



## Changes in Snacking Patterns During Covid-19 Lockdown in Adults from Mumbai City, India

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### Abstract

Mumbai was one of the 1<sup>st</sup> cities in India to go into total lockdown in March 2020. The lockdown was expected to have an influence on eating habits specially the snacking patterns. The main objective of this study was to access the change in snacking patterns of participants living in Mumbai city, India during lockdown. Data was collected in 256 Mumbai residents (60 males, 196 females) using Google forms. Information regarding number of meals consumed, meals at which snacks were consumed, change in snacking pattern, reasons for increase or decrease in snacking, and type of snacks consumed during lockdown as compared to before lock was collected. Around 20% reported a decrease, 31% reported no change and 49% reported an increase in snack consumption during lockdown. Participants consumed higher number of meals during lockdown ( $p < 0.05$ ). Significantly higher percentage of participants did not consume store brought snacks during lockdown (30.9% vs 13.7%) ( $p < 0.05$ ). Significantly higher percentage of participants consumed snacks at mid-evening (50.4% vs 33.6%), late evening (48% vs 32%) and late night (32% vs 16.8%) during lockdown as compared to before lockdown ( $p < 0.05$ ). Significant change in lemon-water (57.8% vs 43.4%), coffee (47.3% vs 40.6%) and carbonated beverages (14.8% vs 23.4%) was observed during lockdown as compared to before lockdown ( $p < 0.05$ ). Significant increase in nuts (74.2% vs 65.6%), instant noodles (69.5% vs 60.9%) and biscuits (78.5% vs 68%)



### Article History

Received: 31 March 2021

Accepted: 29 June 2021

### Keywords

COVID-19;  
Food Consumption;  
Lockdown;  
Snacking.

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Doi: <http://dx.doi.org/10.12944/CRNFSJ.9.3.24>

was observed during lockdown as compared to before lockdown ( $p < 0.05$ ). Significant decrease in South Indian (61.75 vs 69.1%), Frankie (32.8% vs 51.6%), bhel (50.4% vs 69.1%), Chinese bhel (21.5% vs 35.5%) and usal (32% vs 40.2%) was observed during lockdown as compared to before lockdown ( $p < 0.05$ ). To conclude, snacks were consumed at more number of meals during lockdown in comparison to before lockdown. A change in type of snacks consumed was observed during lockdown. Ready and easy to eat snacks such as nuts, instant noodles and biscuits showed an increase whereas snacks that require elaborate cooking procedure showed a decrease in consumption. With partial lockdown still persisting in many parts of the country and many still working from home it is imperative to circulate more accurate information on appropriate snacking habits.

### Introduction

The 2019 Coronavirus disease or as now called, COVID-19 is a severe acute respiratory syndrome caused by SARS Coronavirus 2 (SARS-CoV-2). In December 2019, SARS-CoV-2 apparently transited from animals at the Huanan Seafood Market in Wuhan, City of Hubei, Province of China and rapidly spread from there to the rest of the world.<sup>1</sup> Due to growing case notification rates at Chinese and international locations, on 30<sup>th</sup> January 2020, the World Health Organization Emergency Committee declared COVID-19 a Public Health Emergency of International Concern.<sup>2</sup>

SARS-CoV-2 mainly targets the human respiratory system and is primarily thought to transmit from human-to-human among individuals nearby (about 6 feet) with each other through direct contact and droplets.<sup>3</sup> In order to prevent the spread of the disease, nation-wide lockdown was implemented all across the world. In India, the 1<sup>st</sup> lockdown of 21 days was announced on 25<sup>th</sup> March which later extended to almost 2 and half month.<sup>4,5</sup>

Due to this, a sudden and radical change occurred in the lifestyle and eating habits of the population as there was strict restriction from socialisation, outings and gatherings; and meeting face to face. Quarantine being mandatory resulted in a change in lifestyle of people all over the world including a change in eating habits.<sup>6</sup>

There may have been a decrease in consumption of fresh fruits and vegetables owing to limited access to daily grocery shopping, whereas on the other, stockpiling of non-perishable food items

due to fear of unavailability may have resulted in consumption of high calorie foods.<sup>6</sup> COVID-19 also had severe negative psychological impact such as post-traumatic stress syndrome, confusion, anger, frustration and boredom.<sup>7</sup> Stress is known to affect eating habits drastically. Typically, foods high in fats/sugars such as fast foods, snacks and calorie-dense foods are known to be consumed in stress even in absence of hunger and lack of homeostatic need for calories.<sup>8</sup> Hence, stress may have been another reason for change in dietary habits during lockdown.

