Agriculture's estimated daily energy needs, but as few as 3 % were also within limits for sodium, fat and saturated fat. Main entrées had significantly more energy, fat and saturated fat in family-style restaurants than in fast-food restaurants. Restaurants that made nutrition information easily accessible on websites had significantly lower energy, fat and sodium contents across menu offerings than those providing information only upon request.
Conclusions: The paper provides a comprehensive view of chain restaurant menu nutrition prior to nationwide labelling laws. It offers baseline data to evaluate how restaurants respond after laws are implemented.

Keywords
Obesity
Restaurants
Food labelling
Patient Protection and Affordable Care Act

Restaurants play a major role in the American diet, with 82 % of US adults eating out at least once weekly[1]. Restaurant meals have increased their contribution to total energy intake over time[2] and increased consumption of food away from home is associated with poorer diet quality and higher intakes of energy, fat and sodium[3].

Consumers cannot accurately estimate the nutritional content of restaurant foods and several states and municipalities, led by New York City in 2008, passed menu labelling laws[4]. These initial efforts were superseded by the Patient Protection and Affordable Care Act of 2010 (ACA), which made energy (calorie) labelling on menus a national requirement for restaurants with twenty or more outlets nationwide as of March 2010, although some provisions do not take effect until the Food and Drug Administration finalizes regulations[5], expected in 2012.

The discussion on the effects of menu labelling has focused almost exclusively on consumer responses to a fixed menu[6–11]. Business responses are not well documented in the research, despite the fact that restaurants regularly introduce new items and occasionally reformulate existing ones. In fact, there is not even a comprehensive assessment of nutrient information across the restaurant industry, an essential requirement for future evaluations of the federal legislation. The present research fills this gap by describing how chain restaurant menu offerings shape the food environment faced by children and adults.

Two prior studies analysed the availability of nutrition information and one analysed menu nutritional content. In 2004, 44 % of the 300 largest US chain restaurants by sales provided nutrition information on websites or upon request[12]. Also in 2004, among fifteen table service chain restaurants operating in Minnesota, ten provided some nutrition information but nine of these ten only provided data for items with specific health claims, such as 'heart healthy' or 'low fat'[13]. It is likely that these rates changed

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substantially even before passage of the ACA, due to state and local regulations. One study considered nutritional content of restaurant menus, but it was limited to twelve fast-food restaurants[14]. Population-based dietary survey studies have analysed self-reported intake, but energy and nutrient values were estimated indirectly from databases[15].

The present paper reports the status of data availability and nutritional content of menus in the largest US chain restaurants just prior to passage of the ACA. It analyses the availability of data, updating results from earlier studies, and provides the first study that systematically analyses nutritional content across such an extensive and diverse of set of restaurants. Research questions are:

1. What is the availability of data on standard menu offerings at major US chain restaurants?
2. What are the energy and nutrient levels of these menu offerings?
3. How do these levels relate to restaurant characteristics, existing state/local labelling laws or *trans* fat bans, and ease of data accessibility?
4. What proportion of items appears to meet restaurant industry-supported and government-issued nutrition criteria? 'Sodium', as used throughout the present paper, refers to table salt, which is predominantly NaCl.

Methods

Study population

The study population was identified by the 2009 *Restaurants & Institutions* magazine's list of the top 400 US chain restaurants based on 2008 sales[16]. These restaurants combined had 206 750 US outlets, representing approximately one-third of all US restaurant outlets in 2010 based on analysis from the InfoUSA database[17].

Data collection

Data were collected from February to May 2010 by reviewing restaurant websites for nutrition information. The data collection time frame overlaps with when the menu labelling provision of the ACA was passed (March 2010), but federal implementation rules were still pending in early 2012. When the website did not provide this information, an email request was sent to request it. Restaurants were counted as having complete nutrition information available if energy was listed for the majority of standard menu items. Information for selected nutrients and sodium was also collected when available: total fat, saturated fat, *trans* fat, total carbohydrates, sodium and protein. Data that were inconsistently reported (e.g. serving size, sugar, fibre and vitamins) were excluded. Restaurants classified as not having complete information: (i) did not offer a standard preparation for at least 50 % of menu items (e.g. menu based fully on 'build-your-own' customizations; *n* 5); (ii) only provided information for a minority of the menu (e.g. 'healthy choices' only; *n* 20); (iii) did not provide information on the website nor provide contact information to request it (*n* 4); or (iv) did not provide information on a website nor respond to an email request for it (*n* 126). Complete nutrition information was available for 245 (61 %) restaurants, representing 176 711 (85 %) outlets in the initial study population. Characteristics of the 155 (39 %) restaurants (representing 30 039 (15 %) outlets) not providing complete nutrition information are described in the Results section.

