Boiled Pumpkin as a Nudge: Evidence from a University Cafeteria

Shunichiro Oka, Shoko Yamane, and Naohiro Matsumura

Sumitomo Mitsui Banking Corporation; Faculty of Economics, Kinki University; Graduate School of Economics, Osaka University
syamane@kindai.ac.jp

Abstract

This study aims to improve the dietary habits of university students by planting an easy choice.First, we captured the dietary habits of university students by analyzing their purchasing behavior with the data from their meal cards (a prepaid food voucher). As a result of analysis, we found that the dietary habits of meal card users are unbalanced and have many areas for improvement. we also found that the students aimed to spend the full daily allowance on their meal cards: the average value of the daily spending amount divided by the upper limit is 0.998. Building on this tendency, we conducted an experiment in which boiled pumpkin was placed on the counter with the rice bowl dishes in the university cafeteria. We aimed to offer this small "Shikake," boiled pumpkin, as an alternative to a large portion of rice to improve the students' diet. Our experiment showed that the dietary behaviors of students could be improved easily by a simple Shikake.

Introduction

In Japan, entering a university drastically changes students' dietary habits because many of them begin living on their own. A survey conducted by the Dietary Education Promotion Office of the Cabinet Office (2009) found that only 48.6% of university students who live on their own eat breakfast almost every day. The percentage of eating breakfast is 61.1% among all university students, and the percentage among junior high school students is 83.6%. Therefore, living on their own at a university changes students' dietary habits.

In recent years, adult diseases, including heart disease, stroke, high bold pressure and obesity, have become important issues. Adult diseases are defined as the group of diseases that are caused by dietary habits, exercise habits, and living habits, including smoking and drinking. Therefore, to prevent adult diseases and maintain good health, it is very important to improve students' dietary habits.

There have been many studies conducted to improve dietary habits, but only a few studies have succeeded in improving dietary habits. An experimental study conducted in a cafeteria in the Netherlands (Vyth et al., 2011) placed a logo on the corner of foods that met the International Dietary Guidelines and examined whether the logo influenced the sales of these foods. During the experiment, the sales of fruit increased significantly because of the logo. However, the study also found that the subjects' health consciousness did not change. Freedman and Connors (2010) placed slogans, such as "fuel your life," on shelves with healthy foods and displayed an "Eat Smart Campaign" poster in the window of a convenience store at a university. They found that the sales of healthy foods did not increase significantly in response to the slogans and the poster. Sutherland et al. (2010) indicated the nutritional value of foods with stars in the supermarket, but again, there was no significant increase in the sales of these foods. However, Vyth et al. (2010) implied that only people who are highly health consciousness and worry about their weight change their food selections based on labels that indicate healthy foods. Milich et al. (1976) investigated the dietary habits of women who commonly used a hospital cafeteria. They found that caloric intake decreased significantly when the calorie content of foods was shown.

In contrast, price is a major factor that determines the selection of foods. French et al. (2001) examined the sales of snacks from vending machines and showed that discounting has a greater effect than labeling on the sales of low-fat snacks. Hannan et al. (2002) conducted an experiment in a high school in the United States. During the experiment, they raised the prices of three of the most popular high-fat foods by 10% and reduced the prices of four low-fat foods by 25%. As a result, the sales of low-fat foods increased when they were discounted. However, it is difficult for stores to discount constantly. Indeed, discounting cannot change consumers' long-term dietary habits and health consciousness.

Meal cards can solve above problem. A meal card is a prepaid food voucher that makes it possible to eat in participating restaurants at a university until the limit is reached. Users can choose their daily upper limit: 500 yen, 800 yen, 1000 yen, or 1200 yen (1 yen = approximately

0.01 dollars). Meal cards have two advantages for both students and participating restaurants. First, it prevents dietary disruptions when students are low in funds because the meal card operates on a prepaid system. Second, meal card users intend to spend the full daily amount so that they do not incur any losses. This intent can encourage users to buy more, as if the restaurant offered a discount.

This study has three purposes. We examined the purchasing records in the school cafeteria to determine the influence of meal cards on students' dietary behavior and suggest ways to improve students' dietary habits. Next, we tested the efficacy of the suggested intervention using an experiment.