A snack refers to any food item that is eaten at meals apart from breakfast, lunch or dinner. The term snack also connotes to energy-dense, nutrient-poor foods high in nutrients to limit (sugar, sodium, and/or saturated fat) like cakes, cookies, chips and other salty snacks, and sugar-sweetened beverage.<sup>9</sup> An online survey conducted to assess snacking behaviour during lockdown discovered that late afternoon and late night snacking increased significantly during lockdown.<sup>10</sup>

Even though few studies have explored the changes in dietary patterns during COVID-19 lockdown, there are hardly any studies from India. Also, Mumbai was one of the first cities to undergo a lockdown in India. As of April 2021, Mumbai is currently once again seeing a spike in cases of COVID-19. It is thereby essential to evaluate the snacking habits of residents of Mumbai city during 1<sup>st</sup> lockdown so as to make appropriate recommendations in case the city goes into lock down again. Hence, the main objective of this study was to assess the change in snacking patterns of participants living in Mumbai city, India during lockdown

### Methodology

A rapid assessment survey was conducted using Google Forms. Google form was distributed through various social media platforms such as Whatsapp, Facebook and LinkedIn amongst residents of Mumbai city, India. Results in data collected on 256 adults (60 males and 196 females) is presented in the study.

Information regarding gender and age was collected using pre-structured questionnaire. The mean age of males in study was 25.9±7.4 years and that of females was 24.7±7.5 years ( $p=0.260$ ).

### Snacking Pattern

Snacking pattern before and during lockdown was assessed using a pre-structured questionnaire. Data regarding change in snack consumption, frequency of consumption of store brought snacks and reasons for change in snacking pattern during lockdown was

assessed. The total number of meals consumed before and during lockdown and whether participants consumed snacks at those meals was assessed. A pre-structured list of beverages and snacks was used to assess intake during and before lockdown.

### Statistical Analysis

Analyses were performed using SPSS software for Windows (version 25, 2007, IBM Corporation, Armonk, New York, United State). Cross tabulations were computed for change in snacking patterns by gender and compared using chi-square test. The difference in number of meals consumed and frequency of consumption of store brought snack before and during lockdown was assessed using Wilcoxon Signed Rank test. McNemar's test was used to analyse difference in binomial parameters before and during lockdown.  $P<0.05$  was considered to be statistically significant.

**Table 1: Number of meals consumed and frequency of consumption of store brought snacks before and during lockdown**

	Males (n=60)		Females (n=196)		Total (n=256)	
	Before (%)	During (%)	Before (%)	During (%)	Before (%)	During (%)
<b>Number of meals/ day</b>						
2	26.7	23.3	17.3	12.8	19.5	15.2
3	53.3	23.3	49.5	32.1	50.4	30.1
4	18.3	36.7	28.1	36.2	25.8	36.3
5	1.7	11.7	3.6	14.3	3.1	13.7
6 or more	-	5	1.5	4.6	1.2	4.7
Z value	-3.892		-5.741		-6.886	
P value	0.001		0.001		0.001	
<b>Frequency of consuming store brought snacks</b>						
Never	13.3	25	13.8	32.7	13.7	30.9
Monthly	6.7	11.7	15.3	17.3	13.3	16
Fortnight	5	5	9.2	7.7	8.2	7
Weekly	40	25	36.2	17.3	37.1	19.1
Alternate day	20	20	15.3	18.4	16.4	18.8
Daily	15	13.3	10.2	6.6	11.3	8.2
Z value	-1.931		-4.430		-4.814	
P value	0.054		0.001		0.001	

## Results

Table 1 gives number of meals consumed and frequency of consumption of store brought snacks before and during lockdown. There was a significant change in the number of meals consumed before lockdown and during lockdown. Participants consumed higher number of meals during lockdown as compared to before lockdown ( $p < 0.05$ ). When frequency consumption store brought snacks was assessed, a significant difference was observed in before lockdown and during lockdown intakes ( $p < 0.05$ ). There was a decrease in participants who consumed store brought snacks daily. There was also an increase in participants who never consumed store brought snacks during lockdown.

