RESEARCH
Research Paper

Fast-Food Optimal Defaults Reduce Calories Ordered, as Well as Dietary Autonomy: A Scenario-Based Experiment

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ABSTRACT

Background Low-calorie menu items as optimal defaults may encourage healthier choices when people eat out. Limited research has studied default effects from the restauranteurs' perspective, as well as the public health perspective.

Objective To examine the effects of optimal defaults on calories ordered, dietary autonomy, and visit intention in the context of a fast-food drive-through.

Design Between-subjects randomized scenario-based experiment.

Participants/setting In all, 377 adults who lived in the United States were recruited through a crowdsourcing platform in July 2020.

Intervention Participants were asked to visualize ordering a combo meal in a fast-food drive-through. They were randomly assigned to order from 1 of 3 menu boards: (1) menu items available for combos by customer choice, (2) combos that included traditional high-calorie default items, or (3) combos that included low-calorie optimal defaults.

Main outcome measures Differences in calories ordered among groups, dietary autonomy, and restaurant visit intention.

Analysis Statistical tests included multiple regression, Kruskal-Wallis, χ^2, and 1-way analysis of variance. Covariates such as education and sex were tested in regression models as potential confounders.

Results Compared with the choice combo meals, optimal combo meals reduced calories ordered by consumers (−337 kcal, standard error = 19, $P < .001$), while traditional combos increased them (+132 kcal, standard error = 20, $P < .001$). No significant difference was found in visit intention. Dietary autonomy was affected by the optimal defaults ($P = .025$), even in participants with high health concern. Conversely, the traditional combo's effect on dietary autonomy was moderated by health concern (B = −0.26, $P = .023$), with only individuals with very high levels of health concern perceiving less autonomy.

Conclusions Optimal defaults provided a robust reduction in calories ordered but had implications for dietary autonomy.
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ALTHOUGH COMBO MEALS OFFER PRICE AND CONvenience advantages, the marketing practice of bundling low nutrient-dense options into combo meals has brought suboptimal outcomes for public health.[1] Traditional combination meals in fast-food restaurants are considered drivers of high-calorie and low nutrient-dense food choices that contribute to the obesity epidemic.[2,3] Despite this issue, consumers often believe that a group of products at a single price provide greater value.[4] In fact, an increase in sales associated with combo meals has been reported.[5,6] Combos are a staple of fast-food restaurants and are demanded by consumers.[2]

Restaurants typically refer to combo meals as menu item "bundles" with default options that "push" people to buy specific menu items.[1] Defaults change the decision structure and may alter choices.[7] For this reason, defaults are considered a type of nudge. A nudge is a factor that may "gently" modify a behavior.[8] A nutritional nudge can be described as an initiative that persuades people to move toward better food choices without their complete awareness. According to nudge theory, better decisions could be made with the help of benign defaults.[8] When default options maximize welfare, like in healthy food choices, they are called benign or optimal defaults.[9,10] The inclusion of lower-energy items as optimal defaults in combo meals has been suggested as a noninformational strategy to promote healthy eating.[1,11,12] Therefore, optimal defaults act as a nutritional nudge. However, limited research has been conducted using this type of default at restaurants.[13]

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The existing literature indicates that optimal defaults may improve the nutritional quality of combo meals in restaurants. With lower-energy sides and beverages, interventions in kids' meals show that optimal defaults reduce calories ordered and increase nutrient-dense choices.[14-16] In the case of adults, research studies in noncommercial food services and full-service restaurants offering optimal defaults reported calorie reductions as well.[10,17] However, to the authors' knowledge, no study has tested optimal defaults' effect on adults in the context of fast-food restaurants, where the use of defaults is even more common.

Despite the potential benefits of optimal default options, there is criticism regarding side effects on autonomy. Autonomy is defined as the individual need to feel that one's decisions were made based on their own determination.[18] Literature from other fields reports concern regarding the freedom of choice because defaults alter peoples' right to make their own decisions.[9,19] However, few studies have addressed these adverse side effects. One example of adverse effects on autonomy was in a hospital where an opt-out vaccination policy was implemented. In this study, care workers perceived the default vaccination policy as violating their freedom.[20(p94)] Yet, it remains unclear whether optimal defaults may generate similar side effects at restaurants. Therefore, there is a need to explore if optimal default options in combo meals affect people's right to make their own eating decisions, referred to as dietary autonomy.

If the effect on autonomy is detected, restauranteurs could perceive it as a deleterious outcome for the industry. Outcomes in the industry's interest are as important as health-related outcomes in guaranteeing the feasibility and sustainability of any strategy to promote healthy eating in food establishments.[21] Research studies show that brands that provide a sense of autonomy develop stronger attachments with their clients.[22,23] Attachment is defined as "the strength of the bond connecting the brand with the self."[24(p2)] This bond may predict consumer purchase behavior and intention to maintain a continuous relationship with the brand.[23,25] In light of this, restauranteurs could argue that if there is a lack of autonomy, restaurant visit intention will be adversely affected by the adoption of optimal defaults. Visit intention refers to one's conscious plan to go to the restaurant and establish a relationship with the establishment.[26] If visit intention declines due to optimal defaults, restauranteurs would likely be less willing to adopt this health-related initiative.

The effects of defaults could fluctuate in different market segments. For instance, the segment of the population highly interested in health may represent a market opportunity for the restaurant industry.[27,28] Some adults are more likely to consider health-related aspects of food when eating out.[29,30] In the literature, these individuals are often referred to as "health concerned" or "health conscious."[29,31-33] Consumers with a "health" mindset regularly make healthy choices (or what they think are healthy) and look for places that meet that need.[29,34] In that sense, this kind of consumer would be expected to identify more with optimal defaults than traditional ones. Therefore, the effect of defaults on dietary autonomy could be moderated by health concern, but no research has examined this relationship. Such information would be valuable for restaurant industry marketers who want to know more about the health concerns of consumers.[29] Additionally, it could potentially support the adoption of optimal defaults in the restaurant industry.

