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The Impact of Calories Labeling Policy in Saudi Arabia: Comparing Physical and Online Channels

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Abstract

The Saudi Food and Drug Authority imposed calories labeling policy on all restaurants and coffee shops, effective January 1st, 2019. This study seeks to measure the impact of this labeling policy on calories consumption behavior in both physical and online ordering channels. We use transactional sales data for one of the largest fast food restaurant chains in Riyadh city. The data spans over two different periods: November 2018 and February 2019. We use total calories per order to measure calories intake. The results of our analysis show no significant impact of calories labeling policy on the level of total calories intake during the month of February, 2019. However, we see slight effect of the labeling policy for those who use online food ordering platforms as it shows a decrease in the total calories per order. Further research and limitations are discussed in this paper.

Keywords: Health Informatics, Online ordering, Delivery platforms, Fast food ordering behavior, Obesity, Calories labeling, Calories intake

Introduction

Despite the fact that calories is a term that is not comprehensively understood or defined correctly by the majority of the general population, and is not even defined correctly by many as a unit of measurement, it remains at the heart of all of conversations related to healthy diets and lifestyle (Papadopoulou 2014). The term "calories intake" is looking into changing eating habits (Tran et al. 2018). Hence, the link is always made between calories consumption and obesity, and healthy life styles. Researchers established that fast food consumption and high calories intake are positively related, which in turn increases the risk of obesity (Bleich et al. 2008). Obesity, which is considered an epidemic in many developed countries, increases the risk of many other diseases (Al-Qahtani 2019; Baeg et al. 2018). Obesity incidences in the world has tripled since 1975, and more than 1.9 billion adults are considered overweight, and more than 650 million of them are obese[1]. Obesity is perceived as a health burden and increases disease and mortality, which notably affects people in Saudi Arabia (Djalalinia et al. 2015). Overweight and obesity have been increasing, and the source of this epidemic is not due to biological alteration, but it is due to environmental factors such as increased habits of eating in fast food restaurants (Rosenheck 2008).

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[1] Obesity and overweight, Key Facts, World Health Organization. Accessed February 16, 2019, from https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

The food and beverage industry was largely impacted by the advancement in technologies and the availability of Internet connectivity and mobile devices for the consumer (Sun and Buijs 2018). One major aspect that drastically evolved is the way consumers interact with restaurants using the Internet, making ordering and consuming food much easier, and gaining more calories intake (de Luna et al. 2019). With recent advancements in the Internet technologies, new services and platforms such as sharing economy platforms have emerged, which utilize individuals as assets in order to share personal belongings to serve other individuals; Uber is a well-known example of sharing economy platforms that provide On-Demand Ride services (Alemi et al. 2018). Similarly, food delivery platforms use smartphone apps to connect customers who are willing to order food delivery from various nearby restaurants, and ordered meals are delivered by freelancer drivers; these delivery platforms have emerged and gained popularity around the world (Dablanc et al. 2017). In Saudi Arabia, delivery platforms are becoming popular with many key players such as HungerStation, Jahez, Uber Eats, Carriage, Talabat, Ngwah, W99l, Swyft, and others. HungerStation, one of the first delivery platforms in Saudi Arabia, delivered more than 100,000 orders in a single day, and it delivered more than 10 million orders since Feb, 2012 (HungerStaion twitter account). Those platforms increased the choices and made it more convenient for the consumer to order food from whatever location, anytime; hence, food consumption habits were altered – mainly increased (Thompson 2015).

To address obesity issues and high food consumption, policy makers impose new legislations to influence consumer eating choices to prevent the risk of obesity. An example of those policies is "mandatory calorie menu labels in fast food restaurants" (Kiszko et al. 2014). In Saudi Arabia, the Saudi Food and drug Authority (SFDA) adopted, published, and enforced the calories labeling policy starting Jan 1st 2019[2]. The policy states that all restaurant and coffee shops must disclose the calories of their selling items on menus, and in all forms, whether physical or online.

The objective of this research, then, is to answer the following two main questions:

a) Has the calories labeling policy changed or influenced consumer behavior of consuming food in relation to how aware they are of calories consumption?
b) Does the channel in which the calories are shown to the consumer impact the consumption in any way (physical vs online)?

