Effect of Descriptive Labels on Unpopular Dishes

W241 - Summer 2021 Field Experiment

Lina Sheremet, Navya Sandadi, Shwetha Chitta Nagaraj, Vaishali Khandelwal

Abstract

Customers prefer to order their favorite or familiar dishes at a restaurant over dishes they haven't tried or heard. At the same time, restaurants are working hard to boost sales, especially of their least ordered dishes which they think have the potential to be popular. A previous experiment run at a university cafeteria,[1] showed that the menu is the main driving force behind sales, and having descriptive menu labels for selected popular dishes (example:"Tender Grilled Chicken" vs "Grilled Chicken"), improved sales by 27%. Can we see a similar effect on unpopular dishes and can the effect be translated to a restaurant menu?

To answer the questions, we ran a single-blinded experiment at an Indian restaurant in Morrisville, North Carolina, United States. A list of 13 items or treatment dishes were identified from the restaurant's menu that were less popular than other dishes and assigned descriptive labels through a pre-experiment survey. Some of the dishes received a label that describes the origin of the dish (ex: "Hyderabadi" Paalak Paneer vs Paalak Paneer), others a more sensory name ("Crispy" Gobi 65 vs Gobi 65) and the rest a tradition-based name ("Nawabi" Baingan Masala vs. Eggplant Masala). A new version of the menu was drafted with these newly labeled dishes replacing the existing labels. After 2 weeks of the experiment on 120 dine-in guest parties, we found that the parties that got a menu with the descriptive labels tended to spend an average of $12.80 more on those newly labeled items than those who did not, averaging to about 1 extra item per group (p-value < 0.001). In addition, we observed a heterogeneous treatment effect in sales between the kind of descriptive labels used. "Tradition-based" descriptive names resulted in a 0.45 increase (p-value < 0.001) in the number of dishes ordered per group, "sensory-based" led to a 0.30 increase (p-value < 0.001), and "location-based" led to a 0.17 (p-value < 0.001) increase in the number of items ordered. The increased sales of these unpopular dishes with descriptive labels did not have an impact on the sales of the restaurant's popular dishes.

Background and Prior Research

A 6-week controlled field experiment was done in 2002 by Brian Wansink et al[2]. Over 140 customers at a university cafeteria concluded that using descriptive labels in a menu improved sales by 27% (p-value < 0.05). Another 6-week field experiment over 140 customers done in 2005, by the same authors[3], found that customers who ate foods with descriptive menu names (like "Tender Grilled Chicken", "Grandma's Cajun red beans and Rice") generated a larger number of positive comments about the food and rated it as more appealing and tasty than those eating regularly-named counterparts (like "Grilled Chicken", "Cajun Red Beans with Rice"). They selected 6 products offered by the cafeteria that were popular enough to be offered twice a week and gave them descriptive names. Over the course of the 6 week period, they alternated which items had the descriptive names and evaluated subject satisfaction with questionnaires asking different questions related to how much they liked the food on a 9-point likert scale. An ANOVA test was conducted and found that more descriptive names were viewed as more appealing ($p < .01$) and tastier ($p < .01$). The authors explain that the name of a dish on the menu provides an important cue to customers. They provide a meaning to this cue based on the previously acquired knowledge they have of the dish like taste, the region it is from, the number of calories. When they are given descriptive labels, further associations about the descriptive label are triggered based on their knowledge from memory. Then the customers would draw a mental map to link the menu item they are considering with the corresponding descriptive label. How well both associations match will determine if they would order the dish or not. These descriptive labels can be categorized as geographic labels (Italian, Schezwan, Cajun), affective labels ("Uncle Ben's" or "Grandma's"), sensory labels ("crunchy", "sizzling") or a mix. While choosing a descriptive label, it is important that dishes are of reasonably high quality to see a positive effect on customers' taste and expectation. Such an effect can result in a chain reaction of positive attitudes and outcomes we are measuring like sales of such dishes, and customers' attitude towards the restaurant and also their intent to return.

The above studies influenced further research on descriptive labels using culture by N Guéguen, C Jacob - Food quality and preference, 2012[4]. They found labels that triggered memories of family, tradition and patriotism were associated with higher sales. The experiment was conducted amongst 1838 patrons of a restaurant in Brittany, France, over a period of 8 weeks; six days per week during lunch and dinner settings. Different categories of descriptive labels were used for the second most popular dish under each of salad, dish and dessert categories resulting in four different versions of the menu. The experiment showed that there were more orders from menus with affective, traditional and patriotic labels with a significant effect (p-value < 0.001) as compared to menu with 'usual' labels, with 'affective' labels being most popular. The researchers highlight limitations of using only one experiment used in the study and question the generalization effect to further restaurants and styles of restaurants as the study was conducted in France where food names are influenced by culture.

Current Context

The motive for the experiment was initially driven by personal experiences with dining at restaurants and inclination towards trying menu items with “not the usual” names to satisfy cravings of trying something that sounds “new” and “interesting”. This motivation was supported with the evidence from the prior research done in field experiments. But the question was whether the results from prior research could be generalized to the context of the environment and conditions we would be working with, alongside the limited time-period and resources at hand.

Recruiting a restaurant willing to work in an experimental environment was a challenging proposition. The challenges come from making changes to their working menus (especially during COVID-19 when restaurant businesses are suffering), administrative challenges to execute experimental requirements like randomization of treatment (menu with descriptive labels), sharing the itemized sales data for analysis, and all this within a tight time-line of 3-4 weeks. ADDA Bistro and Dining in Morrisville, North Carolina, USA, agreed to work with us in spite of these challenges. Adda is an Indian restaurant with dishes influenced from north to south India, with more focus on Hyderabadi cuisine. It draws patrons from the Research Triangle area of Raleigh-Durham-Chapel Hill with preferences to the cuisine. It opened in February 2021 in the midst of the COVID-19 pandemic when the restaurant businesses nationwide were hit badly resulting in closures of many popular restaurants. But ADDA survived through the period and quickly became a popular joint amongst the gamut of Indian restaurants in the area with an average 4.7 rating (N=116 as of 08/7/21) through Google Reviews. It is a small sit-down restaurant with 37 indoor place settings (3 tables for up to 8 guests, 2 tables for upto 4 guests and 1 table for 5 guests) and 24 outdoor place settings (2 tables for upto 8 guests and 2 tables for upto 4 guests). It is open Tuesday to Sunday for Lunch and Dinner, served family-style. Takeout and online orders have been the main driving force behind ADDA’s sales. However, with the vaccinations and COVID-19 restrictions eased, Adda was looking for ways to boost in-person dining and sales revenue. This is where our proposal of descriptive labels fits in as an attempt to boost the sales by increasing orders of some of their least popular, in other words, their least ordered dishes.

We took cues from the prior studies by considering the kinds of descriptive labels studied: geographic, affective, sensory, tradition and patriotic to design labels for chosen dishes in ADDA’s menu. Prior research discussed in the previous section considered popular dishes in their respective environments. In the context of ADDA and for their business,, the management was welcoming to experiment on their not so frequently ordered dishes. There would be an inherent risk for the restaurant to disrupt names of popular dishes and risk sales, especially with restaurants like ADDA limping back to normal occupancy with pandemic conditions still lingering around. Considering this, we focus our experiment only on selected least popular dishes from their in-person dining menu. ADDA’s online menu is hosted and maintained by a

third-party vendor, so randomizing treatment assignment here was out-of-scope based on timelines, resources and budget.

Hypothesis

The final agreement between ADDA and the research team was to focus on a single-blinded randomized controlled trial for 2 weeks on their in-person diners to study the effect of descriptive labels on selected unpopular (or least ordered) dishes using two sets of printed menus: Control Menu (with existing non-descriptive or "usual" plain labels) and Treatment Menu (with descriptive labels). From this we seek to answer the following question:

Does using descriptive menu labels improve sales of unpopular dishes?

We project to see a positive effect on sales of dishes when diners order them with their respective descriptive labels as compared to their "usual" plain labels. We also expect the sales from the selected dishes with descriptive sales to boost overall net-sales. Post-treatment effects on sales of such dishes are not within the time frame of the research analysis and hence will not be in scope to be measured.

Experiment Design, Planning and Execution

High-level Design

To test the hypothesis, we design, plan and execute a single-blinded randomized experiment for 2 weeks to study the effect of descriptive labels on select unpopular dishes termed "Treatment Dishes" at ADDA's in-person dining service by measuring the *difference-in-means* between (a) Count of Treatment Dishes ordered from Treatment and Control Menu, (b) Net-Sales generated from Treatment Dishes from Treatment and Control Menu.

