Impact of
outside food
on people
around
Kolkata

Sangbartta
Banerjee
(22214110026),
Jayita
Karmakar
(22214270021),
Upasak
Chattejee
(22214111005)

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Presidency University, Kolkata

June, 2024

Impact of outside food on people around Kolkata

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- Kolkata, the "City of Joy", the city where the nights are busy as the mornings, is a place where people, regardless of whether they are a student studying or a salaryman or a healthcare and sanitation worker, struggle tirelessly for a better future.

Introduction

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Jayita
Karmakar
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- Kolkata, the "City of Joy", the city where the nights are busy as the mornings, is a place where people, regardless of whether they are a student studying or a salaryman or a healthcare and sanitation worker, struggle tirelessly for a better future.

- Food will always be the most important necessity regardless of who they are, no matter how rich or famous or poor they are. At the end of the day people need to eat.

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- Nowadays with the huge development in the hospitality industry getting access to not only the basic amenities but also to the recreational food has become easier than ever.

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- People unlike the older times can access the facilities on a much easier level.

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- People unlike the older times can access the facilities on a much easier level.

- Online food delivery services have revolutionized the entire culture of consuming outside food. People earlier could only consume outside food by physically going to the location of the shops selling those services. But now people have the option of ordering and enjoying outside food from the comfort of their homes which has undeniablely increased the consumption of outside food in general.

Contd.

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- Our objective is to find the impact of consumption of outside food on the people of Kolkata.

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Through the survey, we wanted to answer the following
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Through the survey, we wanted to answer the following
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- Correlation between no. of times outside food consumed to
  no of times gastric problems faced.

Objectives

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Through the survey, we wanted to answer the following
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- Testing on percentage of student's pocket money spent on
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- Testing if students consume more outside food.

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- Correlation between no. of times outside food consumed to
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- Testing if students consume more outside food.
- Checking if people who consume more outside food have
  higher BMI compared to those who do not.

Objectives

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- Checking if people who reside away from home consume
  more outside food

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Our method of collection of data was through an online
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Data Collection Method
Choice of Data Collection method:

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- **Cost-Effective:** Online surveys are significantly cheaper than traditional methods such as phone or face-to-face interviews. There are no printing or postage costs, and data can be collected and processed electronically, reducing labor expenses.

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- **Wide Reach:** Online surveys can reach a large and diverse audience, regardless of geographic location. This allows researchers to gather data from a broader population, which can lead to more generalizable results.
- **Convenience for Respondents:** Participants can complete surveys at their convenience, using their own devices, and at a time that suits them. This flexibility can lead to higher response rates and more accurate data.

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- **Quick Data Collection:** Online surveys enable rapid data collection. Responses can be gathered in a fraction of the time it would take using traditional methods, and researchers can often see the results in real-time.

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- **Easy to Design and Modify:** Online survey platforms often provide user-friendly interfaces and tools for designing surveys. They also allow for easy modifications and updates to the survey if needed.Personalization and Customization: Surveys can be customized to tailor questions based on previous responses, creating a more engaging experience for the respondent and ensuring relevant data is collected.

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We were also aware of the problems that came with using the method of online questionnaire method, which will be discussed later, but we still chose to use it since the pros out-weighed the cons.

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- Besides, we sent it out to our friends and relatives and asking them to spread it in their respective social circles and so-forth.

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- Besides, we sent it out to our friends and relatives and asking them to spread it in their respective social circles and so-forth.
- We followed the Simple Random Sampling Without Replacement (SRSWOR) scheme.

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- We first determined the essential questions that we were needed the data on for our project. Then after we came to terms with each other, we decided that we will divide our questionnaire into three pages with each pages asking questions related to the topic of the page so to avoid cross-questions and confusion for the respondents.

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- Our survey started with a brief introduction of who we were and what was our motive for conducting the survey.

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- We made the questionnaire to be attractive to the respondents by using some warm and comforting colors and pictures.

- Our survey started with a brief introduction of who we were and what was our motive for conducting the survey.

- We also clearly stated that their perosonal information would only be used for our academic purposes and nothing else.

