Can Taste and Nudging Impact Healthy Meal Consumption? Evidence from a Lunch Restaurant Field Experiment

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- *Evidence from a Lunch Restaurant Field Experiment*

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Abstract

Previous research shows that taste is one of the most important factors in determining food choices, and that food choices may be affected by ”nudging”. We analyze how taste, as determined by meal attributes, and nudging affects consumption of a healthy labeled meal. Our analysis is based on a field experiment in a lunch restaurant and our results imply that sales of the healthy labelled meal, and its market share, is greatly impacted by its taste. Nudging, as in order of display on the menu, does not impact sales of the healthy labelled meal in our experiment. We conclude that supplying *tasty* healthy meals may be key to significantly impact healthy eating, superior to other policy measures aimed at encouraging healthier food choices, such as information, nudging and food tax reforms.

Keywords: healthy food consumption; taste; nudging; field experiment

JEL-classification: C93; D12; D83; I12

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1. Introduction

The modern Western diet is often high in calories while low in healthy nutrients, and in combination with a more sedentary lifestyle, the characteristics of the modern diet has proven to be toxic: it has placed obesity, overweight, and several serious diet related diseases (e.g., several types of cancer, diabetes, cardiovascular disease, high blood pressure and osteoporosis) at the top of the list on public health problems in many countries, both developed and developing.

To encourage healthier food choices, policy reforms that entail information, such as nutrition labelling, and taxes on unhealthy food have been implemented, e.g., the legislated menu labelling in many states in the U.S. (starting in New York City, 2008), and taxes on unhealthy food and beverages in Denmark, Finland, France and Hungary, introduced in 2011-2012.

However, field evidence of the impact on healthy food consumption from information is at best mixed. Many studies find no effect on the nutritional quality of consumption from nutritional information, even when it is the most visible, such as point-of-purchase menu labeling (e.g. Harnack et al., 2008; Elbel et al., 2009 and 2011; Vadiveloo, 2011, and Thunström and Nordström, 2011). Further, research on the impact of food tax reforms implies that taxes of the magnitudes that are politically feasible are likely to have little impact on food consumption (e.g., Chouinard et al., 2007, Powell and Chaloupka, 2009, Nordström and Thunström, 2009, Smed et al., 2007). In essence, information and moderate price incentives do not seem to substantially impact healthier food consumption.[1] This may be a result of taste

[1] Other policy initiatives are aimed at increasing the supply of healthy foods in areas where availability has been limited (see e.g. the "Healthy Corner Store Initiative" in Philadelphia, U.S.). Research on the impact on food consumption of increased availability to healthy food shows at best limited effects (see e.g. Wrigley et al., 2003, and Lee, 2012). Also, the prevalence of diet related illnesses is high even in areas where healthy food is highly

being one of the main determinants of food choice, often found to dominate both health and price (Lennernas et al., 1997; Glanz et al., 1998, Blanck et al., 2009).

In this paper, we use data from a field experiment in a lunch restaurant to analyze the impact on healthy labelled meal sales from manipulating ingredients in food, which we take as manipulating taste. We also analyze the impact on the healthy labelled meal sales from "nudging" (Thaler and Sunstein, 2003), an intervention that has been shown to affect food choices (Downs et al., 2009, and Thunström and Nordström, 2011).

More specifically, we analyze how sales of a healthy labelled meal is affected by (i) attributes that affect the taste of the *healthy labelled* meal, (ii) attributes that affect the taste of *non-healthy labelled* substitute meals, and (iii) "nudging" -- placing the healthy labeled meal on top of the menu. To the best of our knowledge, this is the first study to formally analyze how taste improvements (or meal ingredients) affect sales of healthy meals. By addressing (iii), we follow up on Downs et al. (2009), who report a positive impact on sales of healthy sandwiches from nudging.

