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Incremental versus Saturation Hypotheses for Behavioral Nudge in Reducing Sugar Consumption

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Abstract

Objective: This field experiment examined the efficacy of a behavioral nudge intervention towards lowering sugar intake in Indonesia. Specifically, two competing hypotheses were tested as to whether behavioral nudge played an additive role (i.e., the Incremental Hypothesis) or contributed to a ceiling effect (i.e., the Saturation Hypothesis) alongside social context and competition in a multimodal intervention program.

Methods: This field experiment used a three-factorial mixed design involving 403 Indonesian participants based on power statistical analysis: 2 (Sugar content nudge: lower sugar tea vs. regular sugar tea default) x 2 (Social context: individual vs. group) x 2 (Competition: absent vs. present).

Results: Nudging was the most powerful intervention in reducing sugar intake, but its effectiveness might be attenuated by social loafing even within Indonesia's collectivist culture. Competition did not work synergistically with nudging but was effective under the non-nudge condition.

Conclusion: Our results are consistent with those of previous research showing that behavioral nudging has a stronger impact on behavioral change than non-nudge strategies. Contrary to some previous research, people in collectivist Indonesia did engage in social loafing: achievement motivation is not necessarily enhanced in a team of people in a collectivist culture. The Nudge X Competition interaction supports the saturation hypothesis in favor of behavioral nudging: using more than one intervention, when a potent strategy such as nudging is present, might result in diminishing returns that could reduce the overall benefit-cost profile of such multimodal intervention programs.

Impact Statement

Interventions often include more than one form of behavioral change strategy to optimize the likelihood of behavioral change. We conducted a field experiment that included nudging, competition, and social context to change the purchasing behavior toward regular and lower sugar

teas. Our results indicated that the inclusion of more behavioral change strategies in a single intervention does not necessarily increase behavioral change, particularly when a powerful behavioral change strategy such as nudging is involved.

Keywords: nudge, social context, competition, eating behavior, social loafing

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The World Health Organization (2023) identified excessive sugar intake as a significant contributor to noncommunicable diseases; it is associated with weight gain and obesity (Te Morenga et al., 2013) and higher risk of type II diabetes and metabolic syndrome (Malik et al., 2010). Obesity's global financial burden is estimated by the McKinsey Institute at US$2 trillion (Dobbs et al., 2014), and as part of this problem, Indonesia is one of the top ten countries with diabetes incidence (Guariguata et al., 2014). Approximately 11.8% of Indonesians consume excess sugar (Atmarita et al., 2018), and as of 2015, the country had a prevalence of diabetes at 10.9%, which sat well above the global average of 8.5% (The Emerging Risk Factors Collaboration, 2010). There is growing evidence that nudge interventions are effective in promoting healthy eating (Hartmann-Boyce et al., 2018). Nudges are "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2008, p. 6). In this field experiment, we examined the use of behavioral nudging and its efficacy in reducing sugar consumption when moderated by social context and competition.

Nudge interventions have been examined in supermarkets, restaurants, cafeterias, and other public spaces such as train stations. These interventions have included increasing the number of healthy snacks placed in the display shelf by 75% (Van Kleef et al., 2012); placing healthier snacks next to the cash register desk (Kroese et al., 2016); putting a Green Line symbol in the cafeteria (Bauer et al., 2021); and providing vegetable salad (Friis et al., 2017) or vegetarian food (Hansen et al., 2019) as default buffet options. We adopted the default option nudge strategy in this study because past studies have shown it to have the strongest effect size on behavioral change (Cadario & Chandon, 2019; Hummel & Maedche, 2019). In a default nudge, a person receives a pre-determined option unless the person explicitly requests an alternative option. An example would be the dessert in a meal being a piece of fruit by default unless the person asks to change it to another

available option (e.g., ice cream). This nudge works in that people tend to take the pre-determined option rather than make a deliberate, effortful choice.

Our study examines nudging for its incremental or saturation effects in behavioral change programs that involve more than one type of intervention. The incremental effect refers to the increasing potency of behavioral change with the inclusion of different types of interventions (i.e., the Incremental Hypothesis). The saturation effect takes place when the inclusion of a strong intervention strategy such as nudging saturates the impact on behavioral change such that the inclusion of other intervention strategies do not contribute to the program's effectiveness (i.e., the Saturation Hypothesis). Nudges have a strong impact on behavior; the effect size for default nudging is *d* = 0.62 (Mertens et al., 2021) while changes in intention have an effect size of *d* = 0.36 (Webb & Sheeran, 2006). Hence, the inclusion of nudging might contribute to a saturation effect in a multimodal intervention program. Of relevance, though, is that research on testing these two hypotheses involving nudging is lacking (Beshears and Kosowsky, 2020).