The steps involved to run the experiment are: (1) Selection of unpopular dishes from ADDA's sales records or identifying "treatment dishes", (2) Listing options for descriptive labels for each treatment dish, (3) Conducting a public survey to vote for best descriptive label for each treatment dish, (4) Finalizing list of descriptive labels, (5) Printing menus to incorporate the new descriptive labels, (6) Randomization process, (7) Training ADDA's staff with experiment execution and (8) Experiment execution. Table 1 describes the timeline of the above steps.

Table 1: Experiment Design and Execution timeline

Key Timeline Steps	**Start Date**	**End Date**
Restaurant Recruitment - ADDA Dining and Bistro	June 4th	June 4th
Selection of Least Ordered Dishes for Treatment - Treatment Dishes	June 5th	June 8th
Research on Options for Descriptive Labels for Treatment Dishes	June 9th	June 18th
Draft Survey to Vote for Best Descriptive Labels	June 19th	June 20th
Distribution of Survey	June 21st	June 25th
ADDA Closed for Employee Appreciation Week Execution Planning	June 28th	July 5th
Pre-Treatment Period	July 6th	July 18th
Finalize List of Treatment Labels with ADDA	July 12th	July 12th
Menu Changes and Printing	July 13th	July 16th
ADDA Staff Training	July 19th	July 19th
Randomization and Treatment Period	July 20th	August 1st

1. Selection of Unpopular Dishes or "Treatment Dishes"

To select the least ordered or unpopular dishes from ADDA's menu, we analysed the sales orders for all the dishes in the menu for the months of April and May 2021. Dishes were compared based on the number of orders placed for each dish during this time period. Signature dishes like "Biryani" and "Haleem" had been the most popular dishes, so these categories of dishes were excluded from treatment. The bistro items, desserts and drinks were also excluded as these were always subject to availability on a particular day. The treatment dishes for the experiment would be dishes which would be available on all days during the treatment period. Based on these criteria, the least ordered dishes under each category were finalized and approved by ADDA. In total, *13 treatment dishes* were selected as shown in Table 2: 3 from Veg. Appetizers, 4 from Non-Vegetarian Appetizers, 3 from Veg. Entrees, 1 from Non-Vegetarian Entrees and 2 from Tandoor categories. Figure 1 shows a comparison of the counts of least-ordered or treatment dishes and some most popular dishes. The dishes least ordered like Paneer Tikka, Chicken Manchurian are listed on top of the chart, and some most popular dishes like Gongura Paneer Biryani, Boneless Chicken Biryani and others are at the bottom of the chart

Figure 1: Comparison of count of orders for 13 treatment dishes and most popular dishes from April and May Sales

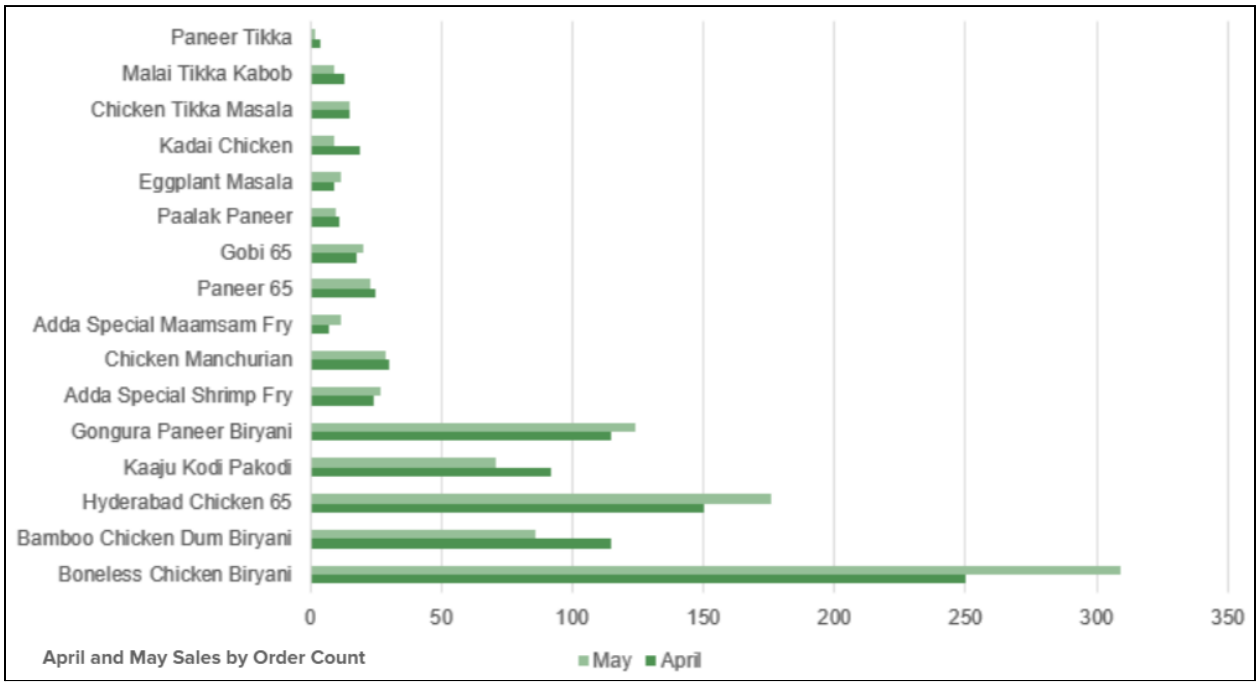


Table 2: Categorization of 13 Treatment Dishes

Veg. Appetizers	**Non-Veg Appetizers**
Gobi 65	Chicken Manchurian
Paneer 65	Mutton Roast
Veg. Muttis	Adda Spl. Maamsam Fry
Veg. Entrees	**Non-Veg. Entrees**
Paalak Paneer	Kadai Chicken
Eggplant Masala	**Tandoor**
Tadka Dal	Paneer Tikka
	Malai Tikka Kabob

2. Options for Descriptive Labels for 13 Treatment Dishes

This step is one of the most important and critical parts of the design as it involves composing possible options for appropriate creative and effective descriptive labels for the treatment dishes. Accurate dish labeling will have a direct impact on quality assurance and consumer confidence. From prior research, descriptive labels can be classified under *Location* (or Geographic), *Affective*, *Sensory* and *Tradition* categories. ADDA's Chef was consulted to get a description for each treatment dish regarding ingredients used (like spices, vegetables, protein) along with its origin (like Andhra region of India), style of preparation involving tradition (like Street-style, Nawabi) and sensory components (like Crispy, Sizzling). Another requirement was to have labels with not more than 3-4 words for easy callout in the kitchen. From these inputs, 3 descriptive labels were finalized for each treatment dish and approved by ADDA. To choose the final descriptive labels for each treatment dish, it was important to get customer vote and approval as they drive the selection and ordering of dishes from a menu.

3. Online Survey to Vote for "Best" Descriptive Label

To obtain customer approval, an online Google Form survey was designed wherein people could vote for their most preferred descriptive label for a treatment dish. A brief description for each dish was presented with 3 options to select from and an option for survey takers to propose their own creative descriptive label if they preferred a different name. To avoid bias and spill over effects, ADDA was not mentioned in the survey and the survey was not distributed to residents of RTP Area where ADDA is located. To encourage participation, three $25 Amazon gift cards were raffled out to survey participants and two $25 gift cards were given out to respondents who proposed their own labels, the best of which were selected by ADDA's Chef. In total 106 respondents participated in the survey. Appendix 1 has in-depth details about the survey.

4. Finalize List of Descriptive Labels

The survey results were presented to ADDA Management and the Chef for review, feedback and approval. Out of the 13 treatment dishes, 11 dishes got descriptive labels from popular vote from the survey and 2 dishes got labels from creative responses by participants selected by the Chef. Table 3 shows the list of treatment dishes and their descriptive labels.

