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Per-ingredient Calorie Information Reduces Calories Ordered More in a Food-Away-from-Home Setting than Information Provided per

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2-1-19Market Report	Year Ago	4 Wks Ago	2-1-19
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	125.00	*	*
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	196.41	177.98	177.15
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	154.79	150.98	149.16
Choice Boxed Beef, 600-750 lb. Carcass.	206.70	215.75	216.65
Western Corn Belt Base Hog Price Carcass, Negotiated	69.27	49.84	50.22
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	81.41	68.52	66.11
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	133.29	134.55	131.38
National Carcass Lamb Cutout FOB.	362.34	386.15	380.90
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	3.80	4.53	4.63
Corn, No. 2, Yellow **Columbus**, bu.	3.32	3.52	3.52
Soybeans, No. 1, Yellow **Columbus,** bu.	9.07	8.13	8.15
Grain Sorghum, No.2, Yellow Dorchester, cwt.	6.58	5.75	5.70
Oats, No. 2, Heavy Minneapolis, Mn, bu.	3.01	3.24	3.30
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	166.25	*	*
Alfalfa, Large Rounds, Good Platte Valley, ton.	90.00	103.00	100.00
Grass Hay, Large Rounds, Good Nebraska, ton.	82.50	87.50	85.00
Dried Distillers Grains, 10% Moisture Nebraska Average.	150.00	155.00	142.50
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	47.50	53.00	52.50

*** No Market**

Obesity rates in the United States have risen dramatically over the past five decades, reaching what many public health officials have referred to as epidemic proportions. A common policy response to this obesity epidemic—which is often attributed to overconsumption of highly caloric, unhealthy foods—has been to increase consumers' access to nutrition information to help them to make healthier choices. Recently, the increasing frequency of food consumption at restaurants led to the development of nutrition labeling requirements for restaurants with 20 or more locations. The rule, requiring food retailers to post calorie amounts and to make available information about other nutrients upon request, went into effect on May 7, 2018. While this does not provide enough time for widely available evidence on the effect of this newly available information, some local governments, such as New York City, in the United States were early adopters of the approach, providing a sense of the likely effectiveness of calorie labeling in restaurants and other retailers of prepared foods. Research that examines evidence from multiple locations and individual studies, referred to as meta-analysis, does not find much evidence that calorie labeling changes consumers' food purchasing behavior (see, for instance, VanEpps et al., 2016 or Bleich et al., 2017).

One potential problem with nutritional labeling is that people may fail to process or even take note of the information. Making healthier options more relevant—by presenting the information in ways that highlight tradeoffs, prompting people to explicitly consider their health, or through behavioral economic nudges—increases the likelihood that individuals choose a healthier item (Cantor et al., 2015). Focusing attention on a few key nutrients or a summary nutritional score promotes healthier choices

(Kiesel and Villas-Boas, 2013; Zhu et al., 2016), particularly if people are in a hurry (Crosetto et al., 2016).

An important consideration for the design of materials that are intended to promote healthier choices is that food preferences play a key role in food choice. When people choose foods—particularly at restaurants—they are motivated by the pleasure they get from eating the food. Calorie information at the level of the whole item (e.g., for the bacon cheeseburger) may not be enough to convince someone to switch to a lower calorie item (a hamburger). However, providing calorie information per ingredient, an alternative approach to whole-item calorie labeling, may help change behavior in the face of strongly held food preferences. Per-ingredient calorie labeling could help customers avoid high-calorie items that contribute relatively little to their enjoyment, while keeping attributes that are most important to them. For example, per-ingredient calorie labeling would identify an easy opportunity to reduce caloric intake for a consumer who does not care much about the cheese on a bacon cheeseburger by highlighting the number of calories the consumer could avoid by foregoing the cheese.

We recently tested this idea by examining the choices of customers at a sandwich shop before and after calorie information was introduced. At this sandwich shop, two categories of sandwiches are available: 1) build-your-own sandwiches (BYO) and 2) pre-defined sandwiches (DEF), which comprise common sandwich combinations, like a Reuben and a club sandwich, among others. When calorie information became available, BYO sandwiches had calorie information provided per ingredient, while DEF sandwiches had calorie information for the entire sandwich (the ingredients in each of the DEF sandwiches were always displayed). For BYO sandwiches, customers select ingredients from the following categories: bread, protein, cheese, spreads, and vegetables.