This study aimed to address research needs regarding defaults' effects on calories ordered, dietary autonomy, and restaurant visit intention in the context of a fast-food drive-through. The examination is an effort to enhance the understanding of outcomes of interest for public health, as well as the restaurant industry. The specific objectives are to (1) compare the impact on calories ordered, dietary autonomy, and restaurant visit intention of low-calorie optimal defaults included in combo meals with the effect of combos arranged by customer choice and traditional combo meals that have high-calorie default items and (2) identify whether defaults' effect on dietary autonomy varies according to the level of health concern.

RESEARCH SNAPSHOT

Research Questions: Do optimal defaults in combo meals alter calories ordered by adults in fast-food drive-throughs? Do optimal defaults affect visit intention to the restaurant or dietary autonomy? Does the level of health concern play a moderating role on visit intention and dietary autonomy? Are the same results found with traditional defaults?

Key Findings: In a scenario-based experiment, optimal defaults provided a robust reduction in calories ordered but negatively affected dietary autonomy. No significant difference was found in visit intention. Traditional defaults in combo meals increased calories but only affected the autonomy of those with very high levels of health concern.

METHODS

Research Design

An experimental design with 3 parallel groups was used in a scenario-based online survey (randomized allocation ratio: 1:1:1). Participants were asked to order combo meals from a menu board that differed among groups by the type of combo, including (1) choice, (2) traditional, and (3) optimal defaults. For the choice combos' group, menu items were available to be selected by participants to create a customized combo meal. In the traditional combos' condition, the board showed combo meals with high-calorie sides and beverages by default. The optimal combos' participants saw combo meals with low-calorie sides and beverages by default. All the menu boards included a section with sides and beverages with low- and high-calorie items to allow participant customization of their order if desired. Figure 1 shows the menu boards used in the study.

Menu items were typical of fast-food restaurants and preferred by adult consumers according to market studies.[35-39] The same menu items were presented in the 3 groups, but the combinations varied according to the group. All menu boards included calories per combo meal and individual items to conform to US menu-labeling regulations.[40] Combo meals displayed the total calories for the items that were part of the combination. Traditional combo meals presented a range of calories because respondents were presented with typical sodas choices with differing calorie content. A registered dietitian nutritionist estimated the

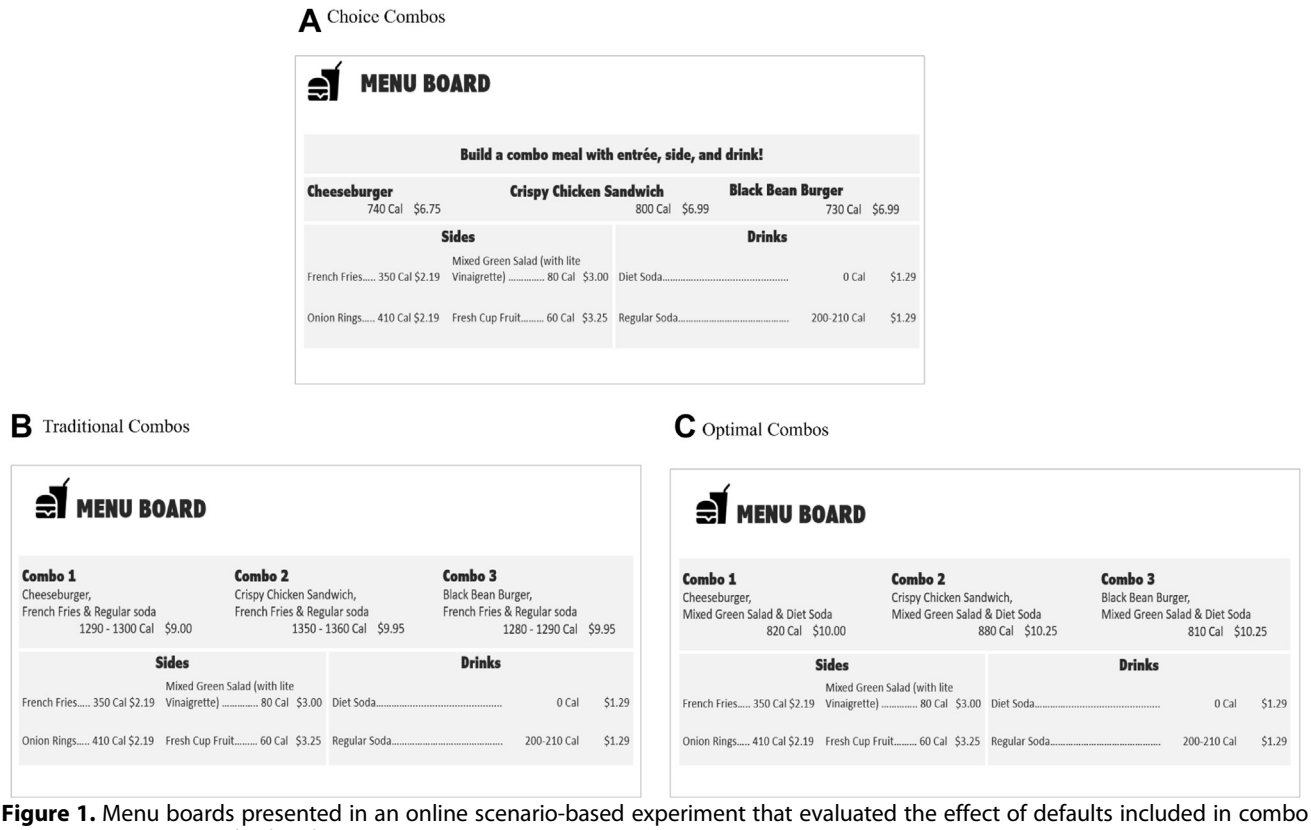


Figure 1. Menu boards presented in an online scenario-based experiment that evaluated the effect of defaults included in combo meals in the context of a fast-food drive-through.

nutritional information using data from the Food Composition Database of the US Department of Agriculture.[41] Estimations were also compared with the calorie information posted by the top-10 fast-food restaurant chains.[42] This comparison confirmed that the calorie information on the study's menus mirrored calories of similar items from the leading chains. Similarly, item prices from the leading chains were examined. The study's entrée prices were set at the higher end of the leading chains' menu prices to position them as high-quality products.