Figure: Introduction to the Questionnaire

Survey on consumption of outside food

Hello to you! We are 2nd year undergraduate students of the department of Statistics in Presidency University. We are conducting a survey to analyse the impact of outside food on the current residents of Kolkata. Your cooperation is highly appreciated. Please provide us with the best answers to your knowledge. Your data is secured and safe with us and won't be used for any other research other than ours.

Switch account

Not shared

* Indicates required question

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- The first page of our questionnaire asks for their names, age, weight and job/profession alongwith their monthly income.

- It also askes about the information of their residence and whether they live away from their family.

- The information about their profession gives us a crucial insight on the lifestyle on the respondent. As our target population was the entire population of people currently residing in Kolkata, it includes people who have come to Kolkata from a different region for either study or work related issues.

- This piece of information is crucial to us as we have a feeling that the people staying away from their homes tend to consume more outside food compared to the people staying in Kolkata with their families.

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Figure: First page of Questionnaire

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- The second page of our questionnaire focused on the type of food that is consumed by the responder.

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- How many times does the responder engage in the consumption of outside food.

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- The second page of our questionnaire focused on the type of food that is consumed by the responder.
- How many times does the responder engage in the consumption of outside food.
- The data obtained here will provide us with the information of the general trends in eating habits of people.

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Figure: Second page of questionnaire

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- The third page contains questions regarding the recent gastrointestinal issues the responder may have faced in a couple of days.

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- We are also asking for an average amount of time the responder has reached out for medical service regarding the gastrointestinal issues.

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- We are also asking for an average amount of time the responder has reached out for medical service regarding the gastrointestinal issues.
- Plus we have specifically asked for the method they use for the treatment since in India people generally tend to avoid visiting a doctor and try to solve the problem using their traditional remedies.

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- Plus we have specifically asked for the method they use for the treatment since in India people generally tend to avoid visiting a doctor and try to solve the problem using their traditional remedies.

- Finally we end our questionnaire with by asking the amount of money the responder spends on outside food in a month.

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Figure: Third page of the questionnaire

We have tried to make sure that our questionnaire isn't too big otherwise the responders will generally not reach the end of the quesionnaire. But we made sure that we can extract all the necessary information.

After the first 80 or so entries the inflow of data was slowing down. We re-circulated the forms to the best of our abilities. We noticed that a huge portion of our entries were by the people of years 18-25, which is to be expected since young adults are generally more accustomed to these kind of services than the elderly section of the population.