The following results are drawn from a recently published study (Gustafson and Zeballos, 2018). We examined changes in calories ordered per sandwich after calorie labeling was introduced in BYO and DEF sandwiches. Ingredient-specific calorie information may highlight opportunities to make marginal—substituting or omitting ingredients—rather than extensive changes from one sandwich to another.

Setting

Customers at the sandwich shop indicate their choices on a paper slip, which employees use to prepare the sandwich. The shop provided the researchers with order slips documenting customers' choices before and after calorie information was made available for a total of approximately 15 months. We calculated the number of calories ordered per sandwich during pre-calorie information (PRE), which constituted approximately six months' worth of slips, and post-calorie information (POST)—nine months—periods using calorie information provided in the POST period. We examine differences in the average number of calories ordered per sandwich using simple statistical tests to estimate the effect of calorie information on the number of calories ordered for BYO and DEF in PRE and POST time periods.

Having the sandwich order slips also allows examination of ingredient-specific ordering patterns for BYO sandwiches in PRE and POST periods to evaluate how patterns changed after introduction of calorie information. For instance, we might see customers substitute lower-calorie items for high-calorie items; decide to skip high-calorie ingredients such as cheese, or decide to consume only one slice of cheese instead of two or more. The list of ingredients in the POST period contains all the ingredients presented in the PRE period.

Results

When we examine the number of calories ordered per sandwich, we see a significant decrease in the number of calories ordered for BYO sandwiches after the implementation of calorie labeling (Table 1). The average number of calories ordered for BYO sandwiches fell from 812.7 in PRE to 750.1 in POST ($p < 0.01$), a nearly 8 percent reduction in the number of calories ordered. DEF sandwiches, on the other hand, experience no change.

Table 1: Calories ordered for BYO and DEF sandwiches before and after implementation of calorie labeling.

	Mean (calories)	Number of Observations
BYO SANDWICHES		
All (pooled)	771.7	1,134
PRE	812.7	391
POST	750.1	743
DEF SANDWICHES		
All (pooled)	971.3	545
PRE	969.6	292
POST	973.2	253

We next look at how ingredient quantity ordering patterns change for BYO sandwiches in PRE and POST periods (Table 2). Significant changes occur in customers' ordering patterns in almost every ingredient category, though not all changes would clearly lead to a decrease in calories ordered. For instance, fewer customers ordered a sandwich without meat on it, but there was also a slight decrease in the percentage of customers who ordered more than one meat. For cheese, there is a clearer pattern: more customers leave cheese off altogether, and there is a decrease in customers ordering more than one slice of cheese on their sandwich. Ordering patterns for spreads work in opposite directions.

There is an increase in customers ordering more than one spread and there is an increase in customers not ordering a spread. While these findings identify changes in ordering patterns at the category level, items within a category may have very different calorie contents. For instance, the number of calories in spreads ranged from five (mustards, vinegar) to 180 calories (mayonnaise). Therefore, we next look at changes in each category to identify how the addition of calorie information led to a decrease in calories ordered.

Table 2: Ordering patterns for build-your-own sandwiches before and after the introduction of per-ingredient calorie information.

			PRE	POST	% Change
All	**Orders**	**number**	**390**	**744**	
Bread	Portions per order	# of portions	1.0	1.0	0
	No Bread	Percentage	0.8	0.1	-88
Meat	Portions per order	# of portions	1.08	1.09	1
	More than one meat	percentage	13.0	11.4	-12
	No meat	Percentage	6.1	2.7	-56
Cheese	Portions per order	# of portions	0.94	0.89	-5
	More than one cheese	percentage	4.3	1.6	-63
	No cheese	percentage	11.8	13.2	12
Veggies	Portions per order	# of portions	2.51	2.23	-11
	More than one veggie	percentage	73.7	75.8	3
	No veggies	percentage	5.1	9.7	90
Spread	Portions per order	# of portions	1.09	1.07	-2
	More than one spread	percentage	17.4	22.9	32
	No spread	percentage	13.0	21.7	67

Ingredients are listed from lowest to highest calorie items in Table 3. Few changes occurred in bread order patterns. The only significant change (in a statistical sense) from PRE to POST occurred for multigrain ciabatta. Although one of the higher calorie bread options, orders including multigrain ciabatta increased from 8.1 percent to 12.7 percent, which may reflect the perceived health benefits of whole grain products.