Participant Recruitment

The scenario-based experiment was conducted through the online platform Amazon Mechanical Turk (MTurk), in which people complete virtual tasks. In this case, the "job" was advertised as a survey about perceptions of menu design. Only English-speaking subjects older than 18 years who lived in the United States could see the advertisement in Mturk. The task was published in July 2020 and was available for 4 days until recruitment goals were met. Participants received $1 as compensation for submitting complete responses. Additionally, an online platform fee equal to 40% of the participants' pay rate was paid. A university institutional review board approved the study protocol.

Participants were unaware of the study's objectives and the nature of their group assignment. The randomization to a specific group automatically occurred after reading the informed consent. The goal was to obtain 3 groups of similar size. With a power level of 0.80 ($\alpha = .05$), a minimum of 100 participants per group was established *a priori* as reasonable for capturing differences per group. That number was increased by 20% to compensate for potential exclusion during data cleaning. Figure 2 shows the flow of the 377 responses collected and the filters used to clean the data (available as supplementary material).

Procedure

Two pilot studies with 40 participants were conducted to check comprehension of the scenario and clarity of the instrument. The scenario-based experiment was embedded in a survey programmed in Qualtrics. Participants were asked to imagine that they had gone to a new fast-food restaurant's drive-through to redeem a gift card that they could use only for a combo meal. The survey instructions indicated that respondents should perform the task according to their usual restaurant behavior; therefore, they could select or change menu items according to their preferences.

The survey exhibited pictures of a traditional fast-food drive-through and similar purchasing procedures to simulate a visitor experience. As mentioned, respondents saw 1 of the 3 menu boards according to their random group assignment. First, the screen displayed the menu board to show available food items. Second, participants ordered their combo meal. Participants could choose a specific drink from the type of beverage already included in the combo (regular or diet soda) as part of the order. The 4 most popular regular/diet sodas were presented. In addition, water was included as a response option on the screen, as is typical in the United

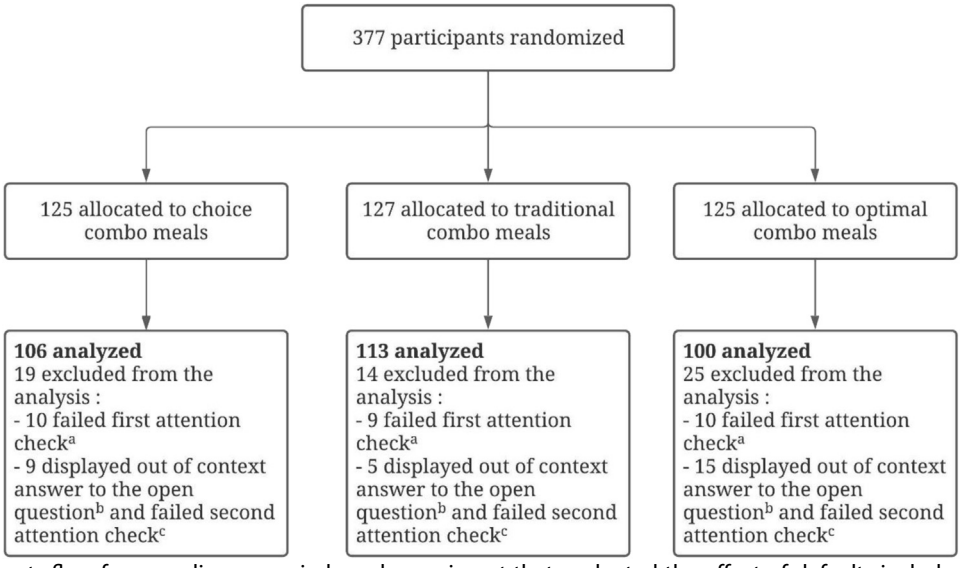


Figure 2. Participants flow for an online scenario-based experiment that evaluated the effect of defaults included in combo meals in the context of a fast-food drive-through. [a]An item that asked for a specific answer on a Likert scale: "As a system check, please check the number 3." [b]Responses that appear to be automatically generated, such as may be created with bot software. [c]An item that asked about the presence of a product not included on the board presented: "As a system check, please respond if there is hot coffee on the menu board."

States. Once participants indicated their selection, they were shown a summary of their food order. At that point, respondents were asked if there was anything else that the operator could help them with. This open-ended question encouraged participants to customize sides and beverages from the traditional and optimal combos. Finally, a self-administered questionnaire was displayed to examine the constructs of interest.

Measurements

The variable calories ordered was estimated using each respondent's final food order. Only responses where participants ordered the 3 components (entrée, side, and beverage) were analyzed. The calories per item were added to get the total per participant. The calculation considered any adjustment requested in the open-ended question where participants could customize their order.

Once participants finished their food order, visit intention, dietary autonomy, and health concern were examined through measurements derived from previously developed and validated scales used with similar populations. In some cases, wording was slightly modified to fit the context of the scenario. Visit intention was measured using 1 item from Lee et al[43] and 3 from Liu and Jang's work.[26] They include statements such as "I would like to come back to this restaurant in the future" and "I would eat at this restaurant." Autonomy has been examined in detail in the Basic Need Satisfaction in General Scale.[44] Later studies adopted the autonomy statements to the study of food choices.[45,46] Based on this research, Johnston and Finney validated the autonomy statements, and the 4 items with the best fit were used to evaluate *dietary autonomy* in the current study.[44] Statements such as "This restaurant made me feel free to eat my way" and "I felt free to decide for myself what I wanted to eat" were used. Health concern was determined with 4 items taken from Jin et al,[29] such as "Self-consciousness about my health encourages me to choose healthy food" and "Concern about my personal health makes me want to purchase healthy food in restaurants." Respondents were asked to rate their agreement with statements for the 3 scales using a 7-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). Additionally, an average score was calculated per variable. Table 1 presents a complete list of items for each scale, along with measures of internal consistency and means.