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```
## 'data.frame': 145 obs. of  25 variables:
##  $ Timestamp  : chr  "04/09/2024 22:08" "04/08/2024 21:26" "04/09/2024 23:20" "04/08/2024
##  $ Name       : chr  "Suparna chakraborty " "Arindam Nath" "Sejuty mondal" "Shampa Pathak
##  $ Age        : int  32 30 30 26 26 24 24 22 22 22 ...
##  $ Sex        : chr  "Female" "Male" "Female" "Female" ...
##  $ Height.in.m.: num  1.52 1.83 1.52 1.53 1.54 ...
##  $ Weight.in.kgs.: num  56 81 62 52 62 82 65 53 79 69 ...
##  $ Pin        : num  7.12e+05 7.43e+05 7.41e+05 7.43e+05 7.06e+09 ...
##  $ Profession : chr  "Student/Researcher" "Student/Researcher" "Student/Researcher" "Stude
##  $ Q8         : chr  "No" "Yes" "Yes" "Yes" ...
##  $ Q9         : int  2000 35000 40000 500 500 2500 10000 5500 10000 5000 ...
##  $ Q10        : chr  "Non-vegetarian" "Non-vegetarian" "Non-vegetarian" "Vegetarian" ...
##  $ Q11        : int  5 1 10 1 3 4 25 7 30 30 ...
##  $ Q12        : chr  "To dine-in" "Through food delivery apps(like Zomato, Swiggy, etc.)"
##  $ Q13        : int  4 7 2 3 30 0 10 25 30 30 ...
##  $ Q14        : chr  "Chinese" "North Indian" "Chinese" "Chinese" ...
##  $ Q15        : chr  "Sweets" "Cake/Pastries" "Cake/Pastries" "Ice cream" ...
##  $ Q16        : int  3 2 1 1 0 4 15 7 15 30 ...
##  $ Q17        : chr  "Personal Choice" "For breakfast/lunch in workplace" "For breakfast/l
##  $ Q18        : chr  "Yes" "No" "No" "No" ...
##  $ Q19        : int  3 0 1 3 15 20 1 1 1 0 ...
##  $ Q20        : chr  "Allopathic medicine" "Do nothing" "Do nothing" "Home remedies" ...
##  $ Q21        : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ Q22        : chr  "No" "No" "No" "No" ...
##  $ Q23        : chr  "0" "More than 2" "Less than 1" "0" ...
##  $ Q24        : int  200 2000 2000 100 300 2000 6000 1500 3000 4000 ...
```

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The data we received are categorized in the above data summary where:

- Q8 stands for the question 'Do you reside away from your family?'
- Q9 stands for the question 'What is your average monthly income? (Your pocket money in case you are student)'
- Q10 stands for the question 'Which type of food do you primarily consume?'
- Q11 stands for the question 'On an average, how many times a month do you consume outside food?'
- Q12 stands for the question 'How do you prefer to consume outside food?'
- Q13 stands for the question 'On an average how many times do you consume from street vendors in a month?'
- Q14 stands for the question 'What is your preferred choice of cuisine?'

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- Q15 stands for the question 'What is your preferred choice of dessert?'
- Q16 stands for the question 'How many times a month do you consume outside food as a meal?'
- Q17 stands for the question 'What is the most likely reason you consume outside food?'
- Q18 stands for the question 'Have you faced any gastric problems(gas/acidity/stomach upset etc) in past 15 days?'
- Q19 stands for the question 'On an average how many times a month do you face gastric problems as mentioned above?'
- Q20 stands for the question 'When you face gastric problems what remedy do you opt for?'
- Q21 stands for the question 'How regularly do you have to consult a medical professional for your gastric problems? (On a scale of 1 to 5)'

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- Q22 stands for the question 'Do you have a health-checkup on a regular interval?'

- Q23 stands for the question 'How many hours do you spend daily on fitness?'

- Q24 stands for the question 'Approximately how much money do you spend on outside food in a month?'

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After we collected the data we found out that our answers that some of the answers were not according to the desired formats, and a few absurd answers, like absurd height and weight.

What is your average monthly income? (Your pocket money in case you are student)
Student / 3000 rupees pocket money per month