Table 3: 13 Treatment Dishes with their Descriptive Labels and Label Type

Menu Category	Treatment Dish (Non-Descriptive Label)	Descriptive Label	Label Type
Veg. Appetizer	Gobi 65	Crispy Gobi 65	Sensory
	Paneer 65	Chatpata Paneer 65	Sensory
	Veg. Muttis	Veg. Kofta Munchies	Sensory
Non-Veg Appetizer	Chicken Manchurian	Street-style Chicken Manchuria	Tradition
	Mutton Roast	Andhra Mutton Roast	Location
	Adda Spl. Maamsam Fry	Deccan Mutton Fry	Location
Veg. Entree	Paalak Paneer	Hyderabadi Paalak Paneer	Location
	Eggplant Masala	Nawabi Baingan Masala	Tradition
	Tadka Dal	Dhaba Dal Tadka	Tradition
Non-veg Entree	Kadai Chicken	Kadai Murgh Masala	Tradition
Tandoor	Paneer Tikka	Tandoori Paneer Tikka	Sensory
	Malai Tikka Kabob	Lucknowi Malai Murgh	Location

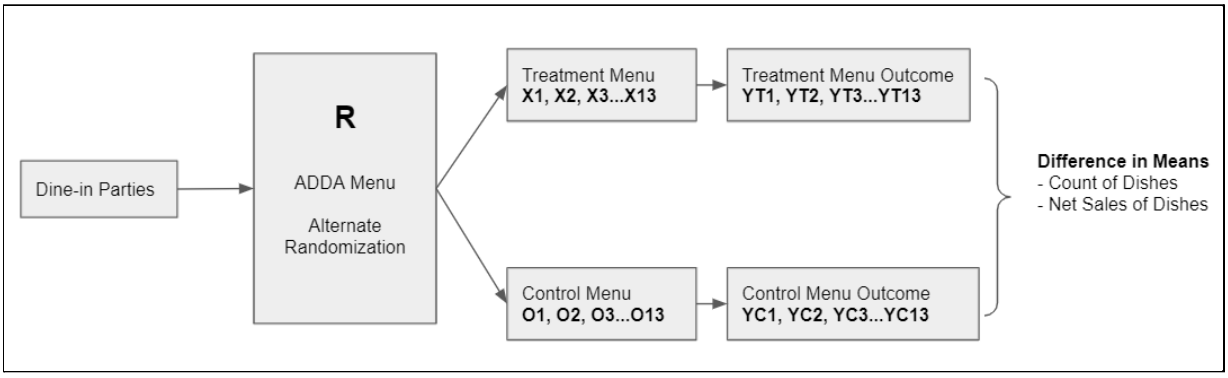
5. Menu Design and Printing

ADDA's in-person dining menu is a 3-fold glossy colored brochure. For the experiment, the same design template was used to produce 2 versions of the menu: Control Menu (existing menu with non-descriptive labels for treatment dishes) and Treatment Menu (with descriptive labels replacing non-descriptive labels from the control menu). To differentiate the Control Menu from Treatment Menu by the look of the front page of the brochures, a subtle design change was added to Treatment Menu by adding an additional border in green color around ADDA's logo. This would allow ADDA's staff to differentiate between the two menus during treatment assignments to in-person diners. Several copies of both the versions of the menu were printed by a local printing service. Copies of Control Menu were also printed even though the content was the same as before the experiment. This was done to match the quality of paper, color and feel of the brochure as the new Treatment Menu with descriptive labels for treatment dishes. Appendix 2 and 3 show details of the Treatment and Control Menu.

6. Randomization Process

To assign in-person diners with either Treatment or Control Menu, we employed randomized assignment by alternately assigning dine-in parties of guests to either Treatment or Control Menu based on the time they arrive for dine-in service. This is because the time of arrival of dine-in guest parties, number of guest parties and number of guests in each party is very dynamic at each service. By alternate random assignment, we can achieve 3 goals: (1) dine-in parties have an equal chance to get treatment or control assignment, (2) proportionately have an almost equal number of guest-parties assigned to Treatment and Control which would facilitate an apples-to-apples comparison between the two groups, (3) execution of randomized assignment of the menus would be easier for the restaurant staff rather than a complicated process which could lead to administrative errors and a chaotic dining experience for the diners. And thus may affect the precision and reliability of the analysis of results. Figure 3 shows the design process. Appendix 4 shows an illustrated example of the whole randomization and design process.

Figure 3: ROX-Y Design



7. Randomization Execution by ADDA Staff

Execution of the experiment effectively required great coordination between the front staff and kitchen staff to provide an overall pleasant experience to the dine-in guests. One day prior to the treatment assignment, on their off day, the staff of ADDA was given an overview by the research team covering the motive behind the experiment, changes to the menu and treating Control as Old (O) Menu and Treatment as New (N) Menu for simplicity. A demo was given to show how randomized assignments of the Control and Treatment Menus were to be done among the in-person dining guests for the next 2 weeks during service. Support materials (Appendix 5) were prepared and posted at the front desk and in the kitchen bulletin board about the changes to the menu. Instructions were printed on the steps to effectively implement random assignment, taking orders with correct labels corresponding to the type of menu distributed to a table (Appendix 6). The restaurant host would additionally record the table number, type of menu: with O or N for (O)ld - Control or (N)ew - Treatment. The new descriptive labels from the Treatment

menu were added to the Clover POS system (Appendix 7) while keeping the corresponding “usual” labels from the Control menu. The restaurant website was updated to replace the usual labels with descriptive labels which was reflected on the online ordering system. At close of business every night, the sales data for in-person dining would be exported from ADDA’s Point of Sale (POS) system provided by Clover to be used for statistical analysis.

8. Power Analysis and Randomization Execution

As a one-off training was not enough to ensure the randomization of the menu treatment was done flawlessly, the execution of the process was monitored by a person from the research team at every service. This was very necessary especially during dinner service as evening hours at ADDA are flooded with takeout orders, order pickup along with serving in-person diners. By a research team overseeing and helping the Front desk staff, the randomization of treatment assignment was executed as per plan without any errors. This ensured the research team analyzed clean data and provided unbiased results. During the experiment period, all treatment dishes were available for dine-in service, so there was no attrition of the treatment units. There were also no instances of non-compliance and spillover effects arising due to treatment and control menu diners. A non-compliance effect would come in place if a dine-in party was supposed to be assigned to the treatment menu but received control menu or vice-versa. Spillover effect would arise if diners from treatment and control groups discussed the menus with each other.

For any good experiment, given the environment and constraints, it is important to run a pre-experiment power analysis to assess the effect size to generate the desired treatment effect. Since our pre-treatment data consisted of data from ADDA’s pre-experiment menu or Control Menu, we ran a power analysis on the data collected from the first week of the experiment. Tables 4a and 4b show that for a power of 80%, we need 8 dine-in parties each in Treatment and Control Groups to see a large effect size > 1.5.

Table 4a: Power Analysis (for number of treatment dishes ordered)

```
     Two-sample t test power calculation

              n = 7.369382
          delta = 1.581889
             sd = 1
      sig.level = 0.05
          power = 0.8
    alternative = two.sided

NOTE: n is number in *each* group
```

Table 4b: Power Analysis (for total sale of treatment dishes)

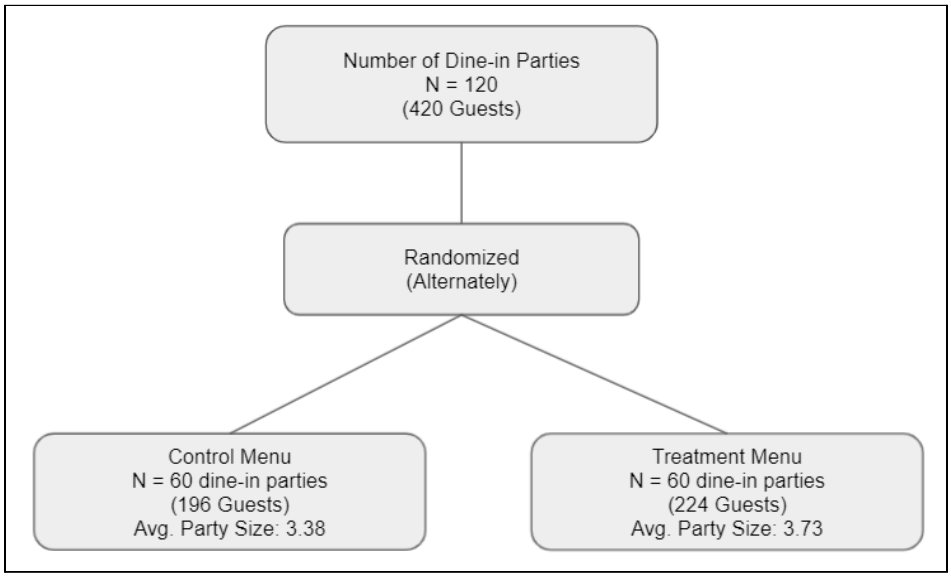
```
     Two-sample t test power calculation

              n = 7.132555
          delta = 1.613287
             sd = 1
      sig.level = 0.05
          power = 0.8
    alternative = two.sided

NOTE: n is number in *each* group
```

Figure 4 shows a flow diagram of the treatment assignment over the course of the experiment. Over a span of 2 weeks of service, the experiment was able to randomize 120 dine-in parties alternately based on their arrival time for a dine-in service on a particular day, into proportionately equal groups of 60 each to receive either Treatment or Control Menu. However, due to the dynamic nature of the assignment, the total number of guests in each group was slightly different with average party size of 3.73 in Treatment group and 3.38 in Control group. Most of the dine-in numbers came from dinner service while only about 21% of them were from lunch service

Figure 4: Flow Diagram of the Treatment Assignment during the Experiment



Data for Analysis

The data for all the analysis presented below were exported from ADDA's Point of Sale System provided by Clover in the form of Excel spreadsheets. The necessary data to test the hypothesis was exported to Google Sheets and consisted of the following fields for each dine-in party as shown in Table 5. The Party Count and Menu Assignment data were manually recorded by the ADDA's front desk staff hosting the guest party. Statistical analysis was conducted using R software.