Nutrition information was entered following implementation guidelines for California's menu labelling law[18] where possible (as proposed federal guidelines were not published at the time of data entry). A key feature was that values represent the restaurant-defined single serving size for an item's standard preparation. The entire item was entered as a single serving if not specified otherwise. Add-ons/toppings and condiments were excluded unless served as part of the item's standard preparation, and alcoholic beverages were excluded. Every individual unique item and size on the standard and children's menu for selected item types (main entrée; appetizer; side; salad; salad dressing; soup; dessert/baked good specialty non-alcoholic beverage) was coded. If items had customization options, the high and low energy values were entered as separate menu items. Catering platters and family size items were excluded unless individual serving portions were noted. Items not designed for individual in-restaurant consumption were excluded (e.g. whole pies).

Indicator variables were created to compare distinct nutrition criteria (Table 1): the National Restaurant Association-supported Healthy Dining and Kids LiveWell criteria for energy, fat, saturated fat and sodium[19], and one-third of the US Department of Agriculture (USDA) 2010 Dietary Guidelines[20]. For USDA estimated energy needs, a daily threshold of 8368 kJ/2000 kcal was used as the basis for adults; for children aged 4–8 and 9–13 years, the mid-range average for moderately active females and males for each respective age group was used (6694 kJ/1600 kcal and 7950 kJ/1900 kcal)[21]. Taking one-third of the USDA RDA is a conservative benchmark for a single meal, as Americans report about five eating occasions per day, typically three main meals and two snacks[22], and fast-food restaurant visitors order an average of 2·4 menu items[23]. It closely follows the 32 % USDA benchmark for children's dietary intake used in the Yale-Rudd Center Fast Food FACTS report[14] and the Institute of Medicine Committee on School Meals National School Lunch Program recommendations[24], although school lunch recommendations use different age groups and higher energy and nutrient levels in order to ensure adequate intake. Unlike school lunches which are complete meals, the present study calculated per single serving size for a main entrée, rather than for a typical meal ordered (such information is not available from the data).

Data on restaurant characteristics come from two secondary sources: (i) the Research Report for Foodservice

Table 1 Comparison of Healthy Dining, Kids LiveWell and US Department of Agriculture (USDA) nutrition standards

	Maximum values						
Standard	Energy (kJ/kcal)	Fat (g)	% of energy from fat	Saturated fat (g)	% of energy from saturated fat	*Trans* fat (g)	Sodium (mg)
Healthy Dining†							
Main entrée	3138/750	25	n/a	8	n/a	n/a	2000
Appetizer, side or dessert	1046/250	8	n/a	3	n/a	n/a	750
USDA, adults‡	2791/667	n/a	35	n/a	10	1‖	767
USDA, adults with low sodium needs‡	2791/667	n/a	35	n/a	10	1‖	500
Kids LiveWell†§							
Children's meal	2510/600	n/a	35	n/a	10	0·5	770
Side	837/200	n/a	35	n/a	10	0·5	250
USDA, children aged 4–8 years†‡	2230/533	n/a	35	n/a	10	1‖	633
USDA, children aged 9–13 years‡	2649/633	n/a	35	n/a	10	1‖	733

n/a, not applicable.
†Excludes specific ingredient criteria (e.g. inclusion of whole grains, lean meats), for which data were not collected.
‡Represents one-third of estimated daily energy needs and recommended daily intake (RDA) limits for each group. USDA criteria were applied to main entrées only, which were recorded as à la carte items whenever possible.
§Excludes criterion for percentage of energy from total sugars, for which data were not collected.
‖No specific limit recommended other than 'as little as possible'. The analysis used <1 g as a benchmark.

(based on the Restaurantchains.net database), a tri-annual telephone survey of restaurant executives, provided data on restaurant operating characteristics[25]; and (ii) the InfoUSA 2010 business database provided outlets by location[17]. Finally, a literature review was conducted to identify menu labelling laws and *trans* fat bans at the city, county and state levels that were effective prior to data collection and might influence the formulation of restaurant menu offerings[26–29]. The analytic variable is the percentage of a restaurant's outlets subject to such laws.

Statistical analysis

Analysis was done using the Stata/IC statistical software package version 10·1 (StataCorp LP, College Station, TX, USA). In addition to descriptive statistics, a logistic regression model analysed whether or not a restaurant provided complete energy information (as the dependent variable) as a function of restaurant characteristics. For restaurants with complete nutrition information, energy and nutrient values of main entrées were analysed using ordinary least-squares multivariate regression with robust standard errors and clustered residuals by restaurant, with no weighting by number of outlets. Main entrées with energy content less than 418 kJ/100 kcal or greater than 20 921 kJ/5000 kcal were excluded; despite being listed as main entrées, those items typically represented substantially less/more than a full meal for one individual (e.g. one chicken wing or fifty chicken wings).