The survey also included questions related to control variables and experimental manipulation checks. Before presenting the scenario, participants rated their hunger level on a scale anchored at 1 = not hungry at all and 7 = very hungry similar to the procedure used by Byrd et al[47] and Ferriday et al.[48] As a manipulation check for customization, a binary question was included asking participants if they were encouraged to make a customized combo meal. Finally, the questionnaire elicited demographic characteristics and other behaviors that may influence their responses, such as education level, intake modification, and frequency of consumption from fast-food restaurants. Responses for hunger and demographics were used to verify comparability among groups before the analysis.

Data Analysis

The effect on calories was evaluated through a weighted regression model. Among the 3 experimental conditions, the variance in calories ordered was highly heterogeneous; therefore, this analytical method was selected because it does not require constant variance among groups. Following a conservative approach due to the left skewness of the data, a Kruskal-Wallis test was conducted to evaluate the effect on dietary autonomy and visit intention. Lastly, Dunn test with Bonferroni correction was used for post hoc analysis.

Table 1. Descriptive information, reliability, and correlation of constructs included in an online scenario-based experiment evaluating the effect of defaults in a fast-food drive-through

Measurement items per construct[a]	Cronbach's α	Mean (SD[b])	Correlation of Study Constructs[c] 1	2	3
1. **Dietary autonomy**[d]	.89	5.44 (0.34)	1		
The following statements assess how free you felt in making the choices you wanted when ordering from that menu board. Please, rate how much you agree or disagree with each of them. • I felt free to decide for myself what I wanted to eat. • I felt that my food choices were based on my true interests and values. • This restaurant made me feel free to eat my way. • I felt like I could pretty much be myself regarding my food choices.					
2. **Visit intention**[e]	.90	5.49 (0.13)	0.68**	1	
Please, rate how much you agree or disagree with each statement regarding the likelihood that you would visit this restaurant again in the future. • I would like to come back to this restaurant in the future. • I would recommend this restaurant to others. • I would say positive things about this restaurant to others. • I would eat at this restaurant.					
3. **Health concern**[f]	.87	5.04 (0.26)	0.43**	0.45**	1
Indicate how much you agree or disagree with each statement about your current health concern when selecting food. • The risk of diet-related diseases makes me choose healthy food. • Self-consciousness about my health encourages me to choose healthy food. • Concern about my personal health makes me want to purchase healthy food in restaurants. • My physical appearance or concern about my weight makes me want to purchase healthy food in restaurants.					

[a]For all the constructs, the response choices were based on a Likert-type response format of 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree. In each construct, the responses to the 4 items were aggregated to calculate an average score.
[b]SD = standard deviation.
[c]Pearson correlation coefficient
[d]Items taken from Johnston and Finney,[44] Jiseon and Ki-Joon,[45] and Churchill and Pavey.[46]
[e]Items taken from Lee et al[43] and Liu and Yang.[26]
[f]Items taken from Jin et al.[29]
**$P < .01$.

A multiple regression model was conducted to test if dietary autonomy predicted visit intention. The experimental conditions were dummy coded in the regression models using 0 and 1. The moderation effect of health concern was also evaluated with regression, using the approach recommended by Hayes.[49] After proving moderation, the Johnson-Neyman technique was applied to examine regions in the range of health concern where the effect of the defaults on dietary autonomy was significant.

Since previous research found that sex and education explained some food choices,[50-52] they were included in the model as covariates to control confounding effects. Similarly, initial differences per group and manipulation checks were tested with χ^2 and 1-way analysis of variance. Statistical significance was set at $\alpha < .05$, 2-tailed, for all analyses.

RESULTS

After data cleaning, the sample used for data analyses came from 42 US states. The largest percentage came from California (14.4%), Texas (9.7%), Florida (7.5%), and New York (7.5%). Most respondents identified themselves as White (53.9%), followed by African American (28.5%) and Asian (7.8%). Table 2 presents other general characteristics of the final sample with their analysis per group.

The results for the manipulation check confirmed that participants in the groups with traditional and optimal combo meals perceived that they had less ability to customize compared with the choice group (χ^2 (2) = 41.68, $P < .001$). In the groups with traditional and optimal combo meals, 51.3% and 50.0% of the participants felt they could customize their orders; for the case of the choice group, 93% of respondents said they could do it. The analysis also showed that within the traditional and optimal combos groups, the number of participants that perceived they could customize vs those who thought they could not did not differ.

Effect on Calories Ordered

Calories ordered varied significantly among the combo types (Table 3). The traditional defaults in combo meals resulted in increased calories ordered, and the optimal options provided a substantial reduction. Participants in the choice combos group ordered an average of 1185 calories, and participants in the traditional combos group ordered meals with 1316 calories, and those in the optimal combos group ordered meals averaging 848 calories. It is also important to note that very few participants (2%) substituted menu items from the default choices when the simulated drive-through operator gave a chance for customization. Figure 3 (available at www.jandonline.org) shows the wide range of calorie distribution found under each experimental condition.

Effect on Dietary Autonomy and Visit Intention

Dietary autonomy was significantly affected only by the optimal defaults in combo meals (see Table 4, available at www.jandonline.org). A post hoc examination using Dunn test with Bonferroni correction determined that dietary autonomy was significantly lower in the optimal combos group compared with those with the choice combo meals (Dunn test = 33.70 $P = .025$).