Table 5: List of Fields for Hypothesis Testing

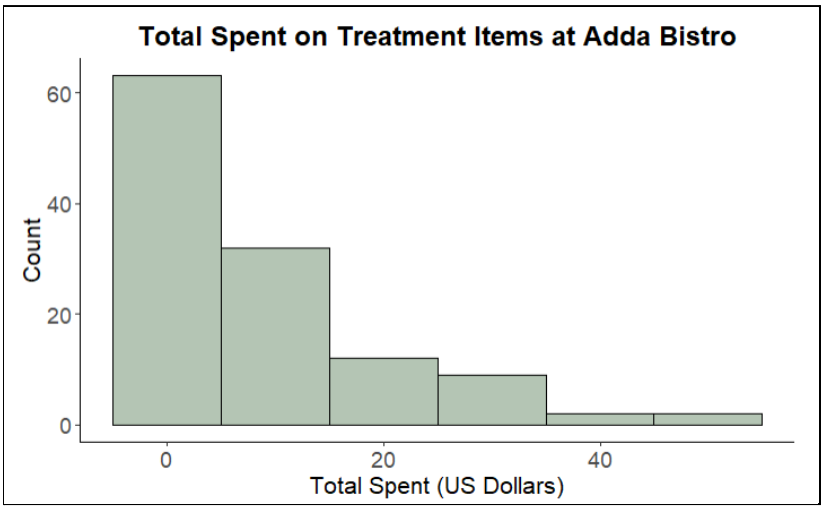
1. Day of Service	Date of Service (7-20-2021 to 08-01-2021)	**5. TreatmentControlMenu_TC**	T (Treatment) or C(Control)
2. TimeOrder	Time of Order HH:MM:SS AM/PM	**6. SubTotal**	Sub Total of Sales before Taxes and Tips
3. TableNumber	Table ID assigned to party	**7 - 95. Order Count for each of the 89 dishes on Menu**	89 fields for each dish on menu with order count per each as ordered by the guest-party or table
4. PartyCount	Number of guests in each dine-in party		

Analysis

Because we were able to isolate menu changes to just 13 dishes, our analysis focused on the difference between treatment and control for just those dishes. Figure 5 shows a histogram of

total spend on *treatment dishes only* over the course of our experiment for both treatment and control groups. The distribution is very right skewed, with most people spending less than 25 dollars on treatment dishes.

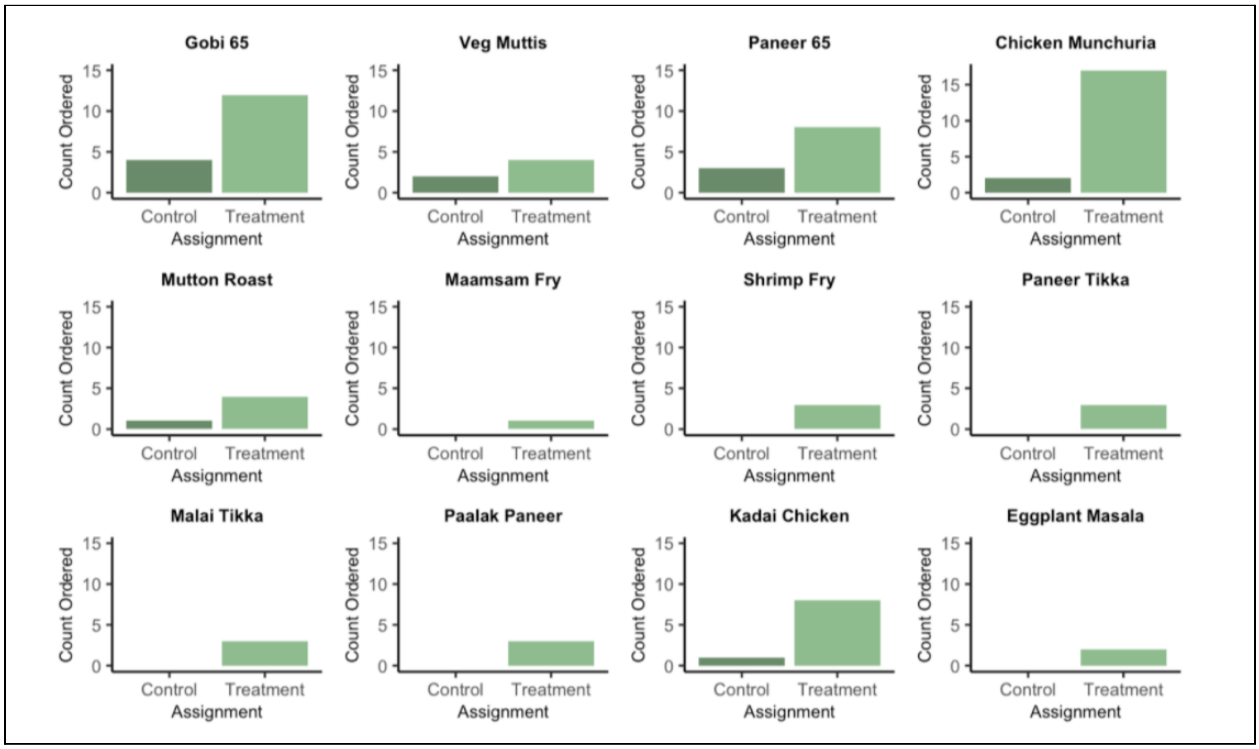
Figure 5: Histogram of Total Spent on Treatment Dishes



Because the number of treatment dishes ordered depended heavily on the number of people sitting at the table, we wanted to make sure that it was fair to compare treatment and control in our experiment. Coincidentally, there ended up being more people in treatment than in control (Figure 4), but the average party size in treatment vs control was very similar, with 3.3 in control and 3.7 in treatment. Thus, we concluded that it was fair to compare the two groups despite there being more people in treatment since the comparison of the dishes was based on averages from the two groups as well.

Figure 6 is a display of the number of orders per treatment dish. It shows the comparison between the number of dishes ordered with the "usual" name vs. "descriptive" labels i.e. Control vs. Treatment. We can see that most treatment dishes were not purchased by the control group at all! This makes sense, as these were the restaurant's least popular dishes and through the assignment of descriptive labels in the treatment menu, the experiment was trying to increase their purchases. Those that did have purchases from both control and treatment still had a clear difference in the number of items purchased by each group. *The treatment group purchased 4.5 times more of the descriptive-labeled items than control did with the "usual" names.*

Figure 6: Count of Dishes Ordered per Treatment Dish



A Welch 2-sample t-test to test the difference in means between the count of treatment dishes ordered between treatment and control groups as shown in Table 6, shows that the *Average Treatment Effect (ATE) is 0.97 with p-value < 0.01*. This means that the dine-in parties in the treatment group, on average, ordered around 1 more treatment dish than the parties in the control group.

Table 6: T-test for Difference-in-Means between Count of Treatment Dishes Ordered between Treatment and Control Menu

```
        Welch Two Sample t-test

data:  num_treat_items by assignment_neat
t = -7.0178, df = 83.923, p-value = 5.392e-10
alternative hypothesis: true difference in means between group Control and group Treatment is not equal to 0
95 percent confidence interval:
 -1.2405910 -0.6927423
sample estimates:
  mean in group Control mean in group Treatment
              0.2166667               1.1833333
```

Group	N	Mean	Difference in Means (ATE)	Std. Error of Difference in Mean	95% Confidence Interval		t	p-value
					Lower	Upper		
Control	60	0.2166667	0.9666666	0.1377448	-1.2405910	-0.6927423	-7.0178	5.392e-10
Treatment	60	1.1833333						

In terms of spend by dish, “Chicken Manchuria” with its “Street-style Chicken Manchuria” descriptive Label generated the most difference in profit from treatment. Overall, those in treatment spent almost $200 more on “Street-style Chicken Manchuria” than in control over the span of 2 weeks as shown in Figure 7. This was followed by “Gobi 65” with descriptive label “Crispy Gobi 65”. Both “Chicken Manchuria” and “Gobi 65” received “sensory” labels. A possible explanation for Chicken Manchuria performing better in sales as compared to other non-vegetarian dishes could be that in general, it is a more popular dish alongside the meat being more popular compared to mutton. A similar explanation could be drawn to Gobi 65 as well in terms of being popular as compared to other vegetarian dishes.