Current usage of "Meal-cards"

Data

In this section, we describe the usage of meal cards based on the purchase records from the school cafeteria of Osaka University. We collected the meal card data between December 1 and December 28 in 2011. Our data includes the purchasing behavior of 1513 students (1321 male and 192 female). Of the students, 919 set their upper limit at 500 yen, 310 students set the limit at 800 yen, 276 students chose 1000 yen, and 8 students chose 1200 yen. Each individual was identified by an eight-digit code, and the individual information included only sex and the selected spending limit. Each purchase record includes the name of the cafeteria, the date, the quantity of items purchased, the price, and nutritional information. The nutritional information for foods includes calories, salt content, and nutritional balance. Nutritional balance is assessed using the "three food group point method." The three food group point method categorizes foods into three groups and calculates a score for each group. The three groups are red (including protein, calcium, and vitamin B1), green (including vitamins, minerals, and dietary fiber), and yellow (including carbohydrates and fat), and ideal nutritional values have been published. This method is often used in the co-op restaurants of universities in Japan. These values are described on the menu and on the receipt.

Descriptive statistics

First, we present the descriptive statistics regarding the usage of the meal cards. On average, the meal card users purchase 2.69 items (SD = 1.53) and pay 428.78 yen (SD = 169,91) per meal and pay 651.25 yen (SD = 211.35) per day. Figure 1 shows the distribution of daily spending. The distribution has three peaks at 500 yen, 800 yen, and 1000 yen, which represent the upper limits of the meal card. The average value of the daily spending amount divided by the upper limit is 0.998. Thus, we found that the students using meal cards spend almost all of their prepaid money.

The average serving includes the following nutritional characteristics: 635.57 kcal, 1.77 red items (including protein, calcium, and vitamin B1), 0.27 green items (including vitamins, minerals, and dietary fiber), 5.89 yellow items (including carbohydrates and fat), and 3.24 g salt. The recommended nutritional values for each serving are 2000 kcal for male adults, 1600 kcal for female adults, 2 red items, 1 green item, 3 to 6 yellow items, and less than 10 g salt. Thus, the dietary habits of the meal card users are unbalanced and have many areas for improvement.

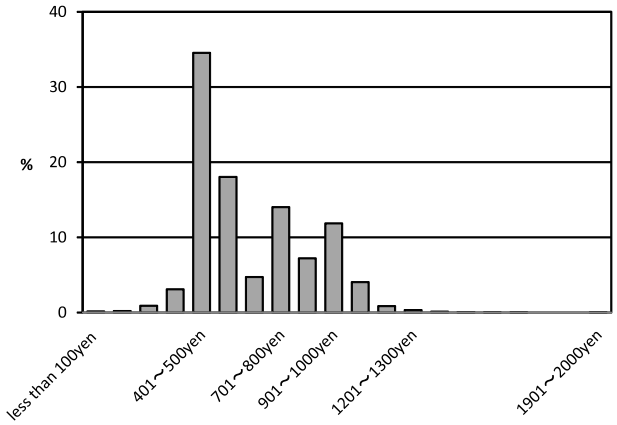

Figure 1. Distribution of the daily spending amount.

The dietary habits of the meal card users

Of all the meals purchased, 22.56% (5835 meals) exactly matched the user's upper limit. We found that most users want to spend their full daily amount. Table 1 presents the top ten foods in the university cafeteria. The left column shows the top items among the users who spent exactly their daily allowance, and the right column reflects the users who did not spend the full amount. Miso soup, rice, and juice boxes are popular among both groups, but a large portion of rice ranked in the top ten purchases only among the users who exactly spent their daily allowance. Among the users who spent their full daily allowance, 9.1% of their meals included a large portion of rice, whereas a large portion of rice was consumed by only 1.6% of the users who left money unspent. A large portion of rice costs 50 yen, and it is associated with rice bowl dishes. Most rice bowl dishes are 450 yen, and the cost becomes 500 yen if students choose a large portion of rice. We consider that the students might purchase a large portion of rice to spend down their prepaid money.