Literature Review

Many researchers attempted to measure and estimate the effect of mandatory, or even voluntary, calories labeling on consumer purchasing behavior on adding calories information to menus of restaurants and coffee shops. Bleich et al. (2015) measure the effect of mandatory calories labeling policy on selling items of 66 large chain restaurants in the United Sates; their study measures the difference of the mean calories between 2012 and 2013 on available selling food items (appetizers and sides, main courses, deserts and toping/ingredients) as a reaction to Affordable Care Act (ACA) in 2010, which required large chain restaurants to provide calories information. The data for this study was obtained from the MenuStat project (menustat.org) which includes information about menu items in each of the 100 largest U.S. restaurant chains along with calories information. The result does not show a noticeable effect as the mean calories among items on menus in both 2012 and 2013 did not show significant change. However, large chain restaurants decreased calories in newly introduced menu items. That study, however, did not measure the effect on actual selling items and measure the effect on consumer purchasing behavior.

VanEpps et al. (2016) measure the effect of disclosing the calories information on ordering behavior in three different ways: numeric labeling (number of calories in each food item), traffic light labeling (red for high amount of calories, yellow for medium amount, and green for low amount of calories), and combined labeling (numeric and traffic light). This study is performed on a corporate's employees (249

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[2] SFDA obliges restaurants and cafes to display calories (translated from Arabic), SFDA. Accessed February 16, 2019, from https://www.sfda.gov.sa/ar/food/news/Pages/f5-8-2018a1.aspx

employees) who have their lunch from the corporate's restaurant. The authors designed a website that allowed the employees to order the lunch meal from it. Different groups of employees were having different views (no labeling, numeric labeling, traffic light labeling, and combined labeling). The result of this experiment shows that all labeling technique had a positive impact on reducing the mean total calorie content of the ordered meal, and the traffic light labeling technique has the most effect on reducing the calories intake. This experiment was applied only on lunch meal during weekdays for people who work in the same place.

Elbel et al. (2009) analyze the influence of New York City's labeling mandate on fast food restaurants on low-income people living in New York. The data for this study was collected after the calories labeling mandate through using customers' receipts in New York City who also participated in designed survey by the authors. It also includes two other cities that don't have calories labeling policy. The finding of this study indicates that the percentage of consumers who reported seeing calorie labels and claimed that influenced their food choices was around 25%. However, calories labeling does not actually influencing these people to consume lower calories in reality.

Transactional sales data was used in several studies to measure the effect of calories labeling (Bollinger et al. 2011; Finkelstein et al. 2011; Pulos and Leng 2010). Bollinger et al. (2011) use transactional sales data of Starbucks in three main cities in the United Sates, including 222 locations in New York, 94 locations in Boston and 12 locations in Philadelphia. The duration of the obtained data for this study is 3 months before labeling the calorie information and 11 months after the labeling. Bollinger et al. (2011) examine the impact of the calorie labeling by measuring the difference of mean calories per transaction before and after labeling the calorie information. This study shows that there was a reduction on mean calories per transaction by around 14 percent.

Pulos and Leng (2010) also uses transactional sales data to assess the effect of calorie labeling by using historical transactional data of six full-services restaurants in Pierce County, Washington, United Sates. This study also uses mean calorie as a measure to assess the effect on the calories intake. The obtained data for this study was 30-day before and 30-day after showing the nutrition information of the selling item. They conclude that showing nutrition information on restaurant menus is associated with a reduction in average calorie consumption per meal ordered after labeling of about 15 less calories.

In Washington state in the United States, Finkelstein et al. (2011) measure the impact of mandatory menu labeling on one Mexican fast-food chain restaurant in King County, using difference-in-differences approach. This study uses historical sales data of that restaurant in more than 70 locations. The obtained data are categorized in three group in terms of time durations: pre-period (before the labeling), post-period 1 (immediately after labeling for 7 months), and post-period 2 (7 months after calories labeling for 6 months). This study also uses the mean calorie per transaction to measure the impact. The result of Finkelstein et al. (2011)'s study is that calories labeling has no significant effect on number of calories per transaction for both pre and post periods.