Figure 7: Comparison of Net-sales of Treatment Dishes

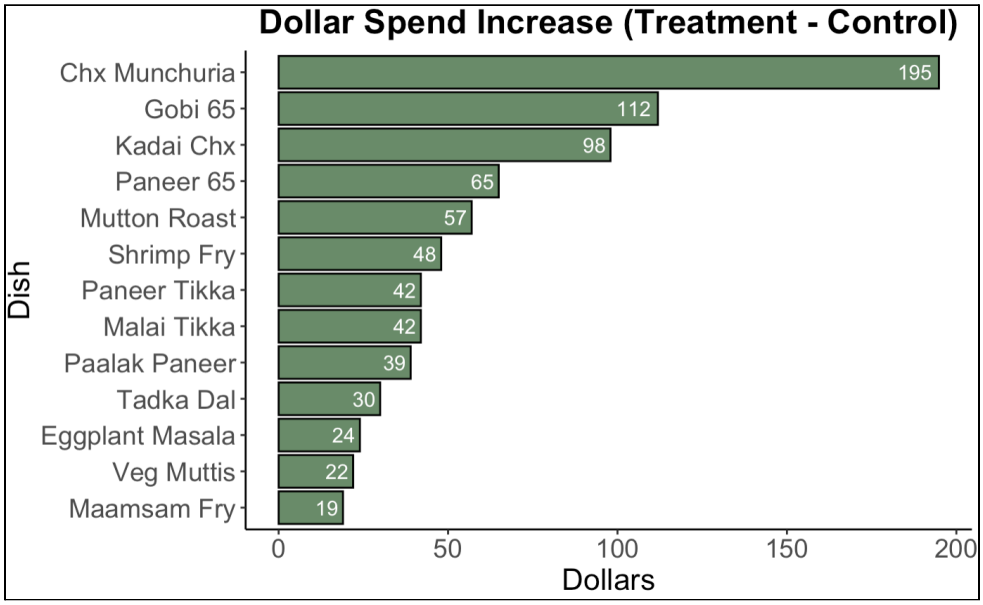
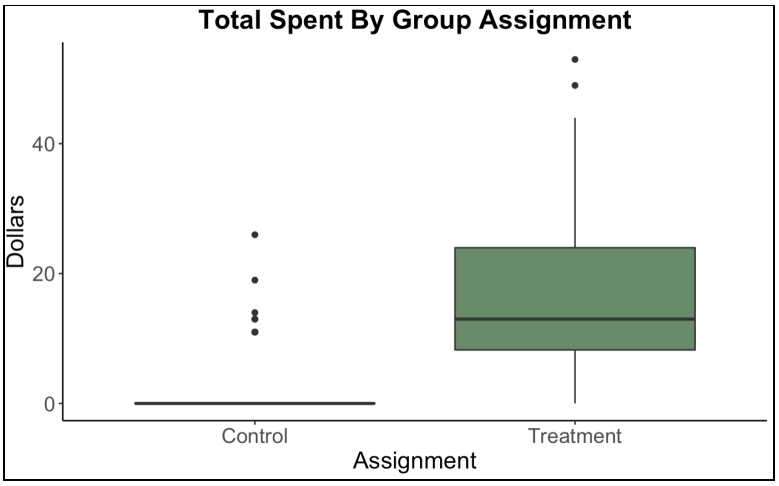


Figure 8 shows a boxplot of the difference in spend on treatment dishes for the control and treatment menu groups. Although there are some outliers on the control group, it is very clear that those in the treatment group spend a significant amount more on treatment menu items on average. In fact, most dine-in parties in control spent $0 on the treatment dishes we focused on. Because the boxplots are not overlapping, it is clear there is a significant difference in dollars spent between control and treatment.

Figure 8: Total Spent in US Dollars by Treatment and Control Group



In order to understand whether these differences are truly significant, we ran 2 regressions, one predicting the amount spent (1) and predicting the number of treatment dishes bought (2), both by whether they were in the treatment group. Table 7 shows the results of both of these regressions.

Table 7: Regression of Total Spent and Number of Treatment Dishes (Items) on Treatment Assignment

	Dependent variable:	
	Total Spent	Treatment Items
	(1)	(2)
assignment	12.807***	0.967***
	(1.825)	(0.139)
Constant	2.731***	0.217***
	(0.761)	(0.059)
SE Flavor	Robust	Robust
Observations	120	120
R2	0.298	0.294
Adjusted R2	0.292	0.288
Residual Std. Error (df = 118)	9.913	0.754
F Statistic (df = 1; 118)	50.075***	49.250***
Note:	*p<0.1; **p<0.05; ***p<0.01	

The regression results in Table 7 show that, on average, those dine-in parties in the *treatment group purchase approximately 1 extra meal* from the treatment menu (robust std error: 0.139, p-value < 0.01, CI: [0.7, 1.2]), which amounts to an *average of about $12.8 extra* (robust std error:

1.825, p<0.01, CI: [9.3, 16.4]) per dine-in party. It seems our descriptive labels in the treatment menu truly made a difference on purchase choices.

We speculated that customers would branch out of their usual orders on the weekends (Friday to Sunday), and perhaps get their usual orders on the weekdays to obtain some comfort during the work week. Thus, we believed it to be possible that a weekend covariate would change our regression. However, as seen in Table 8, a covariate for weekend vs weekday does not change our estimates, and the weekend covariate is not significant. *Customers do not seem to have different purchasing habits of treatment items on the weekends vs. the weekdays*. We obtain similar results from above, where on average those in the treatment group purchase approx 1 extra meal (robust std error: 0.139, p-value < 0.01, CI: [0.7, 1.2]), which amounts to $12.8 extra (robust std error: 1.825, p<0.01, CI: [9.2, 16.3]).

Table 8: Regression of Total Spent and Number of Treatment Dishes (Items) on Treatment Assignment with Weekend Co-variate

	Dependent variable:	
	Total Spent	Treatment Items
	(1)	(2)
assignment	12.806***	0.968***
	(1.844)	(0.140)
weekend	0.044	-0.055
	(1.856)	(0.145)
Constant	2.705**	0.250***
	(1.207)	(0.097)
SE Flavor	Robust	Robust
Observations	120	120
R2	0.298	0.295
Adjusted R2	0.286	0.283
Residual Std. Error (df = 117)	9.955	0.757
F Statistic (df = 2; 117)	24.826***	24.525***
Note:	*p<0.1; **p<0.05; ***p<0.01	

In fact, when performing an Anova test to determine whether the two models on total spent were actually significantly different after adding the weekend covariate as shown in Table 9, we obtain a p-value(0.9811 > alpha =0.1) higher than we need to make us statistically confident that adding that covariate does not change or improve the model.

Table 9: Anova between Models on Total Spent with and without Weekend Covariate

```
Analysis of Variance Table

Model 1: total_spent_treat ~ assignment + weekend
Model 2: total_spent_treat ~ assignment
  Res.Df   RSS Df Sum of Sq     F Pr(>F)
1    117 11595
2    118 11595 -1 -0.056058 6e-04 0.9811
```

When we assigned descriptive labels to the 13 treatment dishes, we did so purposefully into 3 categories: traditional, location-based, and sensory. Our experiment also allowed us to measure the differences in buying patterns for these 3 categories of names. Table 10 shows results of a regression measuring the number of extra sensory, location-based, and traditional items customers bought in treatment vs. control. It appears that traditional names (example: Street-style Chicken Manchuria, Kadai Murgh Masala, Nawabi Baingan Masala, Rajugari Shrimp Fry) make the largest difference in customer purchase, increasing the number of dishes bought by table on average by 0.45 (robust std. error:0.089, p-value < 0.01, CI: [0.28,0.62]), while sensory (example: Crispy GGobi 65, Chatpata Paneer 65) and location-based labels (example: Hyderabadi Paalak Paneer, Lucknowi Malai Murgh, Andhra Mutton Roast, Deccan Mutton Fry) increased the number of dishes bought by 0.3 (robust std. error: 0.1, p-value < 0.01, CI: [0.1,0.49]) and 0.17 (robust std. error:0.063, p-value < 0.01, CI: [0.04,0.29]), respectively.