The field experiment allows us to analyze the impact on healthy labelled meal sales from taste manipulation and nudging, while holding prices, and potentially also perceived nutritional content, constant: prices of all meals (the healthy labelled meal and its non-labelled substitute meals) are equal and constant throughout the study period. The restaurant setting of the experiment is also conducive to controlling for consumers' *perceived* nutritional content of meals: the nutritional content varies over meals, but is likely to be non-transparent to consumers. Evidence suggests consumers have difficulties in making accurate estimates of the nutritional content of prepared meals away from home (Burton et al., 2006). Therefore, consumers in a restaurant are likely to largely rely on the healthy label to distinguish healthy meals from less healthy meals.

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available, suggesting that increased availability may not be key in reducing the overall prevalence of diet related illnesses.

The paper is structured as follows. Section 2 describes the field experiment and data, section 3 provides the empirical analysis and results, section 4 concludes.

1. Field experiment and data

Our analysis is based on data from a lunch restaurant at an industry company in southern Sweden. The restaurant introduced a healthy (Nordic "Keyhole") labelled meal on the menu on the 20th of April, and reported meal sales for the following 6 weeks (27 business days), i.e., until 29th of May 2010. The Keyhole label has been a symbol for healthy food for 20 years in Sweden and is well-known among the general public as an indicator of healthy food choices. Meals eligible to carry the Keyhole symbol must fulfill certain criteria. The general criteria that applies for a Keyhole labeled meal are: the meal should contain 400-750 calories, max 30 energy percent from fat (more is allowed for seafood), max 3 grams of sugar per 100 gram, max 1 gram salt per 100 gram, be well-balanced and contain at least 100 gram of vegetables (excluding potatoes).[2] Hereafter, the Keyhole labeled meal will be referred to as the healthy labeled meal.

The order of the healthy labelled meal on the menu was varied over the study period, and the data contains information on where on the menu the healthy labelled meal was displayed, the type of meals served each day, and the amount sold of each meal. In this study, we are assuming that the main factors that impact sales of regular meals (source of protein and nudging – see Thunstrom and Nordstrom, 2011) also impact sales of healthy labelled meals, and hence therefore include those factors in our analysis. We also include fat content: fat in meals can be both positively and negatively valued by consumers – fat is taste increasing (Drewnowski, 1998), but may pose a health risk if over consumed. We include fat content per

[2] See www.nyckelhalsrestaurang.se.

portion of the healthy labelled meal. A nutritionist assigned each meal its fat content per portion, using the software Dietist XP.[3]

The restaurant was open all workdays, Monday to Friday, and closed at 6pm all weekdays, except Fridays, when it closed at 3pm. Every day one healthy labelled meal and two non-labelled substitute meals were offered on the menu, except April 30th, when only one non-labelled substitute meal was served. The price of all meals was the same (SEK 63). The restaurant is open to the general public, even if it primarily serves contractor employees. There are a couple of other lunch restaurants within walking distance. Restaurant staff estimates that approximately 10-20 percent of daily lunch eaters are civil servants, 80-90 percent are blue-collar workers, and 30 percent are women. The staff also estimates that the restaurant has an equal number of potential customers each week day, despite the shorter opening hours on Fridays. The lunch menu was posted outside the restaurant every day and customers could also get the menu via e-mail: the e-mail list contained approximately 50-60 people.

We created (i) a set of dummy variables for the source of protein in the healthy labelled meals (red meat, poultry, fish or seafood or vegetarian; yes=1; no=0), (ii) a set of dummy variables for the source of protein in the substitute meals (any of the substitute meals containing red meat, poultry, seafood (including fish), or being vegetarian: yes=1; no=0), (iii) a couple of dummy variables indicating the order of the healthy labelled meal on the menu (first on the menu, versus second or last: yes=1; no=0)[4], and (iv) a set of dummy variables indicating weekday (Monday, Tuesday-Thursday, or Friday: yes=1; no=0). Table 1 shows descriptive statistics of the variables included in the analysis.