There is some evidence supporting both hypotheses. For instance, a systemic review found that the combination of two forms of nudge had a consistent positive influence on healthy food choices (Thorndike et al., 2012). However, there is also evidence for the Saturation Hypothesis: a meta-analysis for occupational stress management interventions found that programs that had one intervention strategy had an effect size of *d* = 0.643, but this decreased when the intervention included three (*d* = -0.104) or four or more (*d* = 0.271) strategies (Richardson and Rothstein, 2008). To our knowledge, though, few studies have tested these hypotheses in a multicomponent intervention program that combines nudge and non-nudge strategies. In addition, few studies have included more than two intervention strategies systematically to examine those strategies' combined impact on behavioral change. Richardson and Rothstein's (2008) meta-analysis found only two effect sizes for interventions with three components (*N* = 59). Yet many intervention programs include myriad intervention strategies to optimize the positive impact on behavioral change; that is,

many programs rely on the Incremental Hypothesis assumption. Examining the incremental and saturation effects of nudge and non-nudge interventions is pertinent to understanding the cost-effectiveness of designing single versus multimodal intervention programs for behavioral change: a multimodal intervention program that includes nudging might be less cost effective than a single modal intervention program that only involves nudging.

In this study, we examined the effectiveness of nudging used in combination with two other non-nudging interventions as motivation: social context (more specifically, whether people are alone or in a group) and competition. Social context influences food choices (Hetherington et al., 2006; Higgs & Ruddock, 2020). For example, the presence of other individuals who make healthy food choices will have a positive influence on the decisions of others in the same group (Robinson et al., 2013). Leahey et al. (2012) specifically found that individual teammates' healthy food choices positively affected the overall team's weight loss outcome. In collectivist societies, which are characterized as having strong cohesive groups, the interests of the group outweighs individual interests (Hofstede et al., 2005; Gelfand, Erez, & Aycan, 2007). Therefore, an individual team member might adopt or maintain healthy eating behaviors due to their other team members' healthy eating behaviors. In Indonesia, which has a collectivist culture (Kurniati et al., 2020), young workers tend to mirror the food intake of their peers in the workplace (Habibie et al., 2019). Conversely, a significant social loafing effect could also work in the reverse, decreasing an individual's healthy eating behaviors even as other team members engage in healthy eating behaviors, especially if the group member feels that their effort is unimportant or dispensable (Hertel et al., 2018). For example, two studies by Cade et al. (2009) found that participants with type 2 diabetes mellitus in a team-based intervention did not eat significantly more healthily than individuals not in such an intervention. Zhang et al. (2016) also found that group support was ineffective in increasing physical activity. In the present study, we investigated whether a collectivist culture would lead to group compliance, motivating sugar consumption, or to social loafing.

We also investigated how group compliance and nudging might interact with the presence or absence of competition. Studies have shown competition to be successful in encouraging health behaviors such as non-smoking (Isensee & Hanewinkel, 2012); weight loss (Morton et al., 2011); physical activity (Prestwich et al., 2017); and class attendance (Zhang et al., 2016). However, little is known about competition's impact on eating behavior. In Indonesia, competition is a common strategy used to promote healthy living. For example, the Indonesian Health Ministry holds an annual school competition to encourage schools to be more concerned about their health services, cleanliness, and Nature-integrated living spaces (Kemenkes, 2019). Hence, we examined how competition might work synergistically with nudging to change sugar consumption.

In sum, we hypothesized that behavioral nudging and competition would decrease sugar consumption. However, we tested a non-directional hypothesis for social context on sugar consumption based on the research on social conformity and social loafing. In addition, to test the Incremental and Saturation Hypotheses, we also investigated whether and how nudging might work synergistically with social context and competition to affect sugar consumption. Specifically, the Incremental Hypothesis was tested by a significant a 2-way or 3-way interaction involving two or more of our interventions (e.g., Nudge x Social Context, Nudge x Social Context x Competition) with the presence of two or more intervention techniques decreasing sugar consumption. For example, the presence of nudging and competition decreased sugar consumption over the presence of nudging alone. In comparison, the Saturation Hypothesis was tested by a pattern of significant main effect(s) for intervention techniques with no significant interactions for two or more interventions decreasing sugar consumption.