Table 10: Regression to Compare Heterogeneous Treatment Effects from Sensory, Location-based and Traditional Descriptive Labels on Treatment Assignment

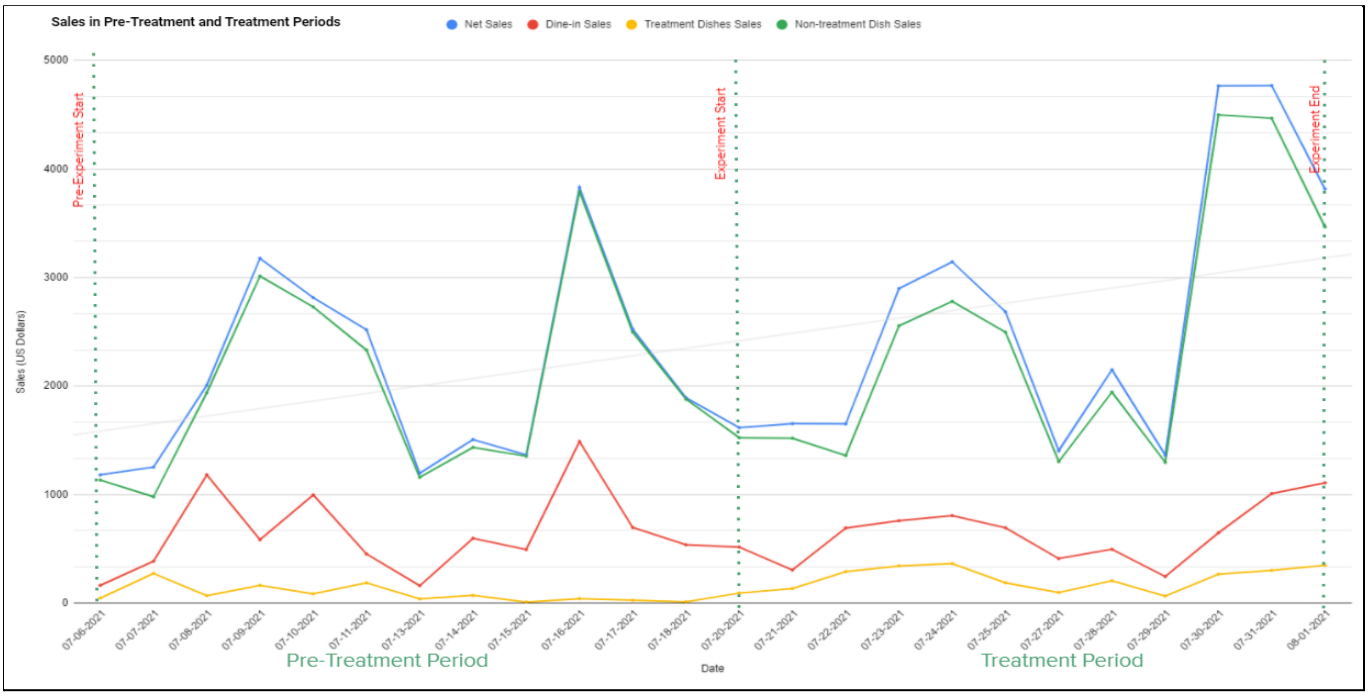
	Dependent variable:		
	Sensory (1)	Location (2)	Traditional (3)
assignment	0.300***	0.167***	0.450***
	(0.100)	(0.063)	(0.089)
Constant	0.150***	0.017	0.050*
	(0.053)	(0.017)	(0.029)
SE Flavor	Robust	Robust	Robust
Observations	120	120	120
R2	0.073	0.056	0.179
Adjusted R2	0.065	0.048	0.172
Residual Std. Error (df = 118)	0.541	0.344	0.486
F Statistic (df = 1; 118)	9.235***	7.041***	25.740***
Note:	*p<0.1;	**p<0.05;	***p<0.01

Further Analysis

Using descriptive labels had a positive effect in sales of the 13 treatment dishes as compared to sales of the same dishes with “usual” names from the control menu. But it is important for the restaurant to know if the sales of these treatment dishes affect the sales of non-treatment dishes which are the more popular ones. Ideally the restaurant expects the net sales from the treatment dishes to boost overall sales keeping the trend of sales of non-treatment dishes the same or more in treatment period as from the pre-treatment period. To examine this, we plot the trend analysis of the overall net sales, dine-in sales, treatment dish sales and non-treatment dish sales from takeout and dine-in orders from start of pre-treatment (July 6th to July 19th) to end of treatment (July 20th to August 1st) as shown in Figure 9.

The “blue” line shows the total net-sales including takeout and dine-in orders. The trend over time shows there is an overall increase in net-sales during the treatment period. The “red” line shows the net-sales from dine-in orders. Even though the trend shows there was a decrease of sales from dine-in orders, the net-sales for treatment dishes during the treatment period is comparatively higher when compared to that from pre-treatment period. This again validates the analysis from before that descriptive labels for treatment dishes (which were some of the unpopular dishes) improved sales of such dishes. But do improved sales of such dishes in the treatment period affect sales of non-treatment dishes (or the popular ones)? The “green” line shows the net-sales from non-treatment dishes. It can be seen that this runs parallel to the overall net-sales in “red”, except for a short slump between 20th and 22nd July at the start of the experiment. This shows that *net-sales of non-treatment (or popular) dishes are not affected by the improved sales of treatment dishes*.

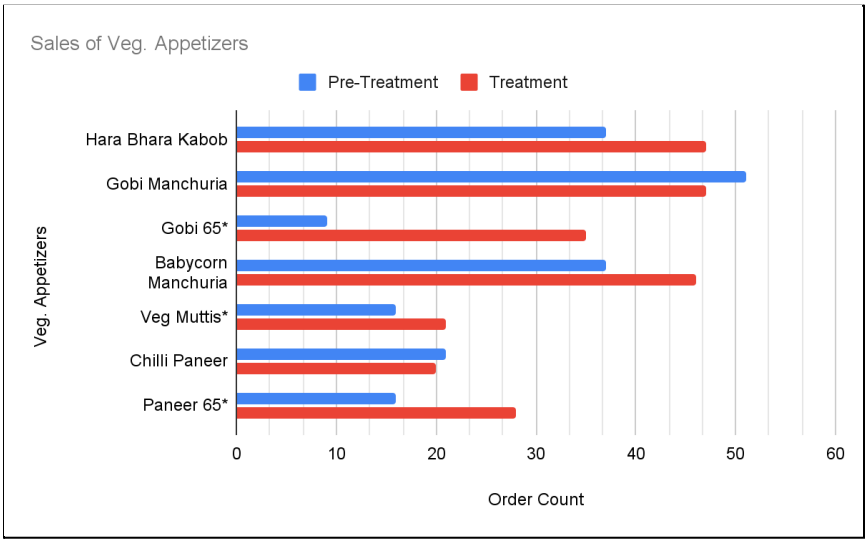
Figure 9: Trend Analysis of Sales for Pre-Treatment and Treatment Periods for Takeout and Dine-in Orders



To look at this comparison at a granular level, we plot the net-sales in the number of dishes ordered for dishes in each category during pre-treatment and treatment periods. Figures 10a and 10b exhibit the comparison for Veg. Appetizers and Non-veg Appetizers as the two treatment dishes from the treatment menu that generated most sales were "Street-style Chicken Manchuria" and "Crispy Gobi 65". Similar trends for other categories can be seen in Appendix 8.

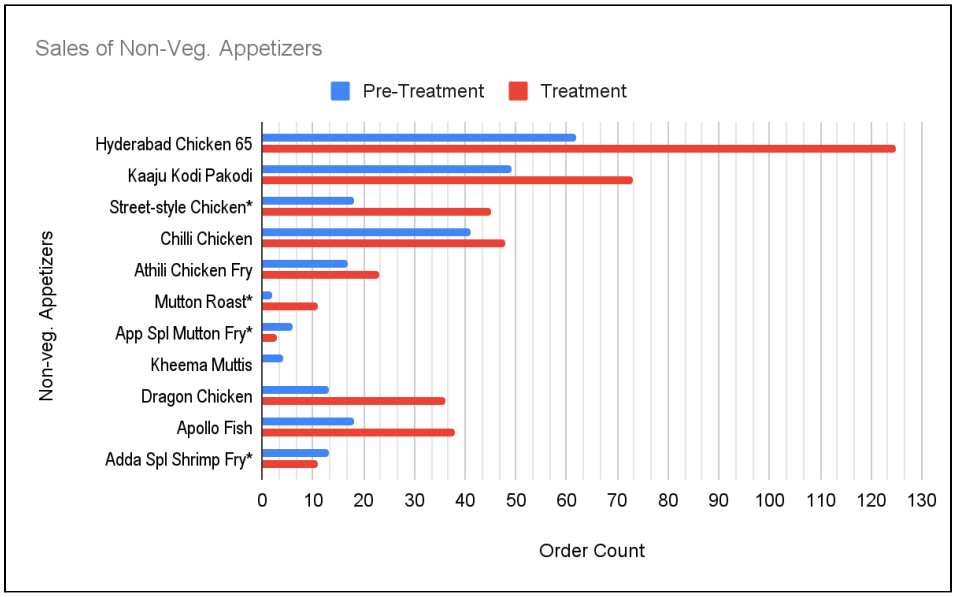
From Figure 10a, it can be seen that "Hara Bhara Kabob", "Gobi Manchuria" and "Babycorn Manchuria" were the most popular Veg. Appetizers in pre-treatment period and continue the trend in the treatment period as well. There are two Gobi (or Cauliflower) dishes: "Gobi 65" and "Gobi Manchuria", with "Gobi 65" being the second best-selling treatment dish during the treatment period with its descriptive label "Crispy Gobi 65". Despite being a best seller, it didn't impact the sales of the most popular "gobi" dish.