[3] In Dietist XP, portion sizes are generally based on portions consumed, not portions served. The nutritional values found in our data are therefore generally smaller than nutritional values calculated based on portions served at restaurants. The nutritional content of the meals is also subject to uncertainties, since the nutritional contents have been calculated based on meal descriptions as found on the menu, where cooking procedures, portion sizes, etc, are unknown.

[4] Only during a couple of days of the study period did the healthy labeled meal appear last on the menu. We therefore merged 2nd and 3rd on the menu into a single dummy variable.

Insert table 1 here.

Table 1 shows that the average number of portions served of the healthy labelled meal per day was 153 during the study period, and that the average market share of the healthy labelled meal was 44 percent, where the market share is equal to the number of portions sold of the healthy labelled meal, divided by the total number of portions sold that day. The highest number sold of the healthy labelled meal was 232 -- a healthy labelled traditional Swedish dish: meatballs and mashed potatoes with lingon berries, displayed at the top of the menu and served on a Monday, and where the substitute meals constituted of a meal with poultry and a meal with seafood. The market share of this healthy labelled meal was 64 percent. The highest market share (68 percent) on any day during the study period was held by a healthy labelled version of another traditional Swedish dish: “Skansk kallops” (a beef stew from the Skane region) with boiled potatoes and beetroot, displayed at the top of the menu and served on a Friday, where the non-labelled substitute meals contained seafood.

The lowest number sold per day of the healthy labelled meal was 52, and the lowest market share of the healthy labelled meal was 14 percent. The same meal holds both these records -- vegetarian spring rolls, with curry sauce and rice, served on a Tuesday, Wednesday or Thursday, displayed second or last on the menu, and where the non-labelled substitute meals constituted of a meal with red meat and a vegetarian meal.

Note that meal prices and the variety of meals supplied by the field experiment restaurant during the study period were not influenced by the authors of this study. The restaurant is privately owned and therefore guided by profit maximization. This is important since it ensures that our analysis is based on combinations of meals, inputs and input costs that are part of a profit maximizing strategy, while it for instance rules out healthy meals or inputs that

significantly may impact sales, but would be too expensive to supply by a profit maximizing entity.

2. Empirical analysis and results

To analyze the factors that influence sales and the market share of the healthy labeled meal, we estimated two different models represented by:

$$\mathbf{S}_{\text{Keyhole}} = \alpha + \boldsymbol{\beta}\mathbf{z} + \boldsymbol{\delta}\mathbf{D} + \boldsymbol{\varepsilon}$$

In our first model, the content of vector $\mathbf{S}_{\text{Keyhole}}$ is daily number of portions sold of healthy labelled meals at t (t=1, …,27). In our second model, $\mathbf{S}_{\text{Keyhole}}$ is a vector of the daily market share of the healthy labelled meal at t. The vector **z** contains grams of fat per portion in the healthy labelled meal. **D** contains the dummy variables indicating the source of protein of the healthy labelled meal, and the dummy variables indicating the source of protein in the non-healthy labelled substitute meals. **D** also contains the weekday dummy variables, and the dummy variable indicating if the healthy labelled meal appears second or third on the menu. Note that the reference meal is a healthy labelled meal that contains seafood, is displayed at the top of the menu and is sold on a Monday, with at least one of the substitute meals also containing seafood.

To test for autocorrelation in both models, we use Durbin's alternative test, which allows for non-normally distributed residuals. The test implies that we cannot confirm the null hypothesis of no autocorrelation in the first model (dependent variable = daily units sold of the healthy labeled meal): Chi2=4.906; Prob>Chi2=0.0268, and that we cannot reject the null

in the second model (dependent variable = daily market share of the healthy labeled meal): Chi2=0.006; Prob>Chi2=0.9366. The first model was therefore estimated with robust standard errors. The results are presented in Tables 2 and 3.

Insert Table 2 and Table 3 here.