Table 2 gives change in meals and snacks consumed during lockdown. Overall, higher percentage of participants consumed midmorning, evening, late evening and bedtime meals during lockdown

( $p < 0.05$ ). When gender specific analysis was performed, it was observed that significantly higher percentage of males consumed evening meal and bed time meal during lockdown as compared to before lockdown ( $p < 0.05$ ). Significantly higher percentage of females consumed mid-morning meal, evening and late evening meals and bed time meal during lockdown as compared to before lockdown ( $p < 0.05$ ). All participants consumed snacks at breakfast before and during lockdown. Overall, there was a significant change in consumption of snacks at most of the other meals (i.e. mid-evening, late evening and late night) during lockdown as compared to before lockdown. Significantly higher percentage of males consumed snacks at lunch, late evening and late night during lockdown as compared to before lockdown whereas significantly higher percentage of females consumed snacks at mid-evening, late evening and late night during lockdown ( $p < 0.05$ ).

**Table 2: Number of meals and snacks consumed at meals before and during lockdown**

Meal name	Males (n=60)			Females (n=196)			Total (n=256)		
	Before (%)	During (%)	P value	Before (%)	During (%)	P value	Before (%)	During (%)	P value
<b>Meals consumed</b>									
Early morning	26.7	30	0.774	14.3	11.2	0.286	17.2	15.6	0.607
Breakfast	61.7	70	0.338	77.6	74.5	0.470	73.8	73.4	1.000
Midmorning	30	33.3	0.815	26	35.2	0.016	27	34.8	0.021
Lunch	80	88.3	0.180	87.2	88.8	0.755	85.5	88.7	0.322
Evening	23.3	45	0.004	31.1	48.5	0.001	29.3	47.7	0.001
Late evening	25	33.3	0.359	29.1	37.2	0.027	28.1	36.3	0.013
Dinner	81.7	83.3	1.000	91.3	88.8	0.499	89.1	87.5	0.651
Bed time	16.7	31.7	0.022	12.2	25	0.001	13.3	26.6	0.001
<b>Meals at which snacks were consumed</b>									
Mid-morning	26.7	31.7	0.607	20.9	25	0.230	22.3	26.6	0.153
Lunch	10	25	0.004	12.2	12.8	1.000	11.7	15.6	0.078
Mid-evening	31.7	43.3	0.167	34.2	52.6	0.001	33.6	50.4	0.001
Late evening	15	46.7	0.001	37.2	48.5	0.004	32	48	0.001
Dinner	13.3	20	0.289	11.7	13.8	0.454	12.1	15.2	0.152
Late night	21.7	43.3	0.002	15.3	28.6	0.001	16.8	32	0.001

Table 3 gives change in snacking pattern of study participants during the COVID-19 lockdown. Around

20% reported that there was a decrease in their snack consumption, 31% reported that their snack

consumption was same whereas 49% reported that there was an increase in their snack consumption during lockdown. The changes were similar in both males and females ( $p>0.05$ ). The main reasons for decrease in snack consumption was either difficulty to find snacks in initial months of lockdown, the steadily increasing weight or an increase in price during lockdown. Higher percentage of females

reduced snack consumption due to increase in weight as compared to males ( $p<0.05$ ). The main reason for increase in snack consumption was to combat boredom, using snacks to bond with family, using snacks as an accompaniment while watching TV shows or using snacks as a stress/ anxiety buster. Reasons for increased consumption were similar in males and females ( $p>0.05$ ).

**Table 3: Change in snacking pattern**

Change in snacking pattern	Males (n=60)(%)	Females (n=196)(%)	Total (n=256)	$\chi^2$ value	P (%) value
<b>Change in snack consumption</b>					
Decreased	25	18.4	19.9	1.545	0.462
Same	26.7	32.7	31.3		
Increased	48.3	49	48.8		
<b>Causes for decrease in snack intake</b>					
Difficulty to find snacks	38.3	42.3	41.4	0.305	0.581
Increase in price	26.7	30.1	29.3	0.262	0.609
Due to increased weight	30	46.9	43	5.379	0.020
<b>Causes for increase in snack intake</b>					
Increase in stress/ anxiety	38.3	49	46.5	2.093	0.148
To combat boredom	78.3	76.5	77	0.084	0.772
Food as an accompaniment when binge watching shows	60	55.6	56.6	0.360	0.548
To bond with family	53.3	65.8	62.9	3.067	0.080