Despite the negative effect on perceived freedom, the experiment did not produce an unfavorable result on visit intention. No significant difference was found in visit intention among the 3 groups. However, a significant relationship between dietary autonomy and intention to go to the restaurant was evident ($r = 0.684$, $P < .001$). Table 5 (available at www.jandonline.org) shows the model estimated for visit intention using the frequency of consumption from fast-food restaurants and education as covariates (available as supplementary material). Adding dietary autonomy to the model significantly improved the prediction of the variance in visit intention compared to the covariates ($\Delta R^2 = 0.38$, $\Delta F = 237.49$, $P < .001$). According to the model, when the frequency of visit and education were held constant, visit intention rose as dietary autonomy increased.

Effect on Dietary Autonomy Moderated by Health Concern

Preliminary examination showed no significant differences in health concern among the 3 experimental conditions. Health concern measured the likelihood of participants considering health-related aspects of food when eating out. Further analysis showed that defaults' effect on dietary autonomy varied according to the level of health concern (see Table 6, available at www.jandonline.org). Specifically, the effect of the traditional defaults on dietary autonomy changed when respondents reported a greater interest in healthy food choices. Nevertheless, optimal defaults' effect on dietary autonomy did not change as the health concern differed among participants.

The analysis supported the role of health concern in moderating the traditional defaults' effect on dietary autonomy. Table 6 (available at www.jandonline.org), presents the original regression model and a second version of the same model with the variable health concern mean centered to render coefficients interpretable as Hayes[49] suggested. Education and sex were examined as potential covariates, but they did not predict changes in autonomy and were therefore not included as predictors.

Estimates from the original model showed that the traditional defaults' impact on freedom is significantly reduced as health concern decreases. Specifically, among those who had a lower health concern, perception of freedom was higher when ordering from the menu board with traditional combo meals. The opposite was found among participants with a higher health concern. For them, ordering food from the menu board with traditional combos reduced their freedom. However, this contrast only significantly affected a small percentage of the respondents. The Johnson-Neyman technique showed that the traditional defaults' effect was significant when health concern was below a value of 2.18 or above 6.58 ($P < .05$). In this study, only 5% (5.02%) and 4% (3.76%) of the cases were in those ranges (see Figure 4). In fact, the mean-centered model displays that, among participants with an average health concern, dietary autonomy is affected significantly only by optimal defaults but not by the traditional ones.

Table 2. Demographic and dietary characteristics of participants in a randomized online scenario-based experiment that evaluated the effect of defaults included in combo meals in the context of a fast-food drive-through (n = 319)[a]

Variables	All	Group[b]			*P* value[c]
		Choice combos	Traditional combos	Optimal combos	
	n (%)				
All	319	106	113	100	
Sex	315	106	112	97	.148
Male	198 (62.9)	67 (63.2)	77 (68.8)	54 (55.7)	
Female	117 (37.1)	39 (36.8)	35 (31.3)	43 (44.3)	
Age category, y	317	106	112	99	.742
19-29	68 (21.5)	19 (17.9)	28 (25.0)	21 (21.2)	
30-39	143 (45.1)	52 (49.1)	50 (44.6)	41 (41.4)	
40-49	54 (17.0)	21 (19.8)	16 (14.3)	17 (17.2)	
50-59	38 (12.0)	9 (8.5)	14 (12.5)	15(15.2)	
60+	14	5	4	5 (5.1)	
Education	318	105	113	100	.774
HS[d] graduate or less	29 (9.1)	11 (10.5)	8 (7.1)	10 (10.0)	
Some school or technical school	37 (11.6)	11 (10.5)	12 (10.6)	14 (14.0)	
College degree or above	252 (79.2)	83 (79.0)	93 (82.3)	76 (76.0)	
BMI[e]	248	82	92	74	.811
Normal or underweight (BMI < 25)	157 (63.3)	47 (57.3)	58 (63.0)	52 (70.3)	
Overweight (BMI 25 to <30)	57 (23.0)	22 (26.8)	21 (22.8)	14 (18.9)	
Obesity (BMI 30 to <40)	31 (12.5)	12 (14.6)	12 (13.0)	7 (9.5)	
Extreme obesity (BMI > 40)	3	1	1	1	
Intake modification[f]	319	106	113	100	.464
Yes	136 (42.6)	41 (38.7)	53 (46.9)	42 (42.0)	
No	(57.4)	65 (61.3)	60 (53.1%)	58 (58.0)	
	mean (standard error)				
Frequency of consumption from fast-food restaurants per week[g]	2.95 (0.11)	2.98 (0.18)	2.97 (0.18)	2.89 (0.21)	.937
Hunger prior to survey[h]	4.44 (0.09)	4.52 (0.18)	4.50(0.16)	4.30 (0.18)	.520

[a]Each category reports the analytical sample due to missing values.
[b]Groups: (1) choice: participants created their combo meals; (2) traditional: participants exposed to combo meals that included per default regular soda and french fries; (3) optimal: participants exposed to combo meals that included per default diet soda and green salad.
[c]χ^2 Analysis was used to test for differences in the percentages for each demographic aspect and intake modification. Analysis of variance was used to test for significant differences in the means for the frequency of consumption from fast-food restaurants and hunger prior to the survey. No significant difference was found for any variable.
[d]HS = high school.
[e]BMI = body mass index; BMI categories according to the Centers for Disease Control definitions for adults. Participants self-reported their current weight in pounds and their current height in feet and inches. After transforming variables to kilograms and meters respectively, BMI was calculated with the equation (weight/[height^2]) • 703. Implausible data entered by participants resulted in 71 entries being treated as missing values.
[f]Intake modification was measured with an item asking, "Are you currently modifying your food intake for health or weight reasons?"
[g]Respondents were asked, "How often do you get food from fast-food restaurants in a typical week (before COVID-19 pandemic)?" For this response, the 1.5 interquartile range rule was applied to remove extreme values. According to the sample distribution, any value higher than 9.5 was replaced with the sample mean (2.95) (22 responses). The cutoff is congruent with a recent report that says that maximum frequencies of around 30 times per month may be seen.[39]
[h]Before seeing the scenario, participants were asked to rate their degree of hunger on a scale anchored at 1 = not hungry at all and 7 = very hungry. This procedure was used by Byrd et al[47] and Ferriday et al[48] in similar studies.