Tables 2 and 3 show that a healthy labelled meal that contains poultry (chicken or turkey) is the big seller: daily portions sold of the healthy labelled meal increases by 55 meals if it contains poultry, and the market share of the healthy labelled meal increases by 13 percent, compared to if the healthy labelled meal contains seafood. The healthy labelled meal also benefits from red meat: a healthy labelled meal that contains red meat sells 33 more meals, and increases its market share by 11 percent, compared to a healthy labelled meal that contains seafood. Vegetarian healthy labelled meals sell the worst: if the healthy labelled meal is vegetarian, both sales and the market share of the healthy labelled meal drop substantially: daily sales decrease by 75 meals and the market share drops by 31 percent, compared to if the healthy labelled meal contains seafood.

From Table 1, we know that the most commonly served healthy labelled meal is a healthy labelled meal containing red meat, despite the fact that healthy labelled meals with poultry sell better: 44 percent of healthy labelled meals contain red meat versus 15 percent that contain poultry. Restaurant management is likely to know that poultry meals are their best sellers, so why are healthy labelled meals that contain red meat more common than those containing poultry? For one, overall profit of the restaurant may not be maximized by maximizing sales of the healthy labelled meal. Also, poultry in healthy labelled meals may be a more expensive input than red meat. Vegetarian healthy labelled meals are uncommon, though, which is in line with our finding that vegetarian healthy labelled meals are a hard sell.

Table 1 shows that only 7 percent of the healthy labelled meals served up during the study period were vegetarian.

Our finding of the impact from fat on sales of the healthy labelled meal is mixed. Fat per portion seems to positively impact the number of healthy labelled meals sold per day, i.e. within the range of fat allowed in healthy labelled meals, people seem to appreciate more fat in health labelled meals: Table 2 shows that if the fat content increases by 1 gram, 6 more healthy labelled meals are sold per day. However, fat seems to have no impact on the market share of the healthy labelled meal: as shown by Table 3, the coefficient for fat content is both small and not statistically significant.

Sales of the healthy labelled meal seem to benefit from its substitutes containing tasty attributes as well, such as red meat and poultry. However, the results in Table 3 imply that the healthy labelled meal does not gain market shares if its substitute meals contain red meat or poultry, suggesting that the increase in sales reported in Table 2 is a result from overall sales increasing due to non-labelled meals that contain red meat or poultry, compared to if they contain seafood. The non-healthy labelled meals that seem to compete the most with healthy labelled meals are vegetarian meals. If the non-labelled meals contain a vegetarian meal, the market share of the healthy labelled meal drops by 13.6 percent.

Nudging, by displaying the healthy labelled meal on top of the menu, does not seem to impact sales of the healthy labelled meal or its market share: the coefficient for the dummy variable that indicates the healthy labelled meal being displayed second or third on the menu is both small and not statistically significant, as shown by both Table 2 and Table 3. Based on *t*-tests, we can therefore not reject the null hypothesis that there is no difference in sales of healthy labelled meals between those displayed at the top of the menu and those displayed second or last on the menu. This result contradiction previous research by Downs et al. (2009), who find that nudging works for healthy sandwiches. The difference in results may be

due to differences in display between this study and Downs et al. (2009): they show that sales of healthy sandwiches increase if healthy sandwiches are displayed on the front of a menu, while regular/unhealthy sandwiches are displayed on subsequent pages. Menu nudging in their experiment therefore imposes an additional cost on finding regular sandwiches (turning the page), compared to nudging in our experiment where all meals are displayed together with the healthy meal, with the healthy meal at the top of the menu.

Finally, sales of the healthy labelled meal are lower on all weekdays, compared to on Mondays (see Table 2), but the decline in sales does not seem to be especially pronounced for the healthy labelled meal: Table 3 shows that the impact of weekdays on the market share of the healthy labelled meal is both small and not statistically significant.