Krieger et al. (2013) examine the effect of menu labeling on mean calories purchased at chain restaurants in King County, Washington in the United States. This study is conducted on 50 sites from 10 different restaurant chains, and the data is obtained through collecting receipts of volunteer customers who also participated in a designed survey by the authors. The time periods for this study were categorized in three periods: 1 to 3 months before the menu labeling, 4 to 6 months after the labeling, and 16 to 18 months after the labeling policy. In their study, there was no significant changes founded for the 6 months after the menu labeling, and the mean calories per order decreased by 38 kcal after 18 months of labeling the menu. Their study concludes that the mean calories per purchased order went down 18 months after labeling the menu in some restaurants among women, but not men.

Swartz et al. (2011) conduct a systematic review of the literature to measure the effect of calories labeling. This review analyzed seven studies published from 2008 to 2011. All the reviewed studies compared calorie ordering in two conditions, which are calorie label versus no calorie label. Only one study reported a significant reduction on calories intake after calories labeling and two studies reported that the calorie label has a slight positive impact on reducing the calorie intake. However other studies reported the lack of influence of calories labeling. The outcome of their comparative study suggests that

the calorie menu labeling doesn't have a true effect, but only a modest effect on calorie ordering and consumption.

While location of neighborhood or the nearby restaurants may restrict consumer choices when ordering food using traditional means, online ordering platforms increase consumer choices, which includes a wide range of both healthy and unhealthy food (Maimaiti et al. 2018). The advancement of the Internet and mobile Apps made this possible as it is evidently presented with the large increase in market share of online ordering platforms during the past decade (Maimaiti et al. 2018). The concern is to understand how consumers behave in response to calories information display on online ordering platforms as compared to traditional ordering platforms. While Chu et al. (2010) indicate many factors that influence online food and grocery ordering behavior including brand, size, and price, it is still challenging to understand whether nutrition information displayed online would have any influence on consumer behavior. In a similar context using self-ordering kiosk, Ham (2019) found that there is a significant relation between nutrition information and consumer satisfaction. More specifically, they found that consumers with higher health consciousness have more regard to nutrition information, and hence are more satisfied. This suggests that displaying nutrition information on online ordering platforms may increase health awareness. However, there is little research on the comparison between online and physical ordering behavior when presenting nutrition information.

The phenomenon of measuring the effect of calorie labeling is a topic of interest for many researchers. While some researchers studied the effect from the restaurants perspective, and how they updated their menu as a reaction to the calorie labelling policy, other studies examine it from consumers' perspective. They examine consumer behavior by measuring the difference of the total calories per order using either transactional sales data, customer surveys, or using orders receipts. The census of researchers seems to agree on the effect of labeling policy that it can effectively alter consumer behavior to reduce calories consumption. However, there is little evidence on whether this labeling policy may affect online ordering behavior in the same (or in a different) way it affects traditional ordering behavior.

Data and Methodology

The data used for this study is from one of the largest fast food chain restaurants in Saudi Arabia. This restaurant opened its first branch on July 2013, and by Feb 2019 it had more than 20 branches, almost all in Riyadh city. The menu of the restaurant offers a variety of burgers, fries, sides, beverages, and ice cream items. Similar to all lunch and dinner restaurants, the opening hours of the restaurant is from 12:00 PM to 2:00 AM every day, with dine-in and take away options. The restaurant doesn't not provide food delivery service by itself, but it contracts with different delivery platform providers. For this study, we use transactional sales data, hosted by a popular cloud POS system in Saudi Arabia that stores all transaction data on a daily basis. The data is time-stamped and contains all details of each order along with the type of ordering channel, whether physical or online (using a service delivery provider).

Data

Two different periods of transactional sales data were obtained: one week prior to the calories labeling policy (Pre: during Dec 2018) and one week post the calories labeling policy (Post: during Feb 2019). Pre and Post transactional sales datasets were obtained in a spreadsheet file format and each dataset has the following data entity:

- Orders: each row represents a single order which may contain more than one item. It contains date, time, branch, and receipt price information. It has an *order id* column which is a unique value for each order (transaction).

- Ordered Items: each row represents a single ordered item name and its quantity. The relationship between Orders and Ordered Items is one-to-many.

- Payments: each row represents the payment method for the transaction. It can be either cash, credit card, or debit card. It also has the delivery platform provider name, which indicates whether the source channel for that order is "online" or "physical" order.