Figure 10a: Comparison of Order Count of Treatment (indicated by *) and Non-treatment dishes under Veg. Appetizers between pre-treatment and treatment period.



From Figure 10b where we look at the comparison of dishes under Non-veg Appetizers, it can be seen that the most popular dishes in pre-treatment period were "Hyderabad Chicken 65", "Kaaju Kodi Pakodi" and "Chilli Chicken". This trend continued in the treatment period as well, even though the sales from most popular treatment dish from treatment menu: "Chicken Manchuria" with descriptive label "Street-style Chicken Manchuria" more than doubled in the treatment period.

Figure 10b: Comparison of Order Count of Treatment (indicated by *) and Non-treatment dishes under Non-veg. Appetizers between pre-treatment and treatment period.



Conclusion

From the analysis above, we can state that descriptive labels had a positive effect in the number of treatment dishes ordered and net-sales of these dishes from the treatment menu as compared to the "usual" dish labels used in control menu or in other words ADDA's pre-treatment menu. On average, dine-in parties assigned to the treatment menu (with descriptive labels for 13 treatment dishes) spent about $13 more on treatment dishes than the dine-in parties assigned to the control menu. The dine-in parties in the treatment group also ordered on average about 1 dish more than those in the control group. It did not matter whether the effect came from weekend or weekday diners. We also saw positive heterogeneous treatment effects towards sales from the 3 different types of treatment labels assigned to the treatment dishes. It was found that "tradition-based" labels generated the most sales in terms of number of treatment dishes ordered. Overall the sales from treatment dishes with descriptive labels improved overall sales for ADDA. It was also found that the net-sales of non-treatment dishes were not affected by the improved sales of treatment dishes.

Limitations

Due to the limited timeline for the experiment and the cooperation from ADDA's management, the treatment could only be run for a 2-week period without room for measuring post-treatment effect. With more time in scope, a post-treatment period of 2-4 weeks could be used to measure if the positive effect of descriptive labels in ADDA's menu had a long term effect and not just a novelty effect. A novelty effect would arise if during the treatment period, guests were ordering

more of the “new” sounding or more “attractive” descriptive labels whether they were first time or repeat diners at ADDA, but this “novelty” didn’t last for a longer period. This could happen due to several reasons. One reason could be that the quality and/or taste of the dishes was not consistent during the post treatment, which could make them move towards the direction of least ordered dishes again. With Covid-19 restrictions back again at the end of the experiment due to the Delta variant surge, there could be a drop in in-person diners which could have an impact on overall sales. So comparing trends from post-treatment with treatment and pre-treatment may not give reliable results.

The experiment was scoped to only dine-in guests at a single restaurant serving Indian cuisine, family-style in suburban North Carolina. The patrons of the restaurant are mainly Indian food lovers with the majority of them with roots from South Asia, particularly the Indian sub-continent. We did not collect demographic data such as race, gender and age for the dining parties. Thus, we cannot measure the treatment effect between different groups, such as Indian vs. non-Indian and male vs. female customers.

It was important to design and run a single-blind experiment since the customers’ knowledge of the treatment dish label will likely bias the results. However, there could be a risk of experimenter bias. If the restaurant staff is aware of the experiment and is explaining the menu to the customer or giving recommendations, they might encourage customers to order treatment dishes.

The menu consisted of only labels under each category without descriptions and pictures of the dishes. Considering this, the question of generalizability is debatable. The experiment can be replicated to in-person dining at other single-chain or multi-chain Indian restaurants in the area, and even to other geographical areas in the United States with similar population demographics and who use similar style menus. To see the positive effect on sales using descriptive labels, restaurants should carefully research the dishes, ingredients to craft labels that invoke appropriate connections for diners, while maintaining high quality and taste of the dishes. Adding descriptions to the labels can boost customers' confidence while ordering unfamiliar dishes especially for people not familiar with the cuisine, which could then have a positive impact on sales and repatronage. Several studies have been done to study the effects of having pictures, price variations and placement of dishes on a menu. So restaurants can experiment at several levels on the menu to boost customer repatronage and sales, keeping the quality, taste of dishes high and consistent.

Considering the time and resources, there was only one version of the treatment menu used at ADDA during the experiment which had descriptive labels for each of the 13 treatment dishes. This is unlike the case in the prior experimental research done at the university cafeteria and the French restaurant, where they had time and resources to create several versions of the treatment menu by rotating descriptive labels for treatment dishes over several weeks (4-8 weeks). Also these experiments had only one version of the menu used during any given dine-in

service. So there was no need for menu randomization like the one done at ADDA between treatment and control menu. If restaurants have the time and resources to measure heterogeneous treatment effects using several versions of treatment menu with descriptive labels, more in-depth trend analysis can be done to see the effect of such labels on sales and repatronage.

Ideally while running an experiment, it would be useful to account for various covariates that could be used to measure the relationship between each other and the outcome variable to improve precision of outcomes. In the experiment at ADDA, we were only able to account for the size of each guest-party. It could have been expanded to account for and measure other factors like repeat customers, type of party (family, friends etc.) along with age/gender of guests. A customer satisfaction survey can be implemented to receive feedback from customers where they could vote for quality and taste for each dish ordered, service, cleanliness and ambience of the restaurant, and whether they would recommend it to others. Such feedback would also be invaluable to the restaurant management and kitchen to make continuous improvements. Considering the positive effect of sales based on the treatment menu, the restaurant ADDA has planned to adopt the treatment menu as their menu post treatment.

References

1. Brian Wansink, James Painter, and Koert van Ittersum (2002) ,"How Descriptive Menu Labels Influence Attitudes and Repatronage", in NA - Advances in Consumer Research Volume 29, eds. Susan M. Broniarczyk and Kent Nakamoto, Valdosta, GA : Association for Consumer Research, Pages: 168-172
2. Brian Wansink, Koert van Ittersum, James E. Painter, “How descriptive food names bias sensory perceptions in restaurants” , Food Quality and Preference, Volume 16, Issue 5, 2005, Pages 393-400, ISSN 0950-3293
3. Nicolas Guéguen, Céline Jacob, “The effect of menu labels associated with affect, tradition and patriotism on sales”, Food Quality and Preference, Volume 23, Issue 1, 2012, Pages 86-88, ISSN 0950-3293

Appendix

Appendix 1: Pre-experiment Survey to vote for best descriptive labels

What would you name it?

Imagine you are at Royal Durbar Restaurant that specializes in Indian Cuisine. And you have the opportunity to rename some of the dishes on their menu!

For each dish below, choose the most appetizing name and help the restaurant improve the sales of the dishes. The names are inspired from the north to the south of India, with the south playing a significant influence on the taste of the dishes.

What's in it for you?
Well, for starters, your mouth is going to be watering! BUT also, we are raffling away 3 $25 Amazon gift cards.
And along with that, the head chef is going to award the 2 most creative names $25 Amazon gift cards.

For any questions or concerns, contact gastronome@berkeley.edu.

* Required

Email *

Your email

First, lets start with Vegetarian dishes :

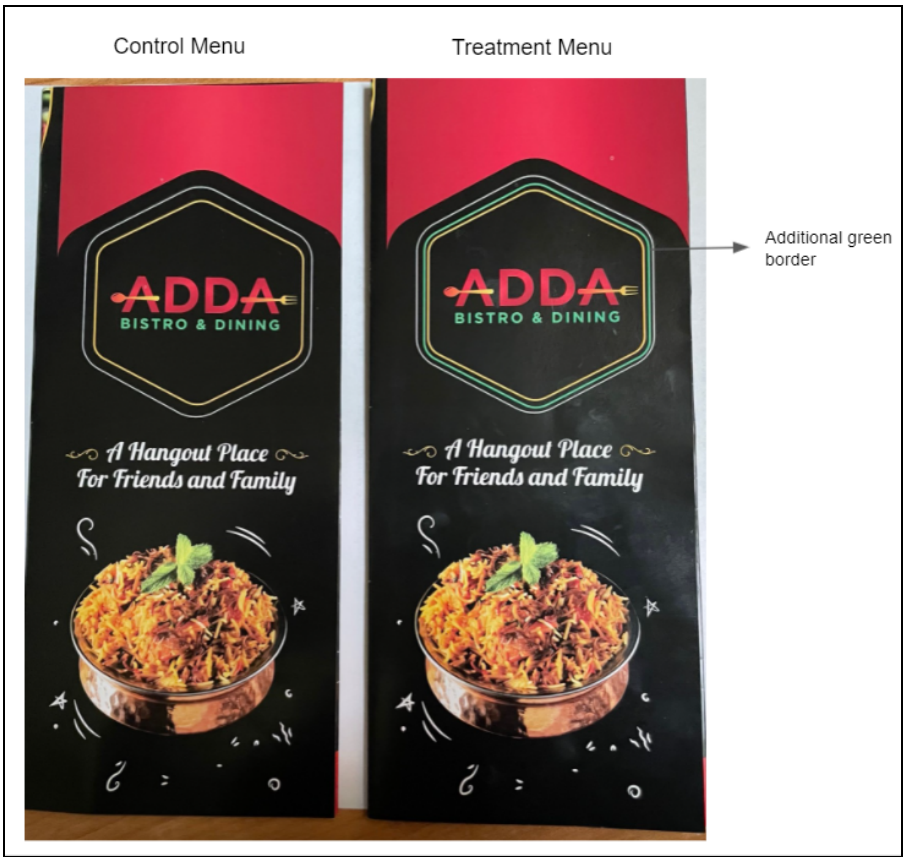
Paneer 65 (Appetizer)
Skewered Crispy Cottage Cheese cubes in a spicy and tangy marination

- ◯ Chatpata Paneer 65
- ◯ Paneer 65 Sixers
- ◯ Skewered Paneer 65

If none of the above sound appetizing, what would you name Paneer 65?