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Throughout the data there was a need to preprocess it, a lot of the entries were not in the form that we expected them to be. For example, In the answers for the Height(in fts) and Weight(in kgs) question, we were expecting to get only numerical data, but what we got in a large portion of answers were alpha-numeric values.

Height(in fts)	Weight(in kgs)	What is your preferred choice of dessert?	How many times a month do you consume outside food as a meal?
5.66		67 Ice cream	18
6		76 Sweets	25
6		52 Sweets	Once
5		55 Ice cream	1
6'3"		78 Crème brûlée	5-10
5.8ft	54kg	Ice cream	50% of a month
5 feet 7 inches	68 kg	Ice cream	20 times
5.3		36 Ice cream	4 to 5
6		75 Ice cream	20
5.1		47 Sweets	20 to 25 times
5		37 Cake/Pastries	10
5.42		60 Ice cream	4
5.2 ft	62 kg	Ice cream	2-3
5 ft 11 inch		80 Sweets	4
5.8		55 Ice cream	10
5'4"		65 Ice cream	Very rare
5'8"		90 Sweets	2
5.1		53 All four options	Daily
5.1		49 Ice cream	15
5ft 3 inch		63 Chop, Singara	never
5.3		70 Sweets	10
5.8		60 All of the above	0
5.7		74 Ice cream	2
5 ft		72 Snacks	1
5'4"		43 Ice cream	30
5'2"		57 Cake/Pastries	0 or 1 time

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- So not only did we have to convert the height data to feets but also we had to again transform it into metres, whereas in weight column we only had to change the alphanumeric values into just numeric values, viz, removing the 'kg' in the answer.

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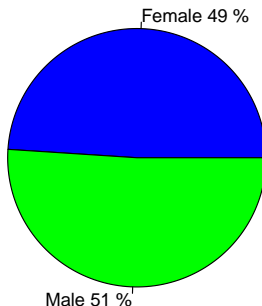
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- We kept the option for open-answers to as less as possible but in some of the questions it was necessary otherwise the answers of the respondents would've become a bit too forced.

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Next, we made a pie chart showing the gender ratio male :
female:

Gender Ratio

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Here, we created a pie-chart showing the ratio of non-vegeterians : vegetarians

Type of Food

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(22214111005)
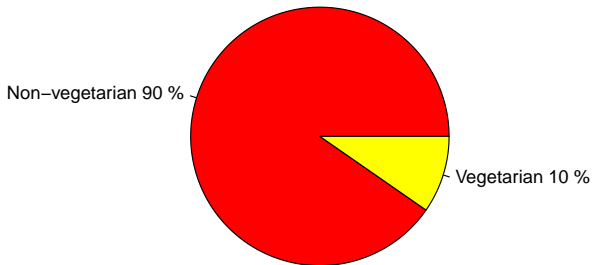
Now, we view the profession of the respondents:

Types of profession
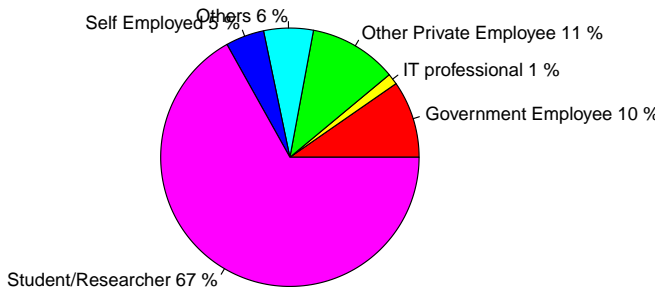
Self Employed 5 % Others 6 % Other Private Employee 11 %

IT professional 1 %

Government Employee 10 %

Student/Researcher 67 %
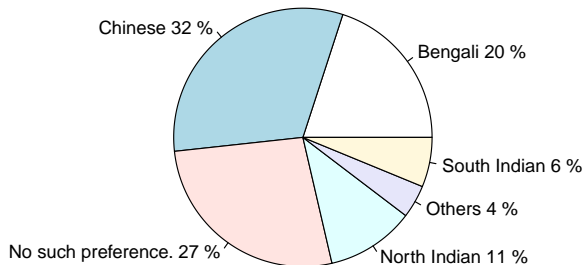
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We created a pie chart representing the choice of cuisines among the respondents:

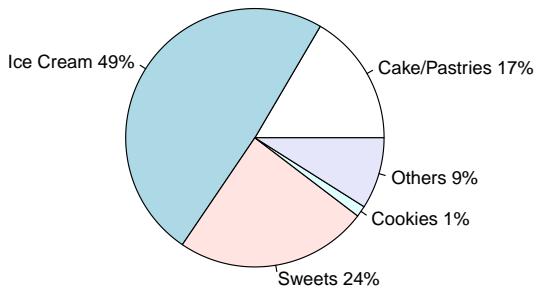**Pie–Chart of Different Types of Cuisines Consumed By People**

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Next, we add another pie chat showing the preferred choice of desserts

Pie chart of the preferences of differnt dessert type

Next, we created a pie chart showing the preferred mode of consumption of outside food, viz. through dine in or food delivery apps.

Pie chart representing the different preference of cuisines

To dine–in 41 %

Through food delivery apps 59 %

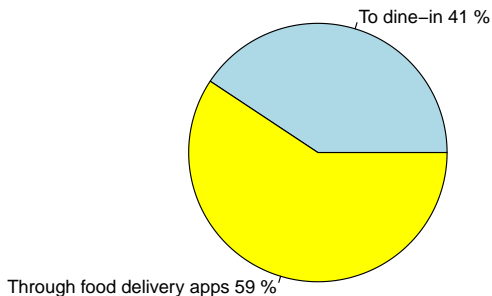**Impact of outside food on people around Kolkata**

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Now we will see most likely reason to consume outside food i.e for lunch , breakfast, party etc

Reasons for consumption of outside food

For breakfast/lunch in workplace 31 %

During long commute hours

For dinner 17 %

Other 8 %

Personal Choice 34 %

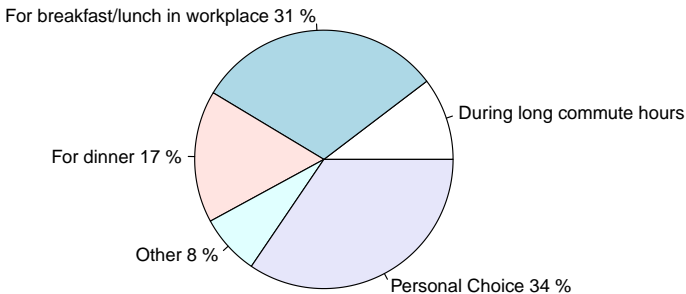**Impact of outside food on people around Kolkata**

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Next, we created a pie chart showing the number of people who reside away from home and who do not:

Do You Reside away of your family

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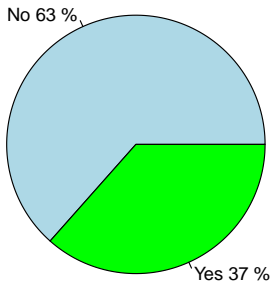
Now, we view the distribution of income of the respondents through boxplot , and the summary is also given

Boxplot representing the income distribution across the respondents
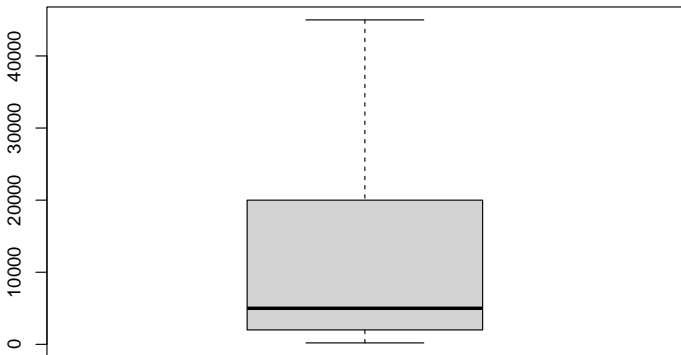
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```
##      Min. 1st Qu.  Median     Mean 3rd Qu.     Max.
##       200    2000    5000    17215   20000   200000
```