Method

Participants

The sample size was determined using G*Power 3.1 (Faul et al. 2007). Effect size was obtained from a meta-analysis for field experiments for nudging of d = 0.39 (Cadario & Chandon,

2019). At 95% power and α = .05, this yielded a minimum sample size of 141 participants to detect a significant main effect for nudging. The same sample size was also used to detect a similar effect for the two-level between-participant variable of Social Context. This yielded a final target sample of 141 x 2 = 282. This study recruited 562 participants to account for 50% sample attrition. Undergraduates from Indonesia were recruited through posters, email, and flyers. An online questionnaire was used to check whether participants were regular sugared tea consumers and free from diabetes, and 122 did not meet the criteria. Participants with a diabetes diagnosis were excluded because they might moderate their sugar intake to control their blood glucose level, which could potentially undermine the efficacy of the interventions in our study. In addition, 37 eligible participants dropped out midway during the experiment. Thus the final sample analyzed and reported here is 403, which exceeded our target sample size due to our over-estimation of attrition. The sample was gender-balanced with 56.6% female participants. The participant ages ranged between 18 and 26 years, and the participants had a mean BMI (*SD*) of 22kg/m^2 (4.55). The research ethics were approved by the UK University Faculty Research Ethics Board (FHS 234) and the Indonesian University Departmental Ethics Committee.

Design

This study adopted a three-factorial mixed design: 2 (between participant; social context: individual vs group) x 2 (between participant; sugar content nudge: lower sugar tea default vs. regular sugar tea default) x 2 (within participant; competition: absent vs. present). The dependent variable was the percentage of cups (8oz) of lower sugar tea purchased by each participant over eight days consecutively. The first four days were the no-competition condition, and the next four days were the competition condition. In Indonesia, the default option for regular ready-sweetened tea has about 25g of sugar per glass or cup. The less sweetened teas in our study had 12.5g of sugar. The percentage of lower sugar tea chosen over the total number of cups of tea purchased by each participant was calculated and analyzed. For example, a participant who chose seven lower sugar

teas out of seven teas purchased would have a lower sugar intake of 100%, and a participant who chose seven lower sugar teas out of eight teas purchased would have an intake of 87.5%. Percentages were an appropriate measure as they took into account the total number of teas obtained by each participant. Competition conditions were not counterbalanced because it would be difficult to estimate the time it would take to remove the carryover effects should participants be exposed to the competition condition first. Hence, for the competition condition, all participants began the experiment with the control (no competition) condition.

Procedure

Prospective participants completed an online screening and consent form for the study. To obtain informed consent, we informed participants that they would receive free tea vouchers and would either be competing as individuals or in a group to achieve the lowest sugar consumed. Each eligible participant then received eight free tea vouchers and was randomly assigned (randomizer.org) to one of the four between-participant conditions obtained by crossing between the social context (individual or group) conditions and the sugar content nudge conditions (less or regular sugar tea as the default option).

Participants assigned to the lower sugar content nudge condition received vouchers to obtain a cup of lower sugared tea from a vendor at the university cafeteria. However, participants could ask for more sugar from the vendor to sweeten their tea to the regular sugar level. Research assistants working as the vendors selling these teas took note if a participant requested more sugar. Each voucher contained the unique participant ID and day each voucher was to be used (‘1’ to ‘8’). Participation was not anonymous because the research assistants needed to contact each participant to provide feedback on the type of teas they had purchased for the interventions. However, the research assistants were blind to the study’s hypotheses.

Participants in the regular sugar tea nudge condition received the regular sugar tea but could ask for the lower sugar tea option if they wanted it (i.e., lower sugar tea was not the default

option for these participants). Research assistants took note of whether participants took the regular sugar tea or requested the lower sugar option.