Each of these entities has and *order id* column which is used to join the entities, forming the data for this study. We excluded orders that contain special offers to eliminate effects of those special offers on calories intake. The menu items are categorized into four groups: (1) burgers, including eight different type of burgers, (2) fries, with eight different sub-items, (3) beverages, with nine items, and (4) extras, with seven sub-items. Calories information for each item were obtained from the restaurant's website and added to the dataset to have the total calories for each order. Using calorie amount for each item, the total calories for each menu category per order was calculated. Some beverage items have zero calorie like water and diet sodas. Table 1 provides a summary of the calories information and ranges for the restaurant menu.

Table 1. Range of Calorie Amounts for Menu Categories

Menu Category	Number of items	Min & Max Calories	Range
Burgers	8	361 to 779	418
Fries	8	325 to 519	194
Beverages	9	0 to 411	411
Extras	7	70 to 355	285

The quantity and total calories for each menu category were calculated separately and added to the dataset. We categorize orders according to the time of order to either lunch (from 12:00 PM to 06:59 PM) or dinner (from 07:00 PM to 02:00 AM). We also label orders whether they fall during weekends in Saudi Arabia (Fridays and Saturdays). The locations of the restaurant' branches were categorized being central, north, south, west or east of Riyadh city. As we emphasize on the effect of the calories intake for physical and online channels, we label orders accordingly, in both pre and post the calorie labeling policy. Table 2 shows the number of orders in each ordering channel and period.

Table 2. Number of Orders in Physical and Online Orders

Channel	Pre Labeling	Post Labeling	Total
Physical	21,049	20,570	41,619
Online	2,226	3,919	6,145
Total	23,275	24,479	47,764

Measurements

To examine the effect of the calories labeling policy and to compare its effect on physical ordering versus online ordering, the dataset was categorized in two time periods, before the calories labeling policy (Pre) and after the labeling policy (Post). The dataset was also categorized according to the source of the ordering channel: physical or online. Differences in average calories per order among these different categories was used as a measure to analyze the impact. Control variables like order time (lunch/dinner), day type (weekend/weekday), and location of the restaurant were used in the analysis. To eliminate the possible bias in data, we only included orders that have one or two Burger items, with up to one Beverage item, and up to two Fries items. We do this to increase the confidence that each order was for one person. We use OLS regression model to measure the impact of calories labeling policy intervention and ordering channel sources. All other variables are used as control variables, and the total calories per order is the dependent variable. Three approaches were used in the regression models: (1) using the entire data for both ordering channels along with all control variables, (2) using data for only physical orders, and (3) using data for only online orders. In all approaches, we use a base model including all variables, and then the full model that includes the labeling policy flag. We do this

to examine the impact of the labeling variable on the average calories per order, and to ensure model stability.

The regression model used for the estimation is in the following general form:

$$Y_{Cal} = \beta_0 + \beta_1 * Price + \beta_2 * Dinner + \beta_3 * Weekend + \beta_4 * Central +$$
$$\beta_5 * East + \beta_6 * West + \beta_7 * South + \beta_8 * Online + \beta_9 * Labeling + \varepsilon,$$

where Y_{Cal}, the total calories per order, is the dependent variable. We use the following independent variables: standardized price of the meals (the mean is 0 and the standard deviation is 1), dinner flag (1 for dinner time and 0 for lunch time), weekend flag (1 for orders during the weekend and 0 for weekdays orders), branch location flags (North is used as a reference category), online flag (1 for online and 0 for physical orders), labeling flag (1 for post calorie labeling policy and 0 for pre). We further examine the effect on specific category items using the same model above, with the dependent variables being $Y_{Burger\ Cal}$, $Y_{Fries\ Cal}$, $Y_{Beverage\ Cal}$ and $Y_{Extra\ Cal}$.

Results

The first step in our analysis is to examine the average calories per order at different settings. In Table 3, we show average calories per order according to the ordering channel (physical and online), and before and after the labeling policy for different food categories. These indicators only show the average level of calories consumption per order according to the channel and time period, and the control variables are not considered at this stage. Therefore, the results do not estimate or measure the true effect of ordering channel or labeling policy. However, the effect is estimated using regression models which are presented later in the results.