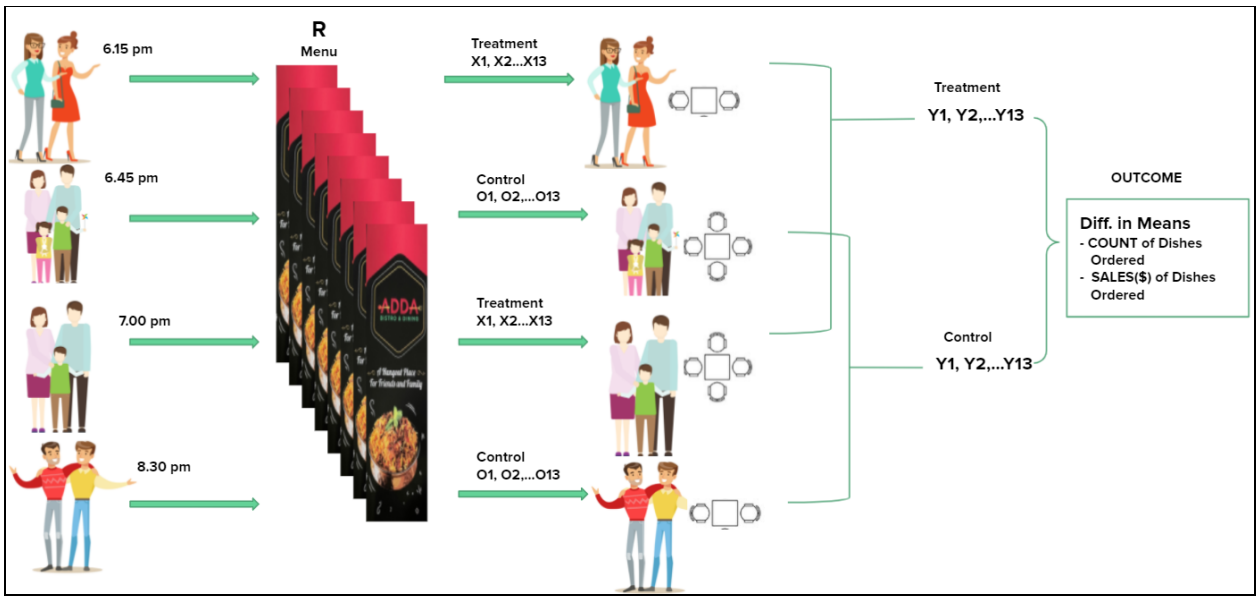
Your answer

Appendix 2: Control and Treatment Menus

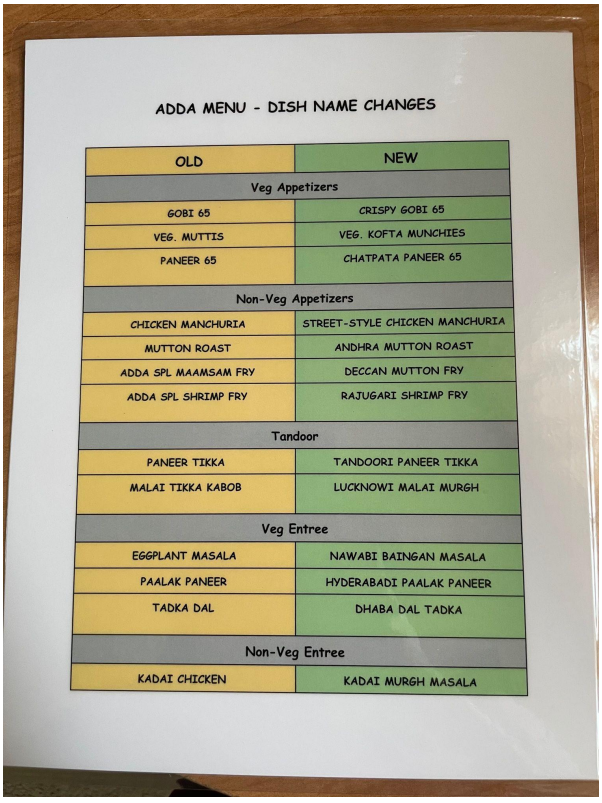


Appendix 3: Treatment Menu with Descriptive Labels for Treatment Dishes

Appendix 4: Illustrated Example of Randomization Process and Outcome Measures



Appendix 5 and 6: Support Materials for Front Desk and Kitchen Staff



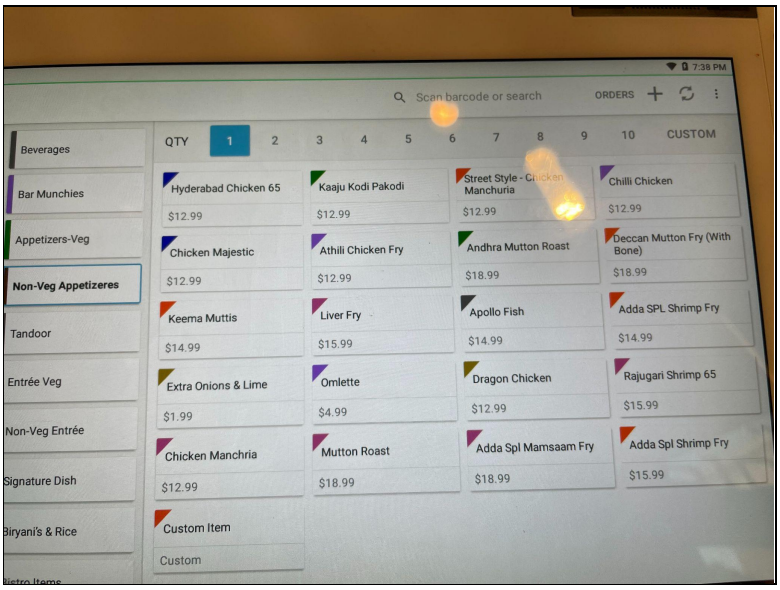
ADDA MENU - DISH NAME CHANGES

OLD	NEW
Veg Appetizers	
GOBI 65	CRISPY GOBI 65
VEG. MUTTIS	VEG. KOFTA MUNCHIES
PANEER 65	CHATPATA PANEER 65
Non-Veg Appetizers	
CHICKEN MANCHURIA	STREET-STYLE CHICKEN MANCHURIA
MUTTON ROAST	ANDHRA MUTTON ROAST
ADDA SPL MAAMSAM FRY	DECCAN MUTTON FRY
ADDA SPL SHRIMP FRY	RAJUGARI SHRIMP FRY
Tandoor	
PANEER TIKKA	TANDOORI PANEER TIKKA
MALAI TIKKA KABOB	LUCKNOWI MALAI MURGH
Veg Entree	
EGGPLANT MASALA	NAWABI BAINGAN MASALA
PAALAK PANEER	HYDERABADI PAALAK PANEER
TADKA DAL	DHABA DAL TADKA
Non-Veg Entree	
KADAI CHICKEN	KADAI MURGH MASALA

ADDA MENU and CHECKOUT STEPS for IN-PERSON DINING

1. PICK MENU
   a. Look at where lamp is and pick that menu
   b. Place object at other stand
   c.
2. MAKE ENTRY
   a. Write the Table Number, Menu(N/O) and Number in Party
3. DISTRIBUTE MENUS TO GUESTS
4. TAKING ORDERS
   a. Make sure to key in CORRECT DISH NAME into system
5. CHECKOUT
   a. Take Payment and Hand Tablet to Guest for Review
   b. PRINT Receipt for Record
      i. Mark N/O for which menu was used: (N)EW or (O)ld
      ii. Keep it aside safely

Appendix 7: Descriptive Labels added to Clover Point of Sales System



Appendix 8: Comparison of Treatment and Non-Treatment Dishes between Pretreatment and Treatment Periods for Takeout and Dine-in Sales