Independent variables were restaurant characteristics (meal periods offered; service model; cuisine type; national outlet count), degree of web-based information accessibility (readily accessible in one page/file; requiring multiple clicks to view information per item; requiring an email request for information) and percentage of the restaurant's outlets subject to an existing menu labelling or *trans* fat policy. Outlet count was analysed as a decile-level variable, probably a more robust data specification than outlet counts, which had a highly skewed distribution owing to a few restaurants with a very large number of outlets.

Results

Restaurant characteristics

Characteristics for the initial study population are shown in Table 2. By service type, family style accounted for the most brands, but fast food accounted for the most outlets. By cuisine, the largest number of brands served American cuisine, but the largest number of outlets served snacks, burgers or sandwiches (although American cuisine was fourth). The reason is that the number of outlets varies by service type and cuisine.

Predictors of information accessibility

Logistic regression analyses were used to estimate the odds ratio of reporting nutrition information at the $P < 0·05$ significance level, using the initial study population of 400 restaurants to compare those that did not report complete information with those that did. By service type, fast casual restaurants had significantly higher odds (OR = 3·06, 95 % CI 1·08, 8·65) of providing nutrition information than fast-food restaurants and upscale restaurants were significantly less likely to do so (OR = 0·21, 95 % CI 0·05, 0·92), with no significant differences by other service types. By cuisine, burger and sandwich restaurants had significantly higher odds (OR = 7·16, 95 % CI 1·47, 34·84 and OR = 7·61, 95 % CI 1·44, 40·19, respectively) of reporting information compared with American restaurants, with no significant differences by other cuisine types. Decile of outlet count was significant at $P < 0·001$ (OR = 1·30, 95 % CI 1·17, 1·45); larger chains were more likely to provide information. Surprisingly, existing state/local menu labelling laws had no independent effect. Having more outlets subject to *trans* fat bans had a significantly higher

Table 2 Initial study population composition by brand, outlet count and subgroup-specific non-reporting rate

Characteristic	No. of brands	No. of outlets	Average no. of outlets per brand	% of brands not reporting, by row subgroup
Service†				
Take-out/delivery	39	37 356	958	23
Fast food	90	119 449	1327	21
Fast casual	53	11 842	223	17
Buffet	12	2333	194	17
Family style	172	34 530	201	50
Upscale	34	1240	36	88
Total	400	206 750		
Cuisine†				
American	136	26 162	192	46
Asian	15	2131	142	60
Burger	25	38 330	1533	08
Chicken	13	13 618	1048	15
Italian	33	4780	145	45
Mexican	31	10 846	350	32
Pizza	30	24 028	801	23
Sandwich	21	33 206	1581	10
Snack‡	47	47 057	1001	23
Steak/seafood	49	6592	135	69
Total	400	206 750		

†Service types and cuisines as reported by Restaurantchains.net database. Service type examples: take-out/delivery (Auntie Anne's, Ben and Jerry's), fast food (KFC, Burger King, McDonald's), fast casual (Au Bon Pain, Panera Bread), buffet (Golden Corral, Sizzler), family style (Denny's, Marie Callender's, Red Lobster), upscale (Capital Grill, Morton's).
‡For example, bakery, café, coffee, ice cream, frozen yoghurt, smoothie restaurants.

odds (OR = 1·03, 95 % CI 1·02, 1·04), but the magnitude was negligible (data not shown).

Energy and nutritional content of menu offerings

Descriptive statistics for the energy and nutrient levels of menu items, by type, are shown in Table 3. The data included 30 923 unique menu items (29 531 regular and 1392 children's menu items) from the 245 restaurants that provided information. All items required energy values to be included, but nutrient values were reported less consistently (*trans* fat in particular).

For regular menu items, appetizers stand out as having the highest values of energy, fat, saturated fat and sodium compared with all other menu item types, even main entrées. Salads combined with dressing values had nutrient values approaching those of main entrées. Quartiles are also shown. The 75th percentile, for example, means that one in four appetizers exceeds 4795 kJ/1146 kcal and 2660 mg sodium, and that one in four main entrées exceeds 3724 kJ/890 kcal and 2000 mg sodium.

Children's menu items are expected to have smaller portions, and thus be lower in nutritional content than the corresponding regular menu item type. For the most part this was true, the glaring exception being beverages. Children's menu specialty beverages had more energy, fat, saturated fat and carbohydrates at most percentiles than specialty, non-alcoholic regular menu beverages.