All participants in both the individual and group social conditions received their four free tea drink vouchers in the university cafeteria without any competition. After having completed the baseline (no competition) condition, all participants received another four vouchers and either competed with other participants (individual social context condition) or competed in their assigned participant group with other participant groups (group social context condition). Participants competed for the lowest sugar consumption either as an individual or in their assigned participant group. Research assistants reported the participants' or groups' sugar consumption daily through text messages to their phone number (e.g., 2/100 meant that their position was 2 of 100 participants). WhatsApp messenger (WhatsApp Inc., Mountain View, CA) was used for these messages. At the end of the study, the link between the participant IDs and WhatsApp contact numbers were deleted to anonymize the data.

Measures and Materials

The Sugar Content Nudge

The sugar content in the lower sugar tea was 12.5g in a hot or cold 8oz teacup. The regular sugar content was 25g. A teaspoon of sugar is approximately 4g. Hence, a regular sweetened tea had approximately 6.25 teaspoons of sugar while the reduced sugar teas had approximately 3.125 teaspoons of sugar. The additional sugar pack, at 12.5g/pack, was placed next to the teacups, so participants in the lower sugar tea condition needed only one pack to obtain regular sweetness. Conversely, participants taking the regular sugar tea were not given an option to take additional sugar. Teacups were grouped and labelled as "lower sugar" and "regular sugar" so that participants could identify the tea for their vouchers. Participants assigned to the lower sugar tea nudge condition (i.e., the experiment group) were given a voucher for a lower sugar tea but had to ask the vendor for a sugar pack if they wanted it. Participants assigned to the regular sugar tea condition

(i.e., the control group) were given a voucher for a regular sugar tea but had the option to take a lower sugar tea if they wanted it. The research assistants served as the canteen staff and took note of the participants' choices. A total of 31.3% of participants completed eight tea purchases with the mean number of tea purchases made by participants at (*SD*) 6.28 (1.54).

Social Context

Participants were allocated into individual and group conditions. In the individual condition, participants were contacted individually via WhatsApp messenger with information about the vouchers and about the competition. The participants in this condition had no access to communication with each other. In contrast, participants in the group condition were grouped in a four-person team and put in a team chat in WhatsApp messenger. Participants in this group condition could chat within their own team via WhatsApp. However, the group chat was neither monitored nor standardized.

Competition

There were two conditions: no competition and competition. In the first four days, all participants consumed the tea without any information about the competition. However, before the fifth day, the participants received a message via WhatsApp that their sugar intake would be competing with that of other individuals or other groups, with the goal being to achieve the lowest sugar intake. The participant's or team's sugar intake rank position was communicated to the participants daily over the next four days. Participants allocated to the group condition learned daily via WhatsApp what their group's daily sugar consumption was and how it compared with that of the other groups. For participants allocated to the individual social context condition, WhatsApp communicated their individual daily sugar consumption and compared it to that of other individuals.

Results

During the study period, 2,534 teas were purchased. Table 1 lists the percentage of low sugar teas purchased under the various field experimental conditions. See Supplementary Material for the raw data.

A 2 x 2 x2 mixed ANCOVA that used the total number of teas purchased by each participant as a covariate was conducted. The main effect of the covariate was not significant, $F(1, 398) = .68$, $p = .41$, partial $\eta^2 < .01$. This result indicated that the analysis of percentages adequately accounted for the varying number of teas purchased by each participant. The main effect of the sugar content nudge condition was significant, $F(1, 398) = 104.62$, $p < .001$, partial $\eta^2 = .21$. Namely, participants assigned to the low sugar content nudge condition purchased more lower sugar tea, $M(SD) = 78.98\%$ (28.97), than participants assigned to the regular sugar condition, $M(SD) = 43.68\%$ (39.11). The main effect for social context was also significant, $F(1, 398) = 17.20$, $p < .001$, partial $\eta^2 = .04$, such that participants purchased fewer lower sugar teas in the group condition, $M(SD) = 53.82\%$ (37.49), than in the individual condition, $M(SD) = 68.47\%$ (38.55). This significant main effect supports the social loafing effect rather than the social conformity effect. There was a significant interaction between the sugar content nudge condition and social context, $F(1, 398) = 10.21$, $p = .002$, partial $\eta^2 = .03$. Figure 1 shows that the lower sugar tea nudging was less effective in the group social context than in the individual context, as social loafing attenuated the efficacy of the low sugar nudging intervention. In addition, the main effect of competition was non-significant, Wilks' $\Lambda = .998$, $F(1, 398) = 0.95$, $p = .33$, partial $\eta^2 = .002$, though competition interacted with nudging significantly, Wilks' $\Lambda = .945$, $F(1, 398) = 23.16$, $p < .001$, partial $\eta^2 = .06$. Competition did not work synergistically with nudging; it was effective only in the regular sugar condition (see Figure 2). The interaction between competition and social context was not significant, Wilks' $\Lambda = .99$, $F(1, 398) = .59$, $p = .44$, partial $\eta^2 < .001$. Finally, the three-way interaction for nudge by social context by competition was also non-significant, Wilks' $\Lambda > .99$, $F(1, 398) = .018$, $p = .89$, partial $\eta^2 < .001$.