**Table 4: Percentage of participants consuming various beverages before and during lockdown**

Beverage	Males (n=60)			Females (n=196)			Total (n=256)		
	Before (%)	During (%)	P value	Before (%)	During (%)	P value	Before (%)	During (%)	P value
Fruit juice	45	46.7	1.000	35.7	32.1	0.418	37.9	35.5	0.561
Tetra juice	26.7	30	0.754	20.9	17.3	0.324	22.3	20.3	0.560
Tea	65	70	0.453	53.1	57.7	0.151	55.9	60.5	0.074
Coffee	50	56.7	0.344	37.8	44.4	0.074	40.6	47.3	0.031
Carbonated drinks	35	23.3	0.143	19.9	12.2	0.009	23.4	14.8	0.002
Energy drink	20	16.7	0.745	12.2	10.2	0.481	14.1	11.7	0.345
Sweet lemon water	46.7	63.3	0.031	42.3	56.1	0.001	43.4	57.8	0.001
Salty or sweet buttermilk	51.7	63.3	0.065	55.6	52.6	0.470	55.1	62.1	1.000

Table 4 gives intake of various beverages before and during lockdown. Overall, significantly higher percentage of participants consumed sweet lemon water and coffee during lockdown as compared to before lockdown whereas carbonated beverages intake reduced significantly during lockdown ( $p<0.05$ ).

**Table 5: Percentage of participants consuming various snack items before and during lockdown**

Food items	Males (n=60)			Females (n=196)			Total (n=256)		
	Before (%)	During (%)	P value	Before (%)	During (%)	P value	Before (%)	During (%)	P value
Fruits	66.7	81.7	0.064	79.1	79.1	1.000	76.2	79.7	0.349
Nuts	63.3	76.7	0.096	66.3	73.5	0.093	65.6	74.2	0.017
Chocolate	60	61.7	1.000	71.4	75	0.381	68.8	71.8	0.366
Cakes or pastries	55	41.7	0.134	57.7	52.6	0.268	57	50	0.070
Jellies or custard	26.7	26.7	1.000	26	24	0.635	26.2	24.6	0.665
Indian sweets	56.7	56.7	1.000	54.1	56.1	0.699	54.7	56.3	0.731
Sandwich	60	46.7	0.096	68.9	66.8	0.658	66.8	62.1	0.169
South Indian	65	60	0.549	70.4	62.2	0.038	69.1	61.7	0.023
Batata vada/ bhajiya/ samosa	56.7	50	0.454	61.7	58.7	0.480	60.5	56.6	0.268
Frankie/ veg roll	50	31.7	0.013	52	33.2	0.001	51.6	32.8	0.001
Instant noodles	65	60	0.508	59.7	72.4	0.001	60.9	69.5	0.005
Bhel puri/ sev puri/ pani puri	60	41.7	0.027	71.9	53.1	0.001	69.1	50.4	0.001
Chinese bhel	40	28.3	0.118	34.2	19.4	0.001	35.5	21.5	0.001
Dry farsan	28.3	35	0.424	44.4	37.8	0.080	40.6	37.1	0.306
Khakra	36.7	38.3	1.000	42.9	37.2	0.100	41.4	37.5	0.212
Usal/ missal/ dabeli	41.7	40	1.000	39.8	29.6	0.003	40.2	32	0.007
Thepla/ bhakri	36.7	40	0.791	38.3	37.8	1.000	37.9	38.3	1.000
Bread	68.3	66.7	1.000	62.2	67.9	0.153	63.7	67.6	0.275
Khari puff	63.3	58.3	0.629	45.4	50.5	0.194	49.6	52.3	0.457
Biscuits	76.7	81.7	0.549	65.3	77.6	0.002	68	78.5	0.001
Chips	63.3	56.7	0.424	61	65.8	0.298	61.6	63.7	0.640
Popcorn	36.7	35	1.000	48.5	45.4	0.451	45.7	43	0.427

When gender specific analysis was performed, it was observed that intake of sweet lemon water increased significantly in both males and females ( $p<0.05$ ). Even though carbonated beverage intake decreased in both males and females, the difference was significant only in females ( $p<0.05$ ).