Figure 1 illustrates how selected item types might fare against the restaurant industry-supported Healthy Dining and Kids LiveWell nutrition criteria, for regular and children's menu items, respectively. This analysis estimates maximum percentages of items that would pass, as it did not include ingredient criteria, for which data were not available. For regular menu items, up to 42 % of main entrées, 39 % of sides, 16 % of desserts and 6 % of appetizers might pass the Healthy Dining standards. Children's menu items did not fare as well with Kids LiveWell standards, with a maximum of 11 % of main entrées and 33 % of sides passing, not taking into account ingredient criteria.

Figure 2 compares main entrées against the conservative benchmark of one-third of the USDA guidelines. Children's menu main entrées are compared with one-third of the USDA estimated energy intake and RDA values for two age groups defined in the USDA dietary guidelines; adolescents' needs are similar to adults' needs. The majority of main entrées fell within estimated energy needs for adults (57 %) and children (67–80 %), but fewer fell within RDA limits for fat and sodium. When main entrées were assessed to see if they fell within estimated energy needs and RDA for fat, saturated fat and sodium simultaneously, a much smaller proportion fell within these limits (between 3 and 4 % for adults and 8 and 11 % for children), compared with Healthy Dining and Kids LiveWell criteria. The finding suggests that the actual percentage of complete meals that meet nutritional criteria as well as energy needs, as typically consumed, is likely to be very small.

Predictors of energy/nutritional content for main entrées

Table 4 shows the results of the regression of item-level energy and nutrient variables *v.* restaurant-level variables for main entrées. Depending on the outcome measure, the model's R^2 explained between 12·9 % and 21·5 % of the total variation.

Table 3 Energy and nutritional content of chain restaurant menu offerings

	Regular menu							Children's menu						
Statistic	Energy (kJ/kcal)	Fat (g)	Saturated fat (g)	*Trans* fat (g)	Sodium (mg)	Total CHO (g)	Protein (g)	Energy (kJ/kcal)	Fat (g)	Saturated fat (g)	*Trans* fat (g)	Sodium (mg)	Total CHO (g)	Protein (g)
	Main entrée†							Main entrée†						
Mean	2820/674	32	12	0	1512	57	34	1950/466	21	8	0	956	47	19
P25	1515/362	14	4	0	745	28	17	1276/305	10	3	0	610	27	12
P50	2469/590	25	9	0	1291	49	30	1757/420	18	7	0	875	42	18
P75	3724/890	43	16	1	2000	77	45	2506/599	30	11	0	1190	63	24
n	13 334	11 204	12 118	6097	12 943	13 058	10 467	927	750	822	346	915	913	686
	Appetizer							Appetizer						
Mean	3502/813	48	16	1	2023	60	35	No children's menu items were reported as appetizers; see sides						
P25	1506/360	19	5	0	880	25	13	–	–	–	–	–	–	–
P50	2929/700	40	12	0	1675	48	28	–	–	–	–	–	–	–
P75	4795/1146	68	22	0	2660	87	51	–	–	–	–	–	–	–
n	1191	925	1018	334	1119	1126	805	–	–	–	–	–	–	–
	Side							Side						
Mean	1088/260	13	4	0	541	29	8	720/172	8	2	0	304	22	3
P25	473/113	3	1	0	170	9	3	377/90	0	0	0	24	11¶	1
P50	877/210	9	2	0	410	23	5	665/159	6	2	0	210	20	3
P75	1423/340	17	5	0	730	41	10	1004/240	13	3	0	477	29	4
n	3059	2685	2803	1707	2979	3000	2567	213	181	197	76	213	213	161
	Salad‡							Salad‡						
Mean	2075/496	28	8	0	1066	30	24	577/138	7	2	0	246	10	3
P25	837/200	9	3	0	400	12	6	251/60	1	0	0	80	5	3
P50	1715/410	21	6	0	897	20	21	473/113	4	1	0	190	10	3
P75	2971/710	40	12	0	1537	40	36	1079/258	10	3	1¶	349	13	5
n	1815	1518	1637	842	1756	1777	1498	15	13	11	3	15	15	12
	Salad dressing							Salad dressing						
Mean	720/172	15	2	0	394	7	1	745/178¶	17¶	–	–	344	7¶	1
P25	377/90	6	1	0	220	2	0	416/100¶	10¶	–	–	230¶	4¶	0
P50	628/150	14	2	0	330	4	0	795/190¶	20¶	–	–	285	7¶	0
P75	983/235	22	4	0	500	9	1	1046/250¶	23¶	–	–	540¶	9	1
n	916	800	813	454	894	903	736	10	10	0	0	10	10	10
	Soup							Soup						
Mean	941/225	11	5	0	1055	22	9	695/166	6	4	–	926	17	10¶
P25	502/120	3	1	0	722	14	5	711/170¶	1	3¶	–	826¶	14	2
P50	837/200	8	3	0	990	20	8	753/180	6	4¶	–	920	19	10¶
P75	1172/280	16	7	0	1312	27	11	795/190	10	5	–	1050	19	17¶
n	1418	1270	1291	929	1399	1410	1256	9	2	9	0	9	9	2
	Specialty non-alcoholic beverage§							Specialty non-alcoholic beverage§						
Mean	1749/418	13	8	0	209	69	8	1699/406	15¶	11¶	0	179	63	7
P25	920/220	1	0	0	85	39	3	1699/279¶	3¶	6¶	0	59	52¶	2
P50	1506/360	8	5	0	170	63	7	1799/430¶	15¶	13¶	0	172¶	65¶	10¶
P75	2343560	18	12	0	290	93	11	2176/520	20¶	14¶	0	280	73	11
n	3286	2936	3017	2208	3149	3267	2907	84	78	64	13	84	84	70