Generally, we notice that the labeling policy (Table 3) has no desired influence on the level of total calories per order. In fact, we see that the average calories per order has slightly increased in almost all settings. For example, we notice that after the labeling policy, the average calories per meal (first row) increased by 1.2% in all physical orders (from 1221 kcal to 1236 kcal), and increased by 6.8% in all online orders (from 1349 kcal to 1434). However, the average calories per order for menu categories such as Fries and Beverage items have slightly decreased in physical orders.

For online orders, the average calories generally increased except for Beverage items, which has slightly decreased by 14 kcal. What is also noticeable is that the average calories per order for online orders is generally higher than physical orders (10% before the calories labeling policy and 16% after that). This might be due to the convenience of online ordering where customers generally have more time to go over menu items and choose more items compared to the physical ordering setting.

Table 3. Average Calories per Order for Different Menu Categories

Average calories per each order (Category)	Physical			Online		
	Pre Labeling	Post Labeling	Difference	Pre Labeling	Post Labeling	Difference
Per Order	1221.0	1235.8	-14.8	1349.2	1433.9	-84.7
Burgers only	643.1	668.2	-25.1	707.4	764.6	-57.2
Fries only	362.4	354.7	7.7	419.0	437.4	-18.4
Beverages only	144.2	141.0	3.2	105.3	91.2	14.1
Extras only	71.4	72.0	-0.6	117.4	140.8	-23.4

The next step is to test the effect of the labeling policy on the level of calories intake using OLS regression models. These models are used to estimate the effects after controlling for all other variables available for this study. We first use the model for orders in both channels. The results of the regression model are shown in Table 4. The model is seen to be consistent after entering the "labeling" variable into the model (full model) with high level of R^2, as the model explain 85% of the changes in calories per order.

What is important to state from the results is that after controlling for price, location, ordering time, weekends, and channel, the level of calories per order has a small increase due to the labeling policy. This indicates that the labeling policy has no notable effect during that period of time. However, orders from the online channel are significantly decreased by an average of about 247 kcal.

Other results from the model are worth noting such that orders during dinner time and during weekends are less in their total calories compared to other times.

Table 4. Regression Model to Estimate Total Calories per Order for both Channels

	Base Model				Full Model			
	β	Std. Error	Std. β	t	β	Std. Error	Std. β	t
(Constant)	1288.67*	1.50		860.26	1285.85*	1.68		767.09
Price	396.37*	0.79	0.97	504.79	396.29*	0.79	0.97	504.62
Dinner	-4.26*	1.48	-0.01	-2.88	-4.05*	1.48	0.00	-2.74
Weekend	-4.48*	1.64	0.00	-2.73	-4.47*	1.64	0.00	-2.73
Location								
Central	5.26*	2.51	0.00	2.10	4.89	2.51	0.00	1.95
East	-2.31	1.89	0.00	-1.22	-2.23	1.89	0.00	-1.18
West	-8.68*	2.42	-0.01	-3.59	-8.67*	2.42	-0.01	-3.58
South	-12.74*	2.26	-0.01	-5.63	-12.72*	2.26	-0.01	-5.63
Online	-246.58*	2.35	-0.20	-104.79	-247.27*	2.36	-0.20	-104.78
Labeling					**5.54***	1.48	0.01	3.75
R^2 (Adjusted)	0.85				0.85			

N: 47,763, * Significant (p < 0.05)

When examining the effect of the policy for the physical and online channels separately, we run the same regression model on two different sets of the data: one containing physical orders only and one for online orders only. The results of the regression models are shown in Tables 5 and 6. The results of both models seem to be consistent after including the labeling variable, with explaining power of %85 and 84%, for physical and online channels respectively. While price has the highest influence on the total calories per order for both channels, we note that for online orders, calories per order are invariant to time and location for the online channel.

Table 5. Regression Model to Estimate Total Calories per Order for Physical Channel

	Base Model				Full Model			
	β	Std. Error	Std. β	t	β	Std. Error	Std. β	t
(Constant)	1234.00*	1.50		823.19	1231.12*	1.68		732.49
Price	364.13*	0.75	0.92	483.86	364.09*	0.75	0.92	483.85
Dinner	-4.92*	1.52	-0.01	-3.25	-4.74*	1.52	-0.01	-3.12
Weekend	-0.58	1.67	0.00	-0.35	-0.60	1.67	0.00	-0.36
Location								
Central	7.40*	2.62	0.01	2.82	6.86*	2.63	0.01	2.61
East	-3.20	1.92	0.00	-1.67	-3.11	1.92	0.00	-1.62
West	-10.67*	2.51	-0.01	-4.25	-10.58*	2.51	-0.01	-4.22
South	-13.60*	2.35	-0.01	-5.80	-13.58*	2.34	-0.01	-5.79
Labeling					**5.70***	1.51	0.01	3.78
R^2 (Adjusted)	0.85				0.85			