A large portion of rice makes students' diets unbalanced. For example, the top selling menu item is "Tenshin-Mapo don," which is a Chinese-Japanese dish consisting of

Mapo-tofu in an omelet on rice. The nutritional information for Tenshin-Mapo don with and without a large portion of rice is shown in Table 2. A serving of Tenshin-Mapo don has 1294 kilocalories, which increases to 1454 kilocalories with a large portion of rice. Furthermore, Tenshin-Mapo don has 6 red points, 0.1 green points, 10.1 yellow points, and 8.9 g salt. It substantially exceeds the standard nutritional values per meal and has too few vegetables. A large portion of rice further impairs the nutritional balance, increasing the number of yellow points from 10.1 to 12.1. If the students eat some vegetables but Tenshin-Mapo don with extra rice, the nutritional balance of the dish is better.

Table 1. Top ten foods in the university cafeteria.

among the users who spent exactly their daily allowance		among the users who did not spend the full their daily allowance	
Miso soup	1018 (17.45)	Miso soup	4265 (21.3)
Rice (medium size)	1012 (17.34)	Rice (medium size)	4060 (20.27)
Juice box	862 (14.77)	Salad bar	3524 (17.6)
Rice (small size)	599 (10.27)	Juice box	3444 (17.2)
Cold tofu	595 (10.2)	Rice (small size)	2256 (11.26)
A large portion of rice	533 (9.13)	Bottled tea	2230 (11.13)
Tenshin-Mapo don	528 (9.05)	Fried chicken	1368 (6.83)
Healthy salad	405 (6.94)	Side dish	1273 (6.36)
Rice (large size)	403 (6.91)	Tenshin-Mapo don	1137 (5.68)
Fried chiken	376 (6.44)	Rice (large size)	1116 (5.57)
All	5835	All	20028

Note: Percentages are in parentheses.

Table 2. Nutritional information for Tenshin-Mapo don.

	Tenshin-Mapo don	Tenshin-Mapo don with an extra-rice	Tenshin-Mapo don with a boiled pumpkin
Amount (yen)	450	500	500
Calories (kcal)	1294.1	1454.3	1361.1
Red (points)	6	6	6
Yellow (points)	10.1	12.1	10.4
Green (points)	0.1	0.1	0.6
Salt (g)	8.9	8.9	10.7

Experiment

The purpose of the experiment

In section 2, we found that the students aimed to spend the full daily allowance on their meal cards. Building on this tendency, we conducted an experiment in which boiled pumpkin was placed on the counter with the rice bowl dishes in the school cafeteria. We aimed to offer this small "Shikake". Matsumura (2012) defined Shikake as “a Japanese word that represents physical and/or psychological mechanism that triggers implicit or explicit behavior change to solve problems.” In this study, boiled pumpkins work as a Shikake. We purpose to boiled pumpkin as an alternative to a large portion of rice to improve the students' diet.

The right column of Table 2 presents the nutritional information for Tenshin-Mapo don with boiled pumpkin. Compared to the nutritional value of the dish with a large portion of rice, most nutritional values are improved with the pumpkin, although the salt content increases slightly. If the sales of boiled pumpkin increase significantly and the sales of the large portions of rice decrease during the experiment, we can say that we succeeded in improving the dietary habits of university students.

Experimental method

The experiment was conducted from December 16 to December 22, 2011 in the cafeteria under the library of Osaka University. We created an extra space for the boiled pumpkin in the corner of the bar where the rice bowl dishes were sold. The students can purchase Tenshin-Mapo don, Tenshindon, Chukadon or Tenshin curry rice in the corner with the rice bowl dishes. The students order their dish from the cook and receive it over the bar. If a student wants extra rice, he orders it at the same time. Next, the students pay at the register. There are some side dishes on the bar, but the boiled pumpkin is not usually displayed there. Figure 2 is a photo of the corner where the rice bowl dishes are sold.

Figure 2. Photo of the corner with the rice bowl dishes.