Table 3 *Continued*

Statistic	Regular menu							Children's menu						
	Energy (kJ/kcal)	Fat (g)	Saturated fat (g)	*Trans* fat (g)	Sodium (mg)	Total CHO (g)	Protein (g)	Energy (kJ/kcal)	Fat (g)	Saturated fat (g)	*Trans* fat (g)	Sodium (mg)	Total CHO (g)	Protein (g)
	Dessert/baked goods‖							Dessert/baked goods‖						
Mean	1795/429	19	10	0	302	59	8	1004/240	10	6	0	114	33	4
P25	962/230	7	3	0	125	32	3	418/100	2	1	0	52	18	2
P50	1481/354	14	7	0	240	52	6	728/174	6	5	0	78	24	3
P75	2284/546	26	13	0	414	74	10	1297/310	13	8	0	150	43	4
n	4512	4167	4230	3318	4454	4446	4123	134	109	127	70	134	134	109
	Total							Total						
n	29 531	25 505	26 927	15 889	28 693	28 987	24 359	1392	1143	1230	508	1380	1378	1050
% missing	0·00	0·14	0·09	0·46	0·03	0·02	0·18	0·00	0·18	0·12	0·64	0·01	0·01	0·25

CHO, carbohydrates, P25, 25th percentile; P50, median; P75, 75th percentile.
†Represents à la carte items whenever separate values were provided; may include some combination meals when à la carte nutritional values were not provided.
‡Includes dressing values only when a single dressing is offered as the standard preparation, per data entry protocol; otherwise does not include dressing.
§Excludes common soft drinks (e.g. Pepsi/Coke), plain coffee/tea and alcoholic beverages.
‖Includes miscellaneous baked goods not labelled as sides (e.g. rolls, bagels, breakfast pastries, cookies).
¶The value of the corresponding regular menu item type is lower than the children's menu.

Across all outcome measures, family-style restaurant menu items consistently had significantly higher levels of energy, fat and sodium compared with fast-food restaurants, and coefficients were large. Fast casual restaurant menu items also had significantly higher energy levels on average, but not significantly higher levels of fat or sodium. The menus for restaurants serving breakfast had lower energy, sodium and protein levels, on average. Pizza and chicken restaurant menu items had significantly lower levels of most nutrients compared with American restaurant menu items. Most cuisines had significantly lower levels of sodium than American, with some large effect sizes.

While the regression analysis is limited to restaurants providing nutrition information, there were differences in how easily information could be accessed online. Restaurants that only provided information upon email request had significantly higher energy and nutrient values than those that provided the information on their website in a readily accessible single file or page. There was no significant effect for the proportion of outlets subject to a state/local labelling policy, and while coefficients for the proportion of outlets subject to a *trans* fat ban were significant, their magnitude was essentially zero.

Discussion

The present paper provides a snapshot of the availability of nutrition information and nutritional content of menu offerings among the largest US restaurant chains just before the ACA mandate that required nationwide menu labelling of energy (calories). Prior research has documented the impact of restaurant dining on overall diet quality[3,30] and nutritional content in selected fast-food restaurants[14], but none has systematically sampled this many restaurants across such diverse service types and cuisines.

One reason for the absence of prior studies was the lack of nutrition information in the past. Harnack found that only three of fifteen table service restaurants provided complete nutrition information on their websites in 2004–2005 and no restaurant without website information provided it upon email request[13]. Wootan and Osbourn found that 44 % of US chains in the *Restaurant & Institutions* magazine list reported complete nutrition information on websites in 2004[12], compared with the present study's 61 % in 2010. The increase may stem from enhanced website content, consumer demand for information and state/local laws requiring nutrition information. The present study updates and expands on prior research by reporting on how nutrition information accessibility varies by cuisine and service type, finding evidence that restaurants making information less readily accessible also have menus that are higher in energy, fat and sodium.