To aid the interpretation of the results for the percentage of lower sugar teas purchased, we analyzed the data for the raw total number of teas purchased by each participant in our study as the dependent variable. The main effect for the sugar content nudge condition was significant, $F(1, 399) = 30.85$, $p < .001$, partial $\eta^2 = .07$. Participants in the lower sugar nudge condition purchased fewer teas, $M(SD) = 5.88(1.45)$, than participants in the regular sugar nudge condition, $M(SD) = 6.69(1.52)$. The main effect for social context was also significant, $F(1, 399) = 18.61$, $p < .001$, partial $\eta^2 = .045$. While in the previous analysis, participants in the group condition purchased fewer lower sugar teas, they purchased fewer teas in general, $M(SD) = 5.97(1.36)$, compared to participants in the individual condition, $M(SD) = 6.60(1.65)$. While in the previous analysis, for the percentage of low sugar teas purchased, the sugar content nudge condition by social context interaction was significant, the analysis for the total teas was not significant, $F(1, 399) = 1.78$, $p = .18$, partial $\eta^2 = .004$. In our previous analysis, the main effect for competition was non-significant; however, this effect was significant for the total number of teas purchased, Wilks' $\Lambda = .83$, $F(1, 399) = 84.24$, $p < .001$, partial $\eta^2 = .17$. Participants in the no competition condition purchased more teas, $M(SD) = 3.36(0.89)$, than participants in the competition condition, $M(SD) = 2.93(1.08)$. Similar to the previous analysis, the competition condition by nudging interaction was significant, Wilks' $\Lambda = .84$, $F(1, 399) = 76.64$, $p < .001$, partial $\eta^2 = .16$. The pattern of results showed that while competition did not affect the percentage of lower sugar teas purchased in the lower sugar nudge condition, participants in this condition purchased fewer teas overall (Figure 2: right graph). The competition by social context interaction was non-significant in the previous analysis, but in this analysis, it was significant, Wilks' $\Lambda = .77$, $F(1, 399) = 118.58$, $p < .001$, partial $\eta^2 = .23$ (Fig. 3): participants in the competition and group condition purchased the least number of teas overall. While the nudge by social context by competition three-way interaction was non-significant in the previous analysis, this interaction was significant for this analysis, Wilks' $\Lambda = .78$, $F(1, 399) = 113.90$, $p < .001$, partial $\eta^2 = .22$. Similar to the previous result (Figure 3), participants in the lower sugar nudge and competition condition purchased fewer teas overall than participants in the other conditions (Figure 4). Overall, the results

suggest that competition affects the overall number of teas purchased rather than the type of tea (e.g., low or regular sugar teas).

Discussion

The present study provides evidence supporting the use of nudging to decrease sugar intake with a large effect size (partial $\eta^2 = .21$). Our behavioral nudge intervention showed how changing the environment choice architecture, such as by providing a lower sugar tea default option, could promote healthier food choice significantly. Asking for additional sugar packs from the tea seller could be regarded by participants as more effortful and time consuming, thus resulting in most participants assigned to the lower sugar tea as default condition sticking with this option. This finding is consistent with that of the previous meta-analysis by Cadario and Chandon (2019), who found that behavioral nudges were the most promising intervention strategy to promote healthier food choices.