DISCUSSION

Combo meals with default options in fast-food restaurants have been considered problematic due to their influence on poor nutritional intake. The inclusion of healthy default options has been suggested as an alternative, but other potential side effects have not been evaluated. This study considered results from a public health perspective, as well as the

Table 3. Effect of defaults included in combo meals on calories ordered by adults in a fast-food scenario-based experiment

		Unstandardized Coefficients				95% Confidence Interval	
Model Fit[a]	Variables	B	SE[b]	t	*P* value	Lower bound	Upper bound
F(2,313) = 1594	Intercept[c]	1184.76	18.60	63.69	<.001	1148.15	1221.35
$P < .001$	Traditional combos	131.61	20.06	6.562	<.001	92.15	171.08
$R^2 = 0.91$	Optimal combos	−336.76	19.03	−17.70	<.001	−374.20	−299.32

[a]Neither sex nor education were significant covariates for the effect of the defaults on calories ordered in this model.
[b]SE = standard error.
[c]Calories ordered in the choice combos were used as the reference group.

restauranteurs' perspective. The inclusion of optimal defaults produced a substantial reduction in calories ordered by adults but negatively affected their dietary autonomy in a fast-food drive-through scenario. No significant optimal defaults' effect was found in visit intention. However, the findings suggest that changes in dietary autonomy may explain some of the variability in visit intention to the restaurant. Additional research is recommended about the effect of dietary autonomy on visit intention. Conversely, the traditional combo meal resulted in a significantly higher number of calories ordered. Further analysis showed that the "extremes" in health concern moderated the effect of the traditional combo meal on dietary autonomy. Those who had very low levels of health concern felt greater levels of autonomy when they ordered from the menu board with traditional combos. And in turn, those with very high levels of health concern felt that it significantly reduced their autonomy. However, these extremes represented a small percentage of the cases observed.

The robust effect on calories ordered supports using optimal defaults to impact the nutritional quality of food choices in restaurants. Regular consumption of fast-food meals has been associated with obesity and comorbidities.[53] This association is important because American adults consume 1 in 5 calories from restaurant foods.[53] In the case of fast-food restaurants, people eat at these restaurants, on average, 10 times per month, but some report eating there as much as 30 times.[39] In addition to the effect on calories, optimal defaults may also encourage the reduction of sugary drinks and sides with more sodium and saturated fat—in line with the suggested Dietary Guidelines for Americans.[54] In that sense, this work adds further evidence about the importance of menu design as a tool to promote healthy eating.

This research contributes to expanding knowledge about nudge theory. The study suggests that nudging people may have potential drawbacks. Nudge theory postulates that if people have the opportunity to modify their choice, that opportunity is enough to provide a sense of autonomy.[8,55] However, that was not the outcome of this experiment. Restaurants implementing nudges should consider the implications when consumers feel less autonomy. This study's results suggest that people perceived that the optimal combo meal did not allow them to eat in their own way. This finding also shows the importance of further research on education and eating patterns that transcend cross-sectional behavioral interventions.

Unanticipated results from this study may generate research questions about consumers' behavior. For example, why did consumers with high health concern not feel more autonomous with the optimal combo meals? A potential explanation is in their interpretation of the healthiness of the combo. The understanding of "low calorie" may vary from person to person.[56] Entrées' calories may have influenced participants' perceptions. For example, 1 study showed that the entrée in combo meals might determine the overall evaluation of the meal as healthy or not.[57] The same study reported that the evaluation affects specific emotions in consumers.

Future research could delve deeper into perceptions about dietary autonomy and other potential influences on dietary autonomy perception. Similarly, the finding that most participants did not feel their freedom was limited by the traditional combo meals regardless of their level of health concern deserves more study. The traditional combos may be perceived as the standard option and familiar and, therefore, could have shaped responses. The theoretical approach of nudging relies on the assumption that preferences are generated by the environment.[8,9] Therefore, people may not have perceived standard offerings as a significant limitation to their preferences because they expect them to be offered. The theory states that if nudges were common, people's preferences could change. Given the limited knowledge about dietary autonomy in restaurants, this area requires further exploration.

The negative effect on dietary autonomy may also affect the overall goal of healthy eating promotion. Autonomy is a basic psychological human need.[18,58] The perception of freedom is associated with higher rates of well-being.[59] A healthy diet should promote all the dimensions of individual well-being, including social and mental ones.[60] Considering that health is defined as a complete state of well-being, a diet oriented to this status should also consider autonomy. Along the same line, interventions to behavior change are more effective if people feel free to make these changes. Autonomy regulates the adoption and durability of health-promoting behaviors.[20,61,62] For these reasons, the findings suggest caution when balancing the need to use optimal defaults to achieve healthy outcomes with the decrease in autonomy and its sustainable longitudinal impact on adults.