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Now we will visualize the pattern of outside food consumption
i.e how many times they consume outside food in a month via
stem leaf plot along with the summary

```
##
##   The decimal point is 1 digit(s) to the right of the |
##
##   0 | 00000111111111111122222222222222233333333333333344444444444
##   0 | 555555555555555556666667788889
##   1 | 00000000000000000122223444
##   1 | 5555557
##   2 | 00344
##   2 | 55555556
##   3 | 00000000003
##   3 | 55
##   4 | 0
##    Min. 1st Qu. Median   Mean 3rd Qu.   Max.
##   0.000   3.000   5.000   9.917  14.000  40.000
```
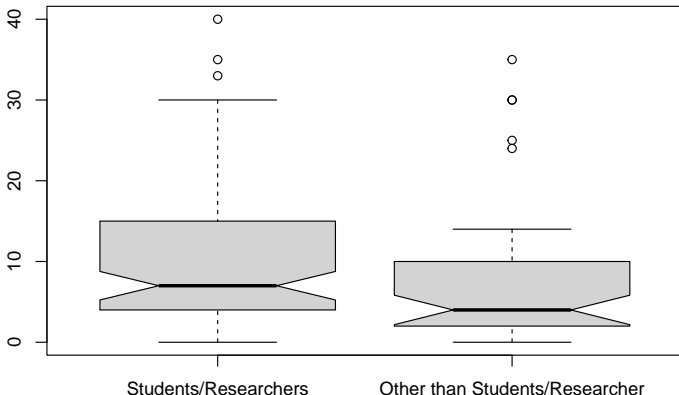
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Now we will compare the pattern of food consumption among students and non students