Furthermore, our results suggest that nudging exerted a stronger impact on sugar consumption than that reported in the meta-analysis by Cadario and Chandon (2019), which showed that research conducted mainly in individualistic cultures such as the US reported average effect sizes that were small to medium (Cohen's d = 0.39). As mentioned above, the power analysis showed that our study has sufficient statistical power to detect such small to medium effect sizes. The effect size obtained in our study is large by Cohen's standard (Cohen, 1988). We propose two reasons why this might be so. Firstly, by systematically including other interventions in our study, namely social context and competition, we might have reduced the overall error variance in our study, thereby improving our experiment's effect size for nudging. Secondly, it could be that nudging, a more implicit form of behavioral change intervention, might be more effective in collectivist cultures such as Indonesia (e.g., Keane & Su, 2019). Indeed, it has been used in such cultures to successfully reduce unhealthy snacking (Sim & Cheon, 2019) and improve glycemic control among patients with newly diagnosed type 2 diabetes (Vinitha et al., 2019). If the former is the case, this study might

indicate a promising behavioral change advantage for behavioral nudge in non-WEIRD (Western, Educated, Industrialized, Rich, Democratic) samples. Future research might examine this cross-cultural hypothesis more systematically.

In addition, we found evidence for social loafing attenuating the effectiveness of our nudge intervention but did not find evidence supporting the role of group conformity in promoting health behaviors in collectivist Indonesia as participants in the group condition purchased more regular, not fewer, sugar teas than participants in the individual condition. This finding contradicts earlier research that found that working in a team, particularly in collectivistic cultures, might improve the performance of team members (see Simms & Nichols, 2014, for a review). Our results are supportive of a similar social loafing effect in collectivistic Indonesia as was found in individualistic cultures (Cade et al., 2009; Zhang et al., 2016). Social loafing among people from collectivistic cultures might be due to globalization; cultures are less isolated than before, and as a result, mixed values or cultures may emerge. For instance, a shift from collectivist to individualist values due to globalization has been reported for South Korea (Bae & Rowley, 2009). Moreover, in collectivistic cultures, social loafing may emerge when no one can identify individual effort in a group, protecting individual group members from social censure and humiliation (Tinsley & Weldon, 2003).

Despite being a common strategy used in Indonesia, we did not find competition to be an effective intervention. One reason for the lack of a significant main effect for competition could be that our nudging intervention, being a highly effective intervention strategy, might have reduced sugar consumption such that a floor effect limited the effectiveness of other interventions. Similar floor or ceiling effects for interventions have been reported elsewhere (Catts et al., 2009; Netz et al., 2005), and further evidence for this effect is present in the significant interaction we found between nudging and competition (Figure 2). Our data showed that in the lower sugar tea nudge condition, participants in the no competition condition were already purchasing 0 to 1 regular tea, which is very close to the minimal value (i.e., ‘0’). Hence, the introduction of competition to the lower sugar nudge condition could do little to reduce this further. While the use of competition as the only

intervention strategy might work to reduce health behaviors like smoking in schools (e.g., Isensee & Hanewinkel, 2012), combining it with nudging might negate or reduce competition's effectiveness. Hence, our results are consistent with the Saturation Hypothesis, particularly when a potent intervention such as a behavioral nudge is present in a multimodal intervention program.

This study's limitations include participant demand characteristics, the duration of each baseline, drinks serving culture, competition intervention, BMI and prior tea choices as confounding variables, and an undergraduate sample. Firstly, to obtain informed consent, we informed participants *a priori* about our social context and competition interventions. These interventions were also outlined via explicit instructions to our participants (e.g., they were told on the fifth day that they would be competing with other individuals or groups). In addition, tea vouchers and the cups of tea in our study were also labelled as low and regular sugared. These factors could have contributed to participant demand characteristics. Secondly, four days for each treatment might not be sufficient for each group to achieve group cohesiveness, identity, and conformity. Thirdly, participants in the competition condition may not have been strongly motivated to compete because of the low reward (i.e., improving their performance over other individuals or groups) even though non-financial rewards such as a certificate or merchandise are common in Indonesia (e.g., Healthy School Competition by Indonesian Health Ministry in 2019). Future research might investigate the impact of financial incentive on competition to elicit healthy dietary behaviors. Fourthly, we did not control for our participants' BMI and prior tea choices in our study, so these could be confounding variables. There is some evidence that people with obesity prefer sweet food and drink (Sartor et al., 2011) and that people compensate for a prior healthy behavior with a subsequent unhealthy one and vice versa, as outlined in the compensatory health belief model (Amrein et al., 2021). Lastly, educational attainment often relates to a healthy dietary profile and is often an index of socioeconomic status as well (Azizi Fard et al., 2021). Our participants were undergraduates, and there is research evidence to suggest that some behavioral change interventions might be more effective for participants who have higher educational attainment

(Beydoun & Wang, 2008). Hence, future research could address these limitations by, for example, investigating the efficacy of our interventions with a non-undergraduate sample and controlling for these variables.