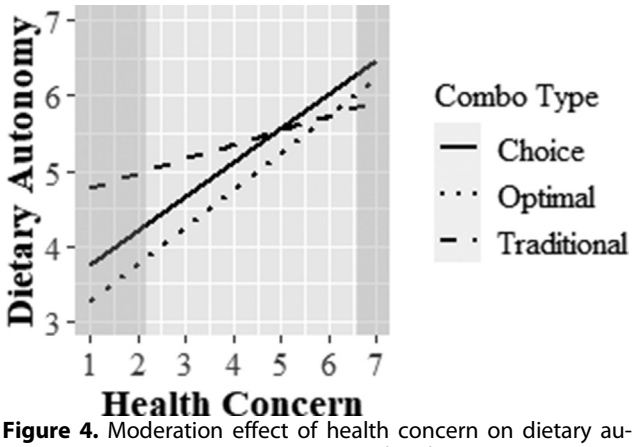


Figure 4. Moderation effect of health concern on dietary autonomy by combo meal type in a fast-food scenario-based experiment. Regression lines were predicted based on the original model, considering minimum, median, and maximum of values for health concern (1, 5.2, and 7, respectively). The gray areas indicate the region of significance for the interaction between the effect of traditional combo meals and health concern. Combo types: (1) choice: combo meals created by respondents; (2) traditional: combo meals included per default regular soda and french fries; (3) optimal: combo meals included per default diet soda and green salad. Dietary autonomy measured as the mean score of 4 items that asked participants their agreement with sentences like "This restaurant made me feel free to eat my way" and "I felt free to decide for myself what I wanted to eat."[44-46] Likert-type response format of 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree. Health concern based on a mean score of 4 items that asked participants their agreement with sentences like "Self-consciousness about my health encourages me to choose healthy food."[29] Likert-type response format of 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree.

Despite the negative effect on autonomy, this study's results did not demonstrate a negative impact on visit intention. The likelihood of going back to a restaurant is influenced by multiple factors such as food quality, service, atmosphere, etc.[26,63] In that sense, although dietary autonomy may predict visit intention, other factors might buffer its impact. A similar study using optimal defaults with desserts in a full-service restaurant showed that adult satisfaction did not decline when exposed to the nudge.[17] Two studies that evaluated autonomy in the context of hotels and tourism showed that the perception of freedom first affects positive emotions and brand compatibility before visit intention.[45,64] In that sense, what was observed in this scenario-based experiment is congruent with research in other contexts. The invariability of visit intention suggests optimal defaults would not negatively impact the restaurant industry in combo meals. This finding is a positive since restauranteurs are more likely to adopt healthy initiatives if they represent a relative advantage for the restaurant or at least not a disadvantage.[65]

Restaurants' stakeholders could use these results in different ways. Policy makers should consider evidence regarding the optimal defaults' effects on adults in future regulation. Health consultants focused on restaurants may cautiously consider the optimal default options, although its inclusion was not the alternative preferred by people with a very high health concern. Even in restaurants that are not health focused, consultants may indicate that the inclusion of optimal defaults could enhance the food environment and people would visit the establishment in the same way. Additionally, the results provide evidence that may be helpful for those advocating for nudging with optimal defaults in restaurants.

Similarly, the study provides insights for the restaurant industry. Restauranteurs may be more appreciative of the effects suggested by the choice combo meals in this study. People in the choice group ordered fewer calories than the traditional option and developed the highest dietary autonomy levels. That option could minimize the impact on public health while providing customers with the freedom to eat how they wish.

This study's findings should be interpreted in light of its limitations. Combo meals are a pricing strategy, which explains why most research focuses on their economic impact.[57] This experiment attempted to restrain the influence of price evaluation with the prompt of a gift card. However, future research should consider how prices shape dietary autonomy and impact the adoption of this initiative. Another limitation is the use of a scenario-based survey as part of the experimental design. Although studies with crowdsourcing have demonstrated validity and consider them a good source of consumer insights,[66-68] results, such as the low rate of customization, could change in a real-world context. People may be more motivated to personalize their choices in a real purchasing situation, potentially affecting the nutritional impact identified. Randomized controlled trials with observational data could provide more definitive evidence regarding what adults do when exposed to optimal defaults as nutritional nudges.

Generalizability is limited to the context studied. The combo of burger and fries is a staple of the US food culture; other gastronomic traditions could react differently to the traditional fast-food combo meal. Furthermore, data were collected during the COVID-19 pandemic. These circumstances may also have affected people's responses. Nevertheless, the use of a drive-through, null social contact, and the wording of the questions attempted to limit that impact. For example, the scenario exhibited pictures of a traditional fast-food drive-through without employees to minimize the potential influence of social distance during the pandemic on visit intention. In fact, using a drive-through is a novel approach to study restaurant consumers due to the lack of research on nutrition in these behavioral settings. The provision of theory-based psychosocial measures that consider different stakeholders interested in the findings is a strength of this research. The results not only illustrated the nutritional effect envisioned from a public health perspective but also covered other potential impacts that the restaurant industry could anticipate.

CONCLUSIONS

The inclusion of optimal defaults produced a substantial reduction in calories ordered by adults in a fast-food drive-through compared with the traditional combo meals. Despite the positive results, a negative effect of the optimal defaults on dietary autonomy was also found in all levels of health concern. In the case of the traditional defaults included in combo meals, the extent of health concern moderated its effect on how autonomous people felt. Those with the lowest health concern felt greater autonomy when exposed to the traditional combo meals. In contrast, those with the highest levels of health concern felt that the traditional combo meal significantly reduced their freedom. However, these extremes represented a limited percentage of the cases. A positive finding of this study was that no effect on restaurant visit intention was found with the optimal defaults. In summary, there are both advantages and drawbacks to using defaults in combo meals, no matter whether they are optimal or traditional. Traditional menu combos are not just (price and convenience) benefit bundles; there are also other bundling impacts, such as the nutritional implications. Similarly, optimal combo meals are not just (nutritional) benefit bundles; there are also other bundling impacts, such as the potential revenue implications when autonomy is negatively impacted, but visit intention is not. To be a sustainable alternative for restaurants, optimal defaults deserve more research.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

M. Diaz-Beltran, B. Almanza, and C. Behnke conceptualized the idea. M. Diaz-Beltran, B. Almanza, C. Behnke, K. Byrd, and D. Nelson developed the protocol and instruments to data collection. M. Diaz-Beltran collected the data, conducted the statistical analysis, wrote the first draft of the manuscript, and was the lead writer of the final version. B. Almanza, C. Behnke, K. Byrd, and D. Nelson provided critical manuscript revisions. B. Almanza supervised all the aspects of the project. All authors approved the final manuscript prior to submission.