How does meal attributes and nudging affect sales of healthy labelled meals compared to sales of conventional meals? Thunström and Nordström (2011) report results on factors influencing meal sales in general, based on data from the same field experiment. Comparing our findings to the results in Thunström and Nordström (2011) we find that the top-selling sources of protein are the same for healthy labelled meals and meals in general, but the impact on healthy labelled meal sales is greater. For instance, Thunström and Nordström report that general meal sales increase by 41 meals if the meal contains poultry instead of seafood, and by 25 meals if the meal contains red meat. The corresponding numbers for the healthy labelled meal is 55 and 33 meals. This difference in sales increases between general meals and healthy labelled meals from adding poultry or read meat to the meals is substantial in real terms, but represents even larger differences in percentage terms. Thunström and Nordström (2011) do not find a drop in sales for meals in general resulting from the meal being vegetarian, which differs from our results on sales of healthy labelled meals. Further, nudging seems to have a positive impact on meal sales in general, but we find no such effect for healthy labelled meals.

3. Concluding Remarks

In this paper, we use a lunch restaurant field experiment to analyze the impact on sales and the market share of a healthy labeled meal from taste improving attributes, and from "nudging". Our analysis concerns both the content of the healthy labeled meal (source of protein – red meat, poultry, seafood or vegetarian, and the fact content), and the content of substitute non-healthy labeled meals. The type of nudging we analyze is order of display on the menu. Prices are held constant in the field experiment and we control for weekdays.

We find that meal attributes of the healthy labeled meal itself has a strong impact on both sales of the healthy labeled meal and its market share: by changing the composition of the healthy labelled meal, sales of the healthy labelled meal may increase by 55 units (where 55 units is equal to 36 percent of average healthy labelled meal sales), and the market share of the healthy labelled meal may increase by 13 percentage points. Meal attributes of non-labelled substitute meals (red meat of poultry) seem to positively impact the number of healthy labeled meals sold, but not to the market share of healthy labeled meals – offering non-labelled meals that contain red meat or poultry therefore seems to positively impact overall sales, including the healthy labeled meal. We find no impact on sales or the market share of the healthy labeled meal from nudging.

Our results imply that food supply focusing on taste of healthy meals may significantly impact healthy food choices. Supplying *tasty* healthy meals may be more efficient in encouraging healthy food choices than any other policy measure, including provision of nutritional information (e.g. menu labeling, etc), which at best has proven to have a mixed impact on consumer food choices (Aron et al., 1995, Perlmutter et al., 1997, Harnack et al., 2008, Harnack and French, 2008, Chu et al., 2009, Downs et al., 2009, Pulos and Leng, 2010, Roberto et al., 2010, Thunström and Nordström, 2011), and food tax reforms (Chouinard et

al., 2007, Powell and Chaloupka, 2009, Nordström and Thunström, 2009, Smed et al., 2007). Correspondingly, if healthy food alternatives are not appealing in taste, nutritional information and food tax reforms are likely to have only a minor impact on healthy food consumption.

For our sample, sales of healthy meals benefit from the same ingredients as regular meals; poultry and red meat (see Thunström and Nordström, 2011). In other words, a successful strategy for increasing healthy meal consumption may be to supply healthy meals that mimic popular regular meals, using cooking techniques and ingredients that reduce the number of calories and nutrients often over consumed (unhealthy fats, salt, sugar. etc). Key is to minimize the taste difference between healthy and less healthy meals.

The large impact on healthy labeled meal sales from meal attribute manipulation that we find in this study is especially encouraging given the context of the field experiment. First, the food analyzed here is prepared lunch meals away from home. Food away from home has been claimed to be one of the main causes of the increase in obesity and overweight (Chou et al., 2004; Binkley, 2006; Rashad et al., 2006), and of meals consumed away from home, lunch meals have been found to have the greatest impact on body weight (Kyureghian et al., 2007). Second, the customer base of the field experiment restaurant consists of consumer groups that generally show less of an interest in healthy eating: primarily male and blue-collar workers.