N: 41618, * Significant ($p < 0.05$)

Table 6. Regression Model to Estimate Total Calories per Order for Online Channel

	Base Model				Full Model			
	β	Std. Error	Std. β	t	β	Std. Error	Std. β	t
(Constant)	1403.85*	4.79		292.82	1395.00*	5.81		239.98
Price	418.52*	2.35	0.92	178.01	417.96*	2.36	0.92	177.17
Dinner	-0.28	4.67	0.00	-0.06	0.66	4.68	0.00	0.14
Weekend	-2.85	5.37	0.00	-0.53	-2.44	5.37	0.00	-0.45
Location								
Central	-1.02	7.12	0.00	-0.14	-0.02	7.12	0.00	0.00
East	5.61	6.74	0.00	0.83	5.54	6.74	0.00	0.82
West	3.00	7.21	0.00	0.42	2.09	7.22	0.00	0.29
South	-5.80	6.72	0.00	-0.86	-5.73	6.72	0.00	-0.85
Labeling					**13.05***	4.85	0.01	2.69
R^2 (Adjusted)	0.84				0.84			

N: 6144, * Significant ($p < 0.05$)

In order to analyze the impact of the labeling policy and the channel of orders on total calories for different food categories, we re-run separate regression models for each category, and the results are shown in Table 7. What we notice from the results of these models is that the effect of the policy is different across categories; the effect is positive on Burgers, but it is negative on Fries and Beverages. In addition, we note that for these categories, there is a significant decrease for all food categories in

orders from Online channel. While the average decrease of calories in online channel is about 20%, Beverages decrease by 50%, and Fries by only 8%.

Table 7. Regression Models to Estimate Total Calories for Each Menu Category per Order

	Dependent Variables (Total Calories)				
	Per Meal (β)	Burger (β)	Fries (β)	Beverage (β)	Extra (β)
(Constant)	1285.85*	671.10*	375.63*	147.94*	91.18*
Price	396.29*	194.88*	99.87*	26.02*	75.53*
Dinner	-4.05*	8.32*	3.09	-9.14*	-6.33
Weekend	-4.47*	1.01	-1.85	-2.01	-1.63*
Location					
Central	4.89	-0.09	7.26*	5.99*	-8.28*
East	-2.23*	-1.14	-4.27	5.28*	-2.11
West	-8.67*	-5.92*	5.52	8.43*	-16.69*
South	-12.72*	-14.53*	-0.42	18.36*	-16.14*
Online	**-247.27***	**-121.09***	**-33.65***	**-74.11***	**-18.42***
Labeling	**5.54***	**20.72***	**-9.07***	**-5.99***	**-0.13**
R^2 (Adjusted)	0.85	0.54	0.21	0.07	0.25
Percent decrease in Online channel**	**19.23%**	**18.04%**	**8.96%**	**50.1%**	**20.2%**

N: 47763, * Significant ($p < 0.05$), **Percent decrease for Online channel is calculated with respect to the constant for each food category.

Discussion

This study is conducted to investigate the calories intake phenomenon in a fast restaurant in Riyadh city after the intervention of calorie labeling policy, comparing its impact in physical and online ordering channels. Generally, the results for this study show no notable impact of calorie labeling policy on the average total calories per meal one month after the policy was in effect in Saudi Arabia. We see no notable effect in neither physical nor online ordering channel. In contrast to the desire of the policy maker, the average total calories per order did not decrease but it showed a non-significant increase of the total calories per order in both ordering channels. However, when examining the effect of the policy on food categories, our analysis shows a slight decrease in average calories for Beverages. This might be due to the increasing attention to the beverages calories content (water or diet soda having zero calories compared to other beverages), where customers tend to sacrifice their beverage choice, but not the other menu categories.