Result of the experiment

During the experiment, 664 servings of the 450-yen bowl dishes were sold, and 1816 servings were sold outside of the experiment. There were 444 servings of Tenshin-Mapo don purchased during the experiment and 1219 servings purchased outside of the experiment. In this section, we used only the records that included 450-yen bowl dishes to investigate the effects of the boiled pumpkin. There were 42 servings of boiled pumpkin purchased in the experiment and 64 servings purchased outside of the experiment. The sales of boiled pumpkin increased significantly at the 1% level during the experiment ($t(2478) = -3.058$, $p = .002$) . There were 191 servings of extra rice sold during the experiment. In contrast, 577 servings of extra rice were purchased in the period outside of the experiment. There was no significant difference between the pre- and post-experiment periods. Therefore, we found that boiled pumpkin was not an alternative to the extra rice, although the sales of boiled pumpkin increased during the experiment. One cause of this result could be that the users who usually purchase extra rice also selected the boiled pumpkin. To examine this hypothesis, we limited the sampling to the meals that included extra rice. However, the sales of boiled pumpkin before and after the experiment were not significantly different ($t(481) = -0.158$, n.s.). In addition, the average amount spent was 559.66 yen in the experiment and 562.25 yen during the non-experimental period; there was no significant difference in spending ($t(2478) = 0.453$, n.s.). It seems that boiled pumpkin was not an additional purchase; it may be considered as an alternative to some foods.

We investigated the changes in the sales of juice boxes and the salad bar, which are commonly purchased with 450-yen bowl dishes. There were no significant differences in the sales of juice boxes ($t(1661) = 0.559$, n.s.) or the salad bar ($t(1661) = -0.246$, n.s.). Thus, it is possible that the boiled pumpkin was substituted for a variety of side dishes, not only one dish.

Next, we examined the relationship between the boiled pumpkin and extra rice using logit estimation. We used the purchase records that included 450-yen bowl dishes throughout the entire period. Table 3 represents the results of the estimation. The dependent variable is the indicator variable, which takes 1 for an extra-rice and 0 otherwise. The left column shows the results using only the indicator variable for boiled pumpkin as the explanatory variable. The results of the extended model, which includes the cross term of the boiled pumpkin and a dummy variable for the experimental period, are shown in the middle column. The results that include the upper limits of the meal cards are shown in the right column in Table 3. In all specifications, the indicator variable for the boiled pumpkin is significantly negative, although the cross term is not significant. Thus, the extra rice and the boiled pumpkin are alternatives. Using regression analysis, we found that the boiled pumpkin could reduce the consumption of extra rice.

Table 3. Result of logit estimation.

	Model 1	Model 2	Model 3
Pumpkin	-2.353	-1.986	-2.096
	[0.000]**	[0.007]**	[0.004]**
Pumpkin * Experimental period		-0.504	-0.461
		[0.688]	[0.714]
Upper limit			-0.001
			[0.000]**
Constant	-0.675	-0.688	0.164
	[0.000]**	[0.000]**	[0.375]
Observations	1663	1491	1491

Note: ** 1%, * 5% significance. P value is shown in bracket. Dependent variable is the indicator variable of an extra-rice, which takes 1 for an extra-rice and 0 otherwise. The variable “Pumpkin” is the indicator variable which takes 1 when the user purchases the boiled pumpkin. The variable “Pumpkin * Experimental period” is the cross term of the boiled pumpkin and a dummy variable for the experimental period. “Upper limit” is the upper limit of the user’s meal-card.

Discussion

This study aims to improve the dietary habits of university students by planting an easy choice. First, we captured the dietary habits of university students by analyzing their purchasing behavior with the data from their meal cards. As a result of this analysis, we found that the dietary habits of meal card users are unbalanced and have many areas for improvement. We also found that the students spend almost all of their prepaid money on their meal cards. Building on this tendency, we conducted an experiment in which boiled pumpkin was placed on the counter with the rice bowl dishes in the university cafeteria. We aimed to offer this small "Shikake," boiled pumpkin, as an alternative to a large portion of rice to improve the students' diet. During the experiment, the sales of boiled pumpkin increased significantly. However, the sales of large portions of rice did not decrease. The increase in the sales of boiled pumpkin might have occurred because more pumpkin was available and highly accessible on the counter. Our experiment showed that the dietary behaviors of students could be improved easily by a simple Shikake, such as expanding the number of healthy foods on the counter or adding new 50-yen items.

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