Boxplot comparing the outside food consumption among students vs other than students

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Now we will see the food consumption pattern with respect to age

Average no of times outside food consumed in different age groups

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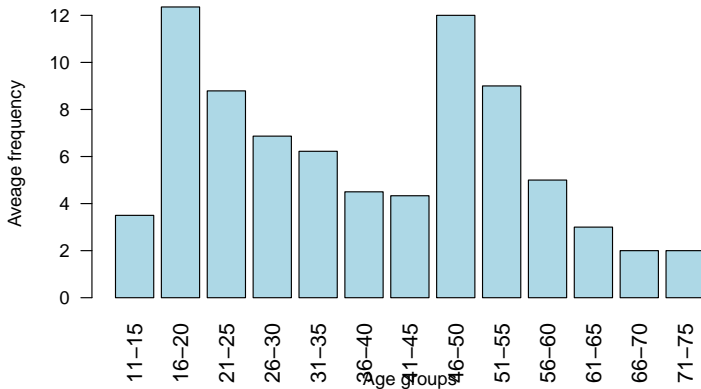
Now we will see how many times in a month gastric problem is faced by respondents

Barplot to show The frequency of gastric problems in a month

No of times gastric problem is faced
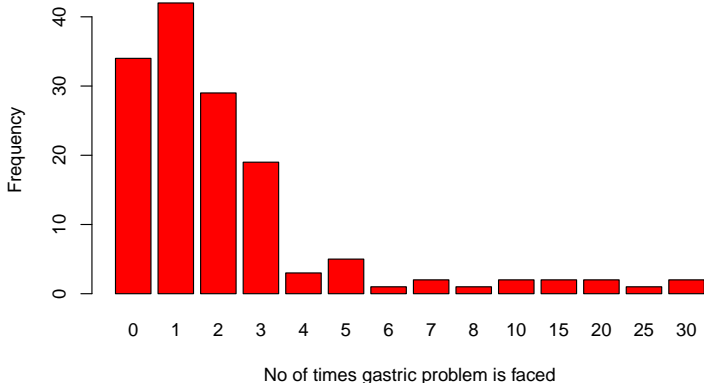
Inferential Analysis

Testing on correlation no of times outside food consumed and no of times gastric problems faced:

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We will try to find if there is any correlation between gastric problem and consumption of outside food. We have used three different methods to find the sample correlation between the two variables. -

- Pearson's product-moment correlation coefficient,
- Kendall's τ ,
- Spearman's ρ

```
cor(data[,12],data[,20],method="pearson")

[1] 0.05598256

cor(data[,12],data[,20],method="kendall")

[1] 0.1889679

cor(data[,12],data[,20],method="spearman")

[1] 0.2444562
```

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As we can see, the sample correlation is extremely weak for Pearon's product moment correlation coefficient, but Kendall's τ , and Spearman's ρ suggest the presence of some weak positive correlation.

Now, we perform statistical test to confirm the presence of any correlation present.

Using Pearson's product-momemt corrlation coefficient:

```
cor.test(data[,12],data[,20])


Pearson's product-moment correlation

data:  data[, 12] and data[, 20]
t = 0.67051, df = 143, p-value = 0.5036
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.1080124  0.2170114
sample estimates:
       cor
0.05598256
```

Testing using the Kendall's τ :

```
cor.test(data[,12],data[,20],method="kendall")


Kendall's rank correlation tau

data:  data[, 12] and data[, 20]
z = 3.0129, p-value = 0.002588
alternative hypothesis: true tau is not equal to 0
sample estimates:
      tau
0.1889679
```

Since the p-value is < 0.05, there is evidence to believe that there is a non zero (a weak positive) correlation between the two.