To achieve the desired effect of the imposed calories labeling policy on reducing calories intake, it requires more time for people to start considering the labeling information on their decision for food ordering (Krieger et al. 2013). Our data was for one month after the calories labeling policy; therefore, it is possible that people might reduce the calories intake for the early days of imposing the policy (a shock effect), then they returned to their previous ordering behavior with slightly increase in calories content as reaction.

Our results show that orders from the online channel have lower total calories per order compared to orders of physical channel, after controlling for price, time, and location. Although the average total calories per order in online orders is higher than physical orders, the results of the regression models show that using online channel for orders has a significant impact on reducing the total calories per order by around 247 kcal. Since the average price of online orders is generally higher than physical

orders by an average of %38 (regardless of the calories labeling policy), people tend to spend more in online orders probably because there is a fix fee for order delivery (delivery fees are not included in the order price), and they may want to compensate the delivery fees with more quantities. These price differences are shown in Table 8.

Table 8. Percentage Increase of Prices for Online and Physical Orders

Time periods	Before Calorie Labeling	After Calorie Labeling	All periods
Percentages of Price increasing on Online orders	34%	41%	38%

Calories information in the online delivery platforms is labeled along with product pictures, product names, and price using the same font size. Therefore, viewing menu item information from different restaurants in online delivery platforms is almost consistent, unlike the way this information is presented in physical stores. Product information tend to vary from one branch to another depending on the store layout. Therefore, it is possible that the consistency of viewing product information on online delivery platforms have an impact on reducing the total calories per order.

The Communication and Information Technology Commission (CITC) in Saudi Arabia requires all online (electronic commerce) providers to register with CITC website to be informed on legislations and regulations relevant to their line of business, including online delivery platforms, which became more popular in Saudi Arabia[3]. CITC with other legislation entities should standardized the calories labeling formant in online delivery platforms to be more effective in enacting calories labeling policy. CITC may also consider the requirement of having filtering features on the platforms that allow the user to filter the available food items based on specific calories range, or using other methods such as traffic light approach for the labeling, which is more effective than numeric labeling for digital ordering platforms (VanEpps et al. 2016).

The differences of calories consumption in physical and online ordering channels raise some concerns about how policies should be imposed for businesses that follow multichannel strategy. Consumer expectations with businesses that use digital channels, especially restaurants in our case, are higher as they expect to interact with the business (restaurant) with no respect to time and location (Hansen and Sia 2015). Hence, it is important for businesses to realize how customer experience across multichannel are different (Park and Lee 2017), and restaurants are no exception of this expected behavior. As our results show that online channel ordering is significantly different from physical ordering behavior, policy makers should review specific elements of the policy to account for restaurants that follow multichannel strategy. This is to ensure that the policy is effective in all possible channels, and to account for customer expected behavior across channels.

While our study shows preliminary results of the impact of the calories labeling policy in Saudi Arabia, and reveals important distinctions between physical and online channels, it has some limitations. Our study analyzes transactional sales data for a single fast restaurant (Burgers focused); therefore, the type of this restaurant's customers might not be paying great attention to the labeling information. Furthermore, the time duration of the data is only one week before the calorie labeling policy and one week after that, which might not provide greater insights on calories intake behavior. Hence, this study is considered an early assessment of the imposed calories labeling policy. The true effect of this policy may require more time periods.

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[3] Invitation to Delivery Platform Providers to Register to CITC Website (translated from Arabic), Communication and Information Technology Commission (CITC). Accessed February 17, 2019, from https://www.citc.gov.sa/ar/mediacenter/pressreleases/Pages/2019042301.aspx

Future studies should be undertaken using longer time periods using different types of restaurants. Since people perceive calories differently, it might be useful to measure the level of knowledge using data such as demographics, which may reveal new insights on the effects of the policy.

Conclusion

The results of this study provide little evidence for the effectiveness of the calories labeling policy in Saudi Arabia, which was imposed on the first day of 2019. These results can be seen on both ordering channels, physical and online. Even though the policy is inclusive of all delivery channels, not all online platforms adhere to the calories labeling policy; therefore, policy makers should exert more effort on achieving proper compliance of the labeling policy among all ordering channel. To examine whether or not the policy has achieved the desired outcome, future studies should be conducted to identify the circumstances under which calories labeling is likely be more effective in all ordering channels. Furthermore, public health policy makers are encouraged to use data from delivery platforms and to utilize it to examine their intervention policies.

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