Although the present study provides a more extensive measure of nutritional content in the largest US chain restaurants than previously available, there are multiple

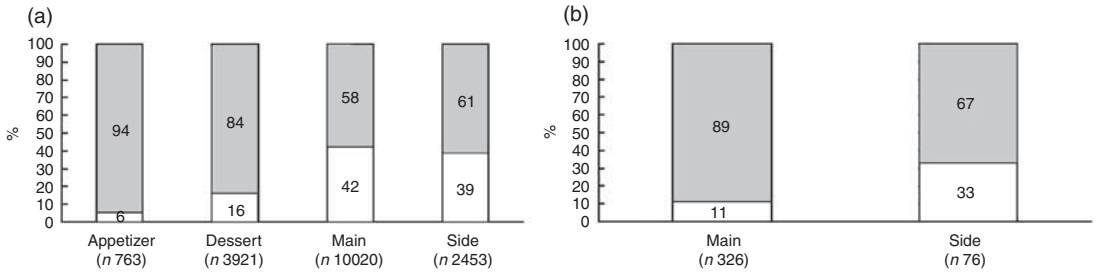

Fig. 1 Menu items meeting (□) or not meeting (■) nutrition criteria by item type: (a) Healthy Dining criteria, regular menus; (b) Kids LiveWell criteria†, children's menus. †Sample size is reduced as analysis includes only menu items with data reported for all nutrition criteria. Data were not available on percentage of energy from sugar (for Kids LiveWell standards) or ingredients (e.g. item includes whole grains, fruits and vegetables, for both standards), so the percentage of items approved estimates maximum possible values

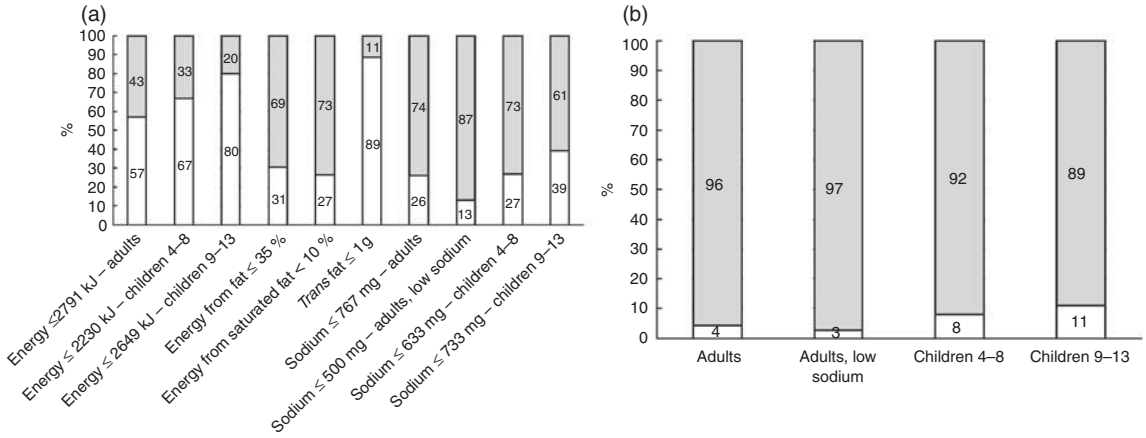

Fig. 2 Main entrées meeting (□, within recommended limit) or not meeting (■, above recommended limit) subgroup-specific values of one-third of the US Department of Agriculture (USDA) estimated daily energy needs and RDA: (a) individual nutritional values†‡§; (b) across multiple USDA guidelines (energy, sodium and percentage of energy from fat/saturated fat§). †2791 kJ = 667 kcal; 2230 kJ = 533 kcal; 2649 kJ = 633 kcal. ‡USDA recommendation for *trans* fat is 'as little as possible'; ≤1 g was used as a benchmark. §Values for children were assessed against children's menu main entrées

limitations. Because data were intentionally collected prior to complete ACA implementation, the self-reported and usually web-based nutrition information was not subject to standardized format requirements and is likely to have variable accuracy. The restaurants studied capture a large share of the market, but large chains are obviously not representative of the universe of all restaurants. One market research group estimated that 37 % of restaurant brands are independents, not chains or non-commercial operations[31]. Individual restaurants and small chains may offer food with systematically different nutritional content, but they are not subject to menu labelling laws. We cannot comment on nutritional content for restaurants that did not make information available. Even among the largest US restaurants, those with fewer outlets and those considered 'upscale' (e.g. Legal Sea Foods, Ruth's Chris Steak House) are less likely to report data. Upscale restaurant websites often noted that accurate nutritional analysis was not possible, due to customizations and less strictly standardized food preparation methods. Results for upscale restaurants and *trans* fat levels should be viewed with caution, due to high non-reporting rates and thus probable reporting bias. Finally, comparison with Healthy Dining and Kids LiveWell standards was based on available data, which notably did not include sugar or ingredients – additional criteria needed to determine whether items fully met those standards. The proportion of menu items characterized as meeting those standards is therefore higher than it would be if full data were available.