Table 5 gives intake of various foods that are consumed as snacks in India. Overall, intake of nuts, instant noodles and biscuits increased in participants during lockdown whereas intake of South Indian foods, Frankie/ veg roll, bhel puri/ sev puri/ pani puri; Chinese bhel, usal/ missal/ dabeli decreased in participants during lockdown ( $p<0.05$ ).

When gender specific analysis was performed, it was observed that, it was observed that in males, intake of Frankie/ veg roll and bhel puri/ sev puri/ pani puri decreased significantly during lockdown ( $p<0.05$ ). In females, intake of South Indian snacks, Frankie/ veg roll; bhel puri/ sev puri/ pani puri and usal/ missal/ dabeli reduced whereas intake of instant noodles and biscuits increased during lockdown ( $p<0.05$ ).

### Discussion

In the current study, the changes in snacking patterns in participant living in Mumbai city, India during the COVID-19 lockdown period have been described. Most participants in the study reported

change in snacking pattern (either increase or decrease) during the lockdown period. The number of meals consumed increased during lockdown and there was an increase in participants consuming mid-evening, late evening or late night snacks. A higher percentage of participants consumed snack items during main meals. There was also a change in type of snack items consumed by the participants.

The World Health Organization issued guidelines during COVID-19 lockdown to help individuals make wise and healthier food choices. The guidelines focused on reducing intake of high fat, high salt and high sugar foods and emphasised to have home-made food, being strategic about use of fresh ingredients, making informed choices about portion sizes, eating fresh and healthy, consume enough fibre and staying hydrated and consuming.<sup>11,12</sup> However, unlike the guidelines, many International studies reported an unhealthy change eating habits during lockdown including the current study.

In a large multi-centric study across Europe, North-Africa, Western Asia and America (ECLB-COVID19 International Online Survey) it was observed that total number of meals consumed per-day drastically increased during the confinement period with larger percentage of participants consuming 5 or more meals as compared to before confinement.<sup>13</sup> An increase in number of meals consumed per day was also observed in studies from United Arab Emirates<sup>14</sup> and Kuwait.<sup>15</sup> In the current study also an increase in number of meals consumed each day was observed.

An increase in consumption of meals other than main meals was observed in the current study. Also an increase in consumption of snacks at was observed in between meals and at late night. These findings are in line with results observed in other studies. An increase in snacking in between meals or late night was also observed in the ECLB-COVID19 International Online Survey.<sup>13</sup>

Even though not statistically significant, an increase in consumption of breakfast, lunch and dinner was also observed in the current study. Similar results were observed in the study from Kuwait wherein percentage of participants skipping the main meals during lockdown was lesser than that before lockdown.<sup>15</sup> This indicates that even if not significant,

more individuals choose to eat main meals during lockdown.

However, the downside to an increase in consumption was also observed in the current study wherein more participants reported consuming snack items at almost all meals specially a significant increasing trend was observed at lunch. Easy availability of snack items or increased experimentation with cooking at home may be one of the reasons for an increased consumption of snacks.<sup>16</sup> There was a significant decrease in consumption of store brought snacks in the current study. However, there was not a significant decrease in percentage of participants consuming many snacks in the current study (Table 5). Thus, this indicates an increase in home-cooking and eating more home-made food as also observed in other studies from Poland,<sup>16</sup> Saudi Arabia<sup>17</sup> and United Arab Emirates<sup>14</sup>

Food accessibility maybe impaired during confinements which could easily impact the overall diet quality.<sup>18</sup> Moreover, the impending possibility of job losses, reduced incomes and uncertainties regarding the future might speculatively lead some people to reduce their expenditures including those for food.<sup>19</sup> Other reasons for change in food increase could include stress/ anxiety and boredom during quarantine, lose weight.<sup>14,18</sup> Similar reasons were found in the current study for change in snack consumption (Table 3).