Our study provides experimental evidence for the effectiveness of nudging in promoting lower sugar consumption in a naturalistic or field setting in collectivist Indonesia. It also shows that social loafing can attenuate the effects of nudging even in a collectivist culture and that competition might be less effective in reducing sugar consumption in a nudging context (i.e., the Saturation Hypothesis). Overall, our study showed that changing the environmental choice architecture via nudging is a practical, highly effective, and useful way to promote healthy eating behaviors in non-WEIRD samples. In addition, when considering the myriad strategies that researchers and policy makers can adopt to change health behaviors, perhaps less is more: as found in our study, if a strong nudge intervention exists, the addition of other less effective interventions might do little to change the target behavior further. Hence, when designing an intervention program, a simpler intervention program that contains fewer intervention techniques might be a more efficient (and cost-effective) design. Future research might also investigate the impact of nudging interventions on biological health indicators such as BMI and fasting blood glucose over a longer time period.

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Table 1

Mean percentage (SD; top row) of lower sugar teas purchased and mean teas purchased (SD; bottom row) by nudging, social context, and competition conditions, N = 403.

		No Competition	Competition
Nudge	Social Context	*M (SD)*	*M (SD)*
Regular Sugar	Individual, *n* = 103	37.22% (43.36) 3.46 (0.86)	54.37% (44.81) 3.45 (0.88)
	Group, *n* = 100	34.42% (40.54) 3.25 (0.87)	49.33% (43.92) 3.22 (0.88)
Lower Sugar	Individual, *n* = 100	91.51% (20.17) 3.06 (1.01)	91.92% (23.61) 3.23 (1.02)
	Group *n* = 100	67.25% (34.88) 3.66 (0.70)	64.50% (42.81) 1.81 (0.63)

Figure 1

Percentage (SE) of lower sugar teas purchased by social context and sugar content nudge condition, N = 403

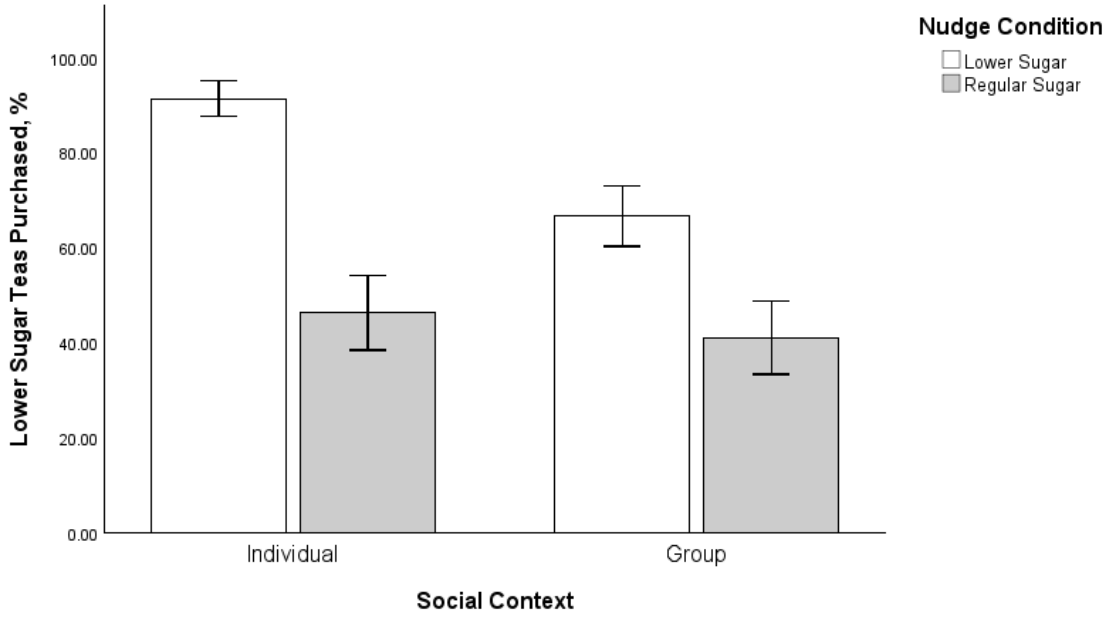

Figure 2

Percentage (SE) of lower sugar tea purchased (left) and total number of teas purchased (SE; right) by competition and sugar content nudge condition, N = 403.