The present study describes energy and nutrient levels of menu offerings in order to provide a baseline set of values on the critical supply-side issue about what restaurants offer, but it is not a study of how menu offerings affect demand, choice or dietary quality. It did not evaluate the influence of price, marketing or bundling/combination meal strategies, which are known to be highly influential[32,33], or ordering/intake patterns[34]. The present study analysed items without weighting either by sales or outlets, although restaurants with more outlets will have a bigger impact on the American diet.

Main entrées appear surprisingly low in energy when viewed à la carte and on a per-serving basis, but nevertheless have high levels of sodium or saturated fat. This may be an artifice of restaurant-determined single serving

Table 4 Linear regression: energy and nutrition

	Dependent variable											
	Energy (kJ/kcal)		Total fat (g)		Saturated fat (g)		Sodium (mg)		Carbohydrates (g)		Protein (g)	
Independent variable	Coefficient	*P*	Coefficient	*P*	Coefficient	*P*	Coefficient	*P*	Coefficient	*P*	Coefficient	*P*
Restaurant characteristics												
Meal period												
Serves breakfast	−475·3/−113·6	0·007*	−5·2	0·051	−1·3	0·236	−374·8	0·000*	−5·7	0·153	−9·8	0·000*
Serves lunch	−192·9/−46·1	0·698	10·8	0·545	−0·2	0·965	−176·2	0·629	−4·5	0·665	3·9	0·576
Serves dinner	−282·4/−67·5	0·229	−0·6	0·826	−2·7	0·259	66·6	0·782	−15·7	0·167	3·3	0·672
Service (ref.: fast food)												
Take-out/delivery	296·2/70·8	0·057	5·1	0·026*	2·0	0·022*	260·4	0·046*	2·7	0·650	4·5	0·155
Fast casual	449·4/107·4	0·033*	3·5	0·238	0·8	0·407	131·7	0·299	13·8	0·010*	8·0	0·016*
Buffet	−514·2/−122·9	0·099	−5·0	0·200	−1·9	0·172	−273·2	0·212	−14·3	0·099	−5·7	0·175
Family style	1132·2/270·6	0·000*	16·3	0·000*	5·4	0·000*	434·5	0·000*	18·5	0·000*	13·5	0·000*
Upscale	−554·0/−132·4	0·503	−0·6	0·974	−2·1	0·696	−847·3	0·090	−24·9	0·141	10·4	0·214
Outlet count												
Decile of outlet count	−2·9/−0·7	0·917	0·1	0·820	0·0	0·830	18·8	0·262	0·3	0·679	−0·3	0·370
Cuisine (ref.: American)												
Asian	−907·5/−216·9	0·069	−19·4	0·004*	−7·1	0·005*	−446·2	0·021*	2·5	0·831	−16·0	0·011*
Burger	5·4/1·3	0·975	3·0	0·254	1·2	0·174	−258·1	0·025*	−3·8	0·489	1·8	0·626
Chicken	−572·4/−136·8	0·015*	−7·8	0·008*	−3·2	0·000*	−483·0	0·000*	−12·2	0·020*	−2·8	0·527
Italian	−296·2/−70·8	0·229	−8·8	0·010*	−0·1	0·948	−364·3	0·012*	9·9	0·098	−13·0	0·001*
Mexican	−196·7/−47·0	0·328	−4·7	0·190	−0·2	0·895	−17·9	0·886	9·8	0·024*	−7·1	0·012*
Pizza	−1327·6/−317·3	0·000*	−20·1	0·000*	−6·0	0·000*	−1038·5	0·000*	−9·0	0·330	−19·7	0·000*
Sandwich	163·2/39·0	0·619	−2·1	0·636	0·1	0·942	69·6	0·732	13·9	0·057	1·5	0·772
Snack	31·4/7·5	0·854	−2·8	0·307	0·1	0·963	−37·7	0·744	10·5	0·048*	−0·7	0·785
Steak/seafood	−686·6/−164·1	0·081	−9·4	0·223	−0·8	0·816	−437·3	0·035*	−26·1	0·000*	2·9	0·534
Policy												
% of outlets subject to menu labelling†	0·4/0·1	0·960	−0·1	0·838	0·0	0·712	−4·0	0·400	−0·2	0·456	0·0	0·907
% of outlets subject to *trans* fat ban†	5·0/1·2	0·014*	0·0	0·225	0·0	0·029*	2·0	0·099	0·1	0·012*	0·0	0·872
Information accessibility (ref.: on website in a single file/location)												
On website in multiple pages/per-item info	344·3/82·3	0·177	6·7	0·082	3·3	0·042*	−145·9	0·285	1·8	0·751	6·0	0·019*
Not on website, provided upon email request	607·5/145·2	0·001*	9·1	0·000*	3·4	0·002*	220·4	0·045*	8·9	0·214	6·8	0·043*
Prob > *F*	0·000		0·000		0·000		0·000		0·000		0·000	
R^2	0·215		0·179		0·179		0·130		0·129		0·186	

ref., reference category.
*$P < 0·05$.
†Scale: 0–100.