In both meat and cheese categories, customers appear to shift away from high calorie and towards low calorie options. In the meat category, this corresponds to fewer customers ordering turkey and more ordering ham and salami. The order slips indicated that turkey contained 300 calories per sandwich, while ham and salami contained 200 and 210 calories. For cheese, the number of orders containing mozzarella dropped significantly, while sandwiches containing cheddar and provolone increased.

The biggest changes in ordering patterns occurred in spreads, which led to a significant decrease in calories ordered. Customers added low-calorie mustards and red wine vinegar to sandwiches much more frequently after calorie information was posted. Sandwiches with mayonnaise, a high calorie ingredient, decreased substantially, from 76.5 percent of orders to 48.8 percent of orders. In the vegetable category, we see a small decrease in orders requesting lettuce or mixed greens and a modest increase in orders requesting tomato.

Table 3: Ingredient-specific ordering patterns before and after the introduction of calorie information for build-your-own sandwiches.

		Calories	PRE	POST	% Change
Bread	Marble Rye	260	12.8	14.6	14
	Sourdough	270	27.9	24.8	-11
	Ciabatta	280	25.0	24.7	-1
	9-Grain	280	26.2	23.3	-11
	Multigrain Ciabatta	310	8.1	12.7	57
Protein	Roast Beef	170	22.4	25.7	15
	Salami	200	4.5	7.3	62
	Ham	210	11.2	18.8	68
	Roast or Smoked Turkey	300	67.3	54.2	-19
Cheese	Cheddar	110	32.2	39.5	23
	Provolone	110	30.7	36.4	19
	Swiss	120	26.3	19.4	-26
	Mozzarella (fresh or smoked)	180	15.2	7.6	-50
Veggies	Spinach	5	40.9	41.7	2
	Tomato	5	60.8	67.3	11
	Lettuce or mixed greens	10	68.6	59.0	-14
	Red Onion	15	41.7	45.0	8
Spread	Yellow Mustard	5	9.9	15.1	53
	Dijon Mustard	5	22.0	34.0	55
	Red Wine Vinegar	5	2.8	23.2	729
	Olive Oil	120	7.7	15.3	99
	Mayonnaise (any kind)	180	76.5	48.8	-36

Discussion

We used a real-world policy change—the introduction of calorie information restaurants—to test how the presentation of calorie information affects calories ordered. Calorie information was presented in different formats for two sandwich types. Calorie information was provided for each ingredient for build-your-own sandwiches (BYO). In the second format—which reflects the standard approach to calorie labeling—a total calorie count was provided for sandwiches with a pre-defined set of ingredients (DEF).

The number of calories customers ordered after the introduction of calorie information did not change for DEF sandwiches, which matches findings from previous studies and meta-analyses of the effect of calorie labeling in restaurants. However, when ingredient-specific calorie information was provided, the number of calories ordered in BYO sandwiches decreased significantly, by nearly eight percent per order.

We also examine how ingredient ordering patterns changed after calorie information was introduced.

While there were significant changes in every ingredient category, we observed a consistent pattern of decreasing orders of high-calorie items and increases in choices of low-calorie items. However, certain results suggest that a focus on calorie information may lead customers to choose products that are less caloric but not necessarily healthier, highlighting the need for further research. For instance, the increase in ham and decrease in turkey may have been driven by the fact that information focused solely on calories, which omits other important nutritional attributes, like sodium.

Overall, we find that the presentation of calorie information matters. Given that many individuals have strong preferences for foods, per-ingredient calorie information may provide an opportunity for consumers to substitute away from high-calorie items without fundamentally changing their choice in a way that traditional calorie labeling does not. Per-ingredient calorie information may more effectively highlight tradeoffs between taste and health by identifying the number

of calories the consumer could save by forgoing a specific ingredient in their meal. We also find that the effects of per-ingredient calorie information are sustained over an eight-month follow-up period, which suggests that per-ingredient calorie labeling may allow more sustainable behavior change (see Gustafson and Zeballos, 2018). Strategies to stem rising obesity rates frequently focus on giving consumers more nutrition information. Though the effects of these strategies have been modest, understanding how the information format influences decision-making could enhance the impact of these policies.

Note: This Cornhusker Economics article draws from an article, "The effect of ingredient-specific calorie information on calories ordered," published by Christopher R. Gustafson and Eliana Zeballos in Preventive Medicine Reports, volume 12 (pp. 186-190). The open access article is available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6174846/.

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