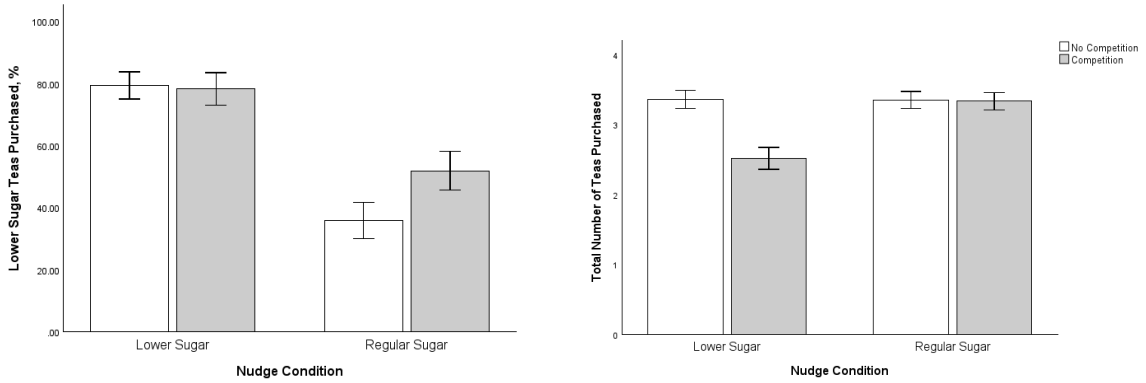

Figure 3

Total number of teas purchased (SE) by competition, social context, and sugar content nudge condition, N = 403.

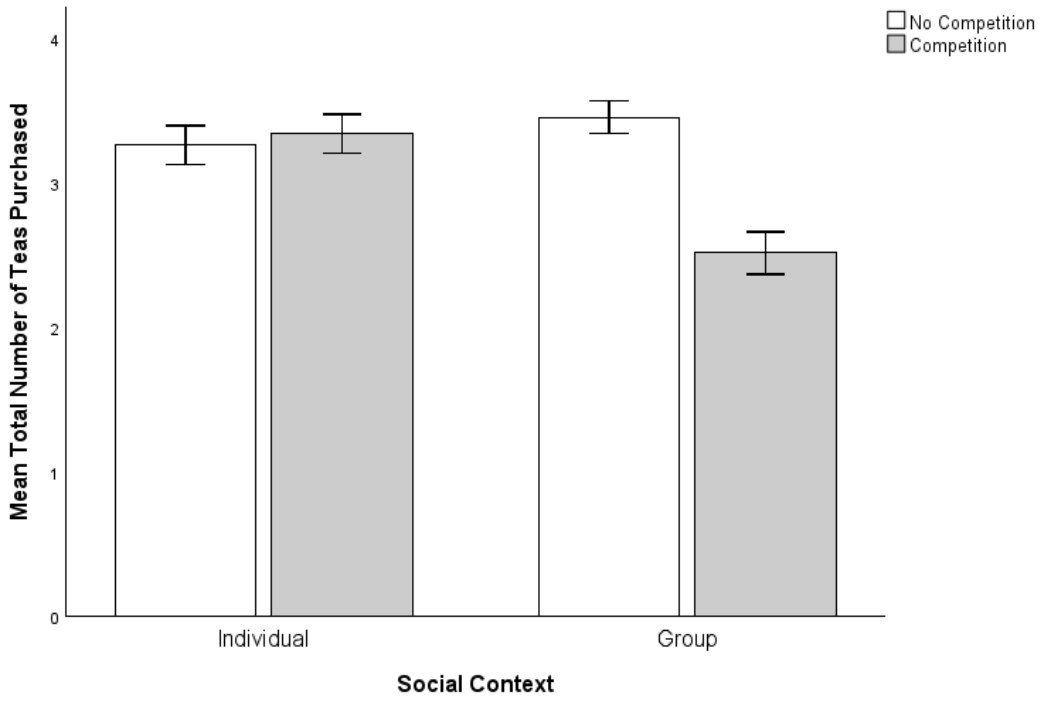

Figure 4

Total number of teas purchased (SE) by competition, social context, and sugar content nudge condition, N = 403.