In a survey conducted in Italians, an increased consumption of hot beverages was observed whereas a decrease was observed in consumption of sweet beverages during lockdown.<sup>20</sup> In the current study also a significant increase in consumption of coffee was observed (Table 4). Even though not significant, there was an increase in consumption of tea during lockdown in current study. Thus, the results of the present study are in line with other studies that indicate an increase in consumption of hot beverages.<sup>15,18</sup>

Study conducted in Kuwait demonstrated no change in consumption of fizzy drinks, energy drinks whereas it depicted a decrease in consumption of fresh fruit juices.<sup>15</sup> In the current study, there was a very small change in percentage of participants who consumed fresh fruit juice during lockdown as compared to before lockdown (Table 4). This may be due to the

fact that there was an increased awareness about benefits of fruits for immunity which may have boosted the participants to continue consuming fruit juices during lockdown. Another surprise change was a significant increase sweet lemon water which may also be due an increased awareness of role of vitamin C and lemons in boosting immunity (Table 4). Unlike the Kuwait study, there was a significant decrease in consumption of carbonated beverages in the current study which may due to an increased awareness towards healthy eating patterns.

Majority of participants reported consuming similar amounts of fruits and vegetables in Italy,<sup>18,20</sup> Spain<sup>21</sup> and Kuwait.<sup>15</sup> Similar results were observed in the current study (Table 5). Higher percentage of participants showed an increase in consumption of chocolates, cakes, spreads, ice-cream in the Italian study<sup>18</sup> whereas no such changes were observed in study from Kuwait.<sup>15</sup> The results in the current study are in line with the study from Kuwait as no significant changes were observed in consumption of chocolates, cakes or pastries, jellies or Indian sweets in the present study.

There was a significant increase in consumption of biscuits and instant noodles in the current study which may be due to easy availability, low price point and easy storability of biscuits at home. There was a significant decrease in consumption of most salty snacks in the current study. The reduction in consumption of the salty snacks (Table 5) may be either due to less availability of snacks due to closure of street food stalls or restaurants or simply an attempt to eat healthier foods.

There were a few limitations faced during the study. As this was an online survey, the weight, height and body mass index of participants could not be assessed and thereby it was not possible to draw any associations between weight and changes in snacking patterns. Also, owing to the fact that this was an online survey, the frequency consumption of foods before and during lockdown could not be collected as the questionnaire would have been too long if frequency of food intake was collected. Frequency intake of food would have further enhanced the understanding of changes in food consumption in Indian population. Another limitation of the current study was that it focused only on

consumption of snacks and did not calculate the actual nutrient intake as collecting appropriate and accurate dietary recall using an online questionnaire would have been a difficult task.

However, despite these limitations, the study holds a lot of merit. India is a multi-cultural country. Mumbai being a metropolitan city and financial capital of India, has individuals of all cultures residing in Mumbai and hence the study can be representative of changes in dietary consumption in most cities in India. Also, the study can form basis for further research and can be used to formulate guidelines for healthy snacking in Indian participants given the risk of a second lockdown due to increasing number of cases in India specifically in Mumbai.

### Conclusion

To conclude, snacks were consumed at more number of meals during lockdown in comparison to before lockdown. A change in type of snacks consumed was observed during lockdown. Ready and easy to eat snacks such as nuts, instant noodles and biscuits showed an increase whereas snacks that require elaborate cooking procedure showed a decrease in consumption. With partial lockdown still persisting in many parts of the country and many adults are still working from home it is imperative to circulate more accurate information on appropriate snacking habits.

### Recommendations

- Adults who are working from home should follow a healthy diet. They should consume 3 major meals – breakfast, lunch and dinner and 2 mid-meals.
- At 3 major meals, wholesome, homemade food comprising of moderate to high protein, moderate carbohydrates and low in fat should be consumed.
- Adults should not consume snack items during main meals.
- Snack items should be restricted to in between meals such as mid-morning and evening and avoid late night snacking.
- Snack items should consist of wholesome foods such as fruits, salads, nuts and dry-fruits; low fat-homemade snacks and healthy drinks such as salted buttermilk, salted lemon water, coconut water or whole fruit juices to keep hydrated.

- Participants should avoid high-fat, fried snacks, avoid drinking a lot of coffee or tea. They should also avoid consumption of sugary foods such as cakes, chocolates and biscuits.

#### Funding

No external funding was availed for this study.

#### Conflict of interest

The authors declare no conflicts of interest

#### Acknowledgement

Authors would like to thank all the participants for filling the Google form for this survey.

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