size, and also must be interpreted in light of what is typically ordered and consumed at restaurant meals. Dumanovsky *et al.* found that in three fast-food restaurants, only 19·4 % of purchases were single items, whereas 70·9 % of purchases were dollar meal menu combinations of two or more items[34]. Market research data found that fast-food patrons order 2·4 menu items, on average, and that only 21 % of children aged 6–12 years order kids' meals at fast-food restaurants[23]. That gives more cause for alarm, given the high sodium content in individual items. How people combine items may also differ across restaurant types and combination orders are likely to be different in family style restaurants compared with fast-food restaurants.

There were significant differences in nutritional content of menu items, particularly for some service types and cuisines. Some may be reporting artifices and reflect a limitation of how restaurants report data, including self-determined serving sizes (e.g. appetizers reported as multiple servings in some restaurants but not all). In particular, some pizza and fried chicken restaurants had surprisingly low energy content in main entrées because they used unusually small serving sizes (e.g. one slice of pizza, one chicken piece). This provides a clear indication that serving sizes need to be standardized for menu labelling to offer meaningful comparisons. There is less ambiguity in the finding that family-style restaurants offer items substantially higher in energy, fat and sodium. This may be due to larger portion sizes and/or higher energy density. Larger portion sizes can contribute to higher energy intake and weight gain over time in adults and children[35–39]. Family-style restaurants and, independently, American cuisine also offer main entrées with higher sodium levels. sodium intake in the USA is far higher than USDA-recommended levels, generating substantial social costs due to morbidity and excess health-care expenditures[40].

While children's main entrées were lower in energy than regular menu ones, as they should be, children's menu specialty beverages were often dessert-like, sugary items such as milkshakes. They typically had more energy, fat and saturated fat than non-alcoholic, regular menu specialty beverages, which included more smoothies, coffee and tea specialty beverages. Over the past few decades, beverage-only snacking occasions have increased considerably in children[22], and the percentage of energy intake from beverages increased in non-Hispanic black 12–19-year-olds[41]. School-based policies targeting sugar-sweetened beverages have focused on soft drinks and vending machines; the present study provides data about specialty beverages served in restaurants.

The present data also show that the proportion of items meeting USDA, Healthy Dining and Kids LiveWell criteria is: (i) highly sensitive to specific criteria (e.g. a generous sodium threshold); (ii) substantially lower when nutrient values are considered in addition to energy; and (iii) potentially very different for USDA *v.* Healthy Dining and Kids LiveWell. Healthy Dining's sodium limit of 2000 mg per main entrée could allow intake of up to 6000 mg sodium/d across three meals – 2·6 times the USDA RDA for adults and four times that for adults with low sodium needs – without considering other items ordered. Many items met a single nutrition criterion, but far fewer satisfied multiple criteria. Thus, many items that may be perceived as falling within USDA-recommended levels based on energy alone, which is the only value that will be added to menus under ACA, would not meet other nutritional standards. Finally, a much larger proportion of main entrées could meet Healthy Dining and Kids LiveWell criteria, compared with one-third of the USDA RDA limits, suggesting that restaurant industry-supported criteria are more generous than government-established ones. Although comparisons were based on partial data (e.g. without sugar, ingredients), it is clear that restaurant industry-supported criteria differ from USDA ones – particularly for sodium. The Healthy Dining and Kids LiveWell logos are used on many chain restaurants' menus to highlight 'healthy choices', but they provide a vastly different picture from USDA guidelines. Misleading health claims used by grocery manufacturers on front-of-package labelling has been a concern for federal regulators[42]. The present study provides evidence that restaurant industry labelling also deserves further discussion.

Conclusions

There is not compelling evidence that labelling alters individual choices from a fixed menu, but restaurant menus change over time, and the present study provides baseline data just before national labelling laws came into effect that can be used to assess such changes. Many restaurant menu items are high in fat, saturated fat and sodium, and restaurant industry-supported logos used to highlight 'healthy choices' are more generous than USDA recommendations, particularly for sodium. Menu items that appear reasonable based on energy alone must be considered within the context of an entire meal and for other nutrient values. Sometimes those extras, such as children's specialty beverages, are problematic.

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