The food attributes that appeal the most to consumers are likely to be context dependent, though, and may also vary over consumer groups. A question for future research is therefore how healthy meals and other foods (e.g., snacks) can be composed in order to encourage healthy food consumption in different contexts and over consumer groups. The lack of impact found in this study from nudging on healthy labeled meal consumption is somewhat discouraging. Future research may analyze how nudging can be designed to impact healthy labeled meal choices. For instance, does effective nudging require that healthy meal

alternatives are the “default option”, with some search costs associated with finding non-healthy meal alternatives (e.g., turning the menu, or even asking for a menu – see Downs et al., 2009)?

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Tables

Table 1 – Descriptive statistics

Variable	Mean	Std. Dev	Min	Max	No. Obs
Daily portions sold of the healthy labelled meal	152.852	41.544	52	232	27
Daily portions sold in total	349.259	55.318	82	381	27
Daily market share of the healthy labelled meal	0.444	0.108	0.140	0.683	27
Healthy labelled meal characteristics					
Red meat, healthy labelled meal	0.444	0.506	0	1	27
Poultry, healthy labelled meal	0.148	0.362	0	1	27
Seafood, healthy labelled meal	0.370	0.492	0	1	27
Vegetarian, healthy labelled meal	0.074	0.267	0	1	27
1^{st} on menu	0.444	0.506	0	1	27
2^{nd} or 3^{rd} on menu	0.556	0.506	0	1	27
Fat, grams, healthy labelled meal	14.441	3.060	10.2	21.7	27
Substitute (non-healthy labelled) meal characteristics					
Any substitute contains red meat	0.593	0.500	0	1	27
Any substitute contains poultry	0.111	0.320	0	1	27
Any substitute contains seafood	0.296	0.465	0	1	27
Any substitute is vegetarian	0.815	0.396	0	1	27
Weekdays					
Monday	0.222	0.424	0	1	27
Tuesday-Thursday	0.593	0.501	0	1	27
Friday	0.185	0.396	0	1	27

Table 2 – OLS regression results of determinants of healthy labelled meal sales

Variable	coefficient	s.e.	*p*-value
Dependent variable: Portions sold of healthy labelled meal			
Constant	1.834	1.526	0.230
Healthy labelled meal characteristics			
Red meat	32.620***	13.891	0.032
Poultry	55.322***	15.145	0.002
Vegetarian	-75.942**	28.188	0.016
2nd or 3rd on menu	1.754	9.484	0.856
Fat content	6.311***	2.012	0.006
Substitute (non-healthy) meal characteristics			
Red meat	37.706**	14.943	0.023
Poultry	26.843*	14.852	0.090
Vegetarian	11.994	14.823	0.430
Weekdays			
Tuesday-Thursday	-34.653*	17.771	0.069
Friday	-75.357***	16.078	0.000

No of obs: 27, R-squared = 0.8360. *> 0.90 statistical significance, **>0.95 statistical significance, and ***>0.99 statistical significance.

Table 3 – OLS regression results of determinants of the share of healthy labelled meal sales, of total meal sales

Variable	coefficient	s.e.	*p*-value
Dependent variable: Market share of healthy labelled meal			
Constant	0.415***	0.123	0.004
Healthy labelled meal characteristics			
Red meat	0.109**	0.042	0.019
Poultry	0.132**	0.056	0.031
Vegetarian	-0.305***	0.084	0.002
2nd or 3rd on menu	-0.010	0.081	0.904
Fat content	0.007	0.006	0.263
Substitute (non-healthy) meal characteristics			
Red meat	0.022	0.039	0.585
Poultry	-0.042	0.048	0.390
Vegetarian	-0.136**	0.052	0.019
Weekdays			
Tuesday-Thursday	-0.001	0.092	0.992
Friday	-0.012	0.048	0.800

No of obs: 27, Adjusted R-squared = 0.6036. *> 0.90 statistical significance, **>0.95 statistical significance, and ***>0.99 statistical significance.