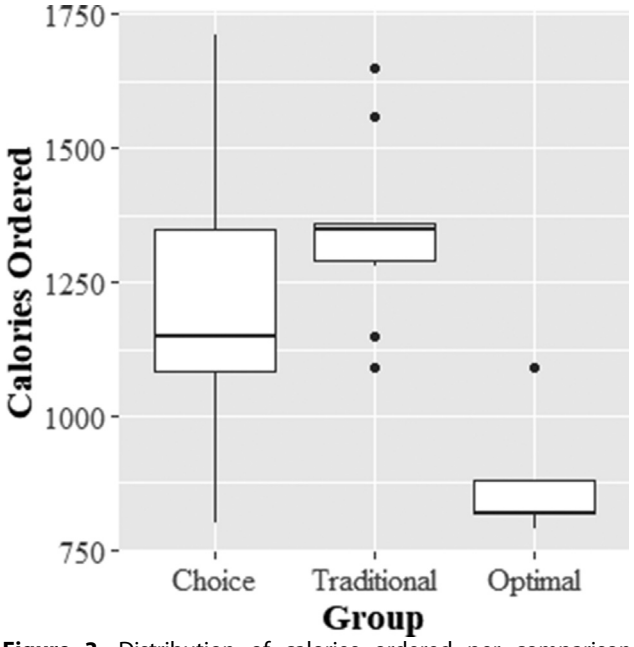


Figure 3. Distribution of calories ordered per comparison group in a randomized online scenario-based experiment that evaluated the effect of defaults included in combo meals in the context of a fast-food drive-through. Groups: (1) choice: participants created their combo meals; (2) traditional: participants exposed to combo meals that included per default regular soda and french fries; (3) optimal: participants exposed to combo meals that included per default diet soda and green salad.

Table 4. Main effects of defaults included in combo meals on dietary autonomy and visit intention per comparison groups in a fast-food scenario-based experiment

	Descriptive Statistics per Group[a]						Kruskal-Wallis Test			
	Choice Combos		Traditional Combos		Optimal Combos					
Variables	Mean (SE[b])	Median (IQR[c])	Mean (SE)	Median (IQR)	Mean (SE)	Median (IQR)	H[d]	df[e]	*P* value	Effect size
Dietary autonomy[f]	5.67 (0.10)	6.00 (1.13)	5.55 (0.10)	5.75 (1.13)	5.18 (0.14)	5.50 (1.44)	7.265	2	.026	$\varepsilon^2 = 0.023$
Visit intention[g]	5.57 (0.11)	6.00 (1.50)	5.54 (0.10)	5.75 (1.25)	5.34 (0.12)	5.50 (1.50)	2.202	2	.333	

[a]Groups: (1) choice: participants created their combo meals; (2) traditional: participants exposed to combo meals that included per default regular soda and french fries; (3) optimal: participants exposed to combo meals that included per default diet soda and green salad.
[b]SE = standard error.
[c]IQR = interquartile range.
[d]H = H test for Kruskal-Wallis test.
[e]df = degrees of freedom.
[f]Dietary autonomy measured as the mean score of 4 items that asked participants their agreement with sentences like "This restaurant made me feel free to eat my way" and "I felt free to decide for myself what I wanted to eat."[44-46] Likert-type response format of 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree.
[g]Visit intention measured as the mean score of 3 items that asked participants agreement with statements such as "I would like to come back to this restaurant in the future" and "I would eat at this restaurant."[26,43] Likert-type response format of 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree.

Table 5. Summary regression analysis for the relationship between dietary autonomy and visit intention according to the responses collected in a fast-food scenario-based experiment

		Unstandardized Coefficients				95% Confidence Interval	
Model fit	Variables	B	SE[a]	T	*P* value	Lower bound	Upper bound
$R^2 = 0.49$	**Covariates**						
$F(4,318) = 76.60$	Intercept[b]	2.047	0.259	7.900	<.001	1.537	2.557
$P < .001$)	Frequency of consumption from fast-food restaurants	0.082	0.025	3.270	.001	0.033	0.132
	Education: some school or technical school	−0.480	0.204	−2.349	.019	−0.881	−0.078
	Education: college degree or above	−0.334	0.162	−2.057	.041	−0.653	−0.014
	Predictors						
	Dietary autonomy	0.643	0.042	15.411	<.001	0.561	0.725

[a]SE = standard error
[b]People with high school or less as the reference group.

Table 6. Summary regression analysis for moderation role of health concern on the effect of defaults included in combo meals on dietary autonomy, according to the responses collected in a fast-food scenario-based experiment

			Unstandardized Coefficients				95% Confidence Interval	
Model fit	Version	Variables	B	SE[a]	t	*P* value	Lower bound	Upper bound
$R^2 = 0.226$	Original	Intercept[b]	3.296	0.482	6.835	<.001	2.35	4.25
F(5,318) =18.280		Trad[c]	1.299	0.609	2.133	.034	0.10	2.50
$P < .001$		Opt[d]	−0.520	0.606	−0.857	.392	−1.71	0.67
		HN[e]	0.453	0.090	5.037	<.001	0.28	0.63
		HN * Trad	−0.262	0.115	−2.278	.023	−0.49	−0.36
		HN * Opt	0.040	0.115	0.344	.731	−0.19	.27
	Mean-centered	Intercept[a]	5.578	0.102	54.499	<.001	5.38	5.78
		Trad	−0.023	0.141	−0.163	.871	−0.30	0.26
		Opt	−0.320	0.146	−2.188	.029	−0.61	−0.03
		HN (mean centered)	0.453	0.09	5.037	<.001	0.28	0.63
		HN * Trad (mean centered)	−0.262	0.115	−2.278	.023	−0.49	−0.04
		HN * Opt (mean centered)	0.040	0.115	0.344	.731	−0.19	0.27

[a]SE = standard error.
[b]Choice combos as the reference group.
[c]Trad = traditional combos.
[d]Opt = optimal combos.
[e]HN = health concern.