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Testing using Spearman's ρ:

```
cor.test(data[,12],data[,20],method="spearman")


Spearman's rank correlation rho

data:  data[, 12] and data[, 20]
S = 383877, p-value = 0.003044
alternative hypothesis: true rho is not equal to 0
sample estimates:
       rho
0.2444562
```
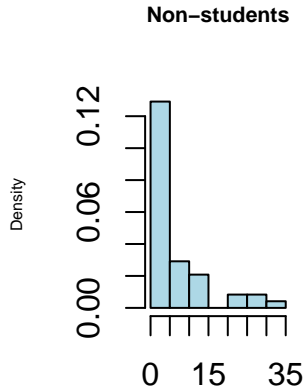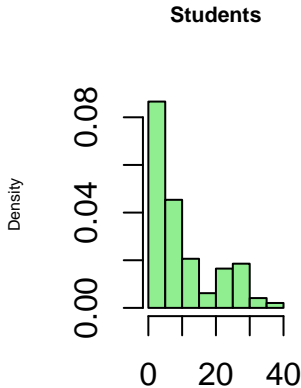
Since the p-value is < 0.05, there is evidence to believe that there is a non zero (a weak positive) correlation between the two In conclusion, since Pearson's poduct-moment correlation coefficient is low, there is no linear dependence between the variables. However, as Kendall's τ , and Spearman's ρ show weak positive correlation, we may conclude that they are weakly correlated in terms of monotonicity.

Inferential Analysis

Testing if students consume more outside food:

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Sangbartta Banerjee (22214110026), Jayita Karmakar (22214270021), Upasak Chattejee (22214111005)

First, we try to visualise the distribution of consumption of outside food in students and non students:

Students

Density

0.08

0.04

0.00

0   20   40

No of times outside food consumed

Non–students

Density

0.12

0.06

0.00

0   15   35

No of times outside food consumed

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So we plot histograms of the two variables after taking log, and try to fit a normal curve:

Students

Non–students

No of times outside food consumed

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However, as we know that t-test is robust to slight departures from normality, we shall still use it, to get a result:

```
t.test(a[is.finite(a)],b[is.finite(b)],"greater")


Welch Two Sample t-test

data:  a[is.finite(a)] and b[is.finite(b)]
t = 2.6307, df = 88.861, p-value = 0.005021
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 0.1736772       Inf
sample estimates:
mean of x mean of y
 2.020538  1.548804
```

Since the p-value is < 0.05, we will reject the $H_0 : \mu_{st} = \mu_{nst}$ against $H_1 : \mu_{st} > \mu_{nst}$, i.e. it is statistically significant that students consume more outside food than non-students.

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Now, we shall approach the problem in a non-parametric sense, because the t-test was not fully justified. We shall test if the number of times students consume outside food is stochasticly larger than the number of times non-students consume outside food. To do that, we shall use Mann-Whitney U test:

```
wilcox.test(food_cons.st,food_cons.nst,alternative="greater")


Wilcoxon rank sum test with continuity correction

data:  food_cons.st and food_cons.nst
W = 2947.5, p-value = 0.004539
alternative hypothesis: true location shift is greater than 0
```

Since the p-value is < 0.05, we will reject the $H_0 : \mu_{st} = \mu_{nst}$ against $H_1 : \mu_{st} > \mu_{nst}$, i.e. it is statistically significant that students consume more outside food than non-students.

Inferential Analysis

Testing if people who consume more outside food have higher BMI (Body Mass Index):

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We need to first clearly define what do we mean by "More outside food". Here we have taken that It is considered more outside food if no of times outside food consumed ≥ 10

Next we shall plot boxplots to get a rough compaison between the sampled data of BMI of those who consume more outside food and those who do not:
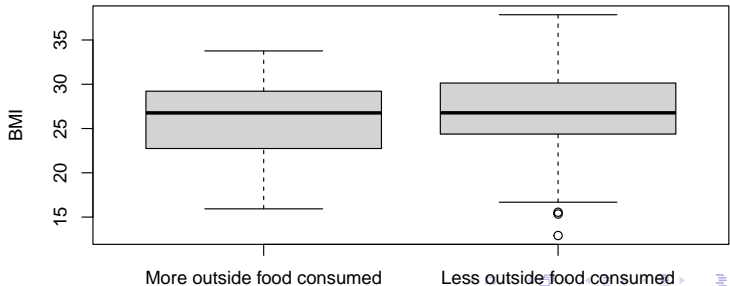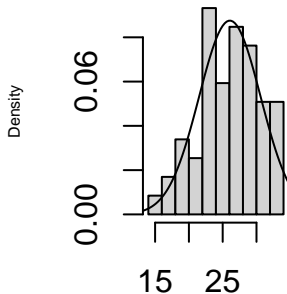
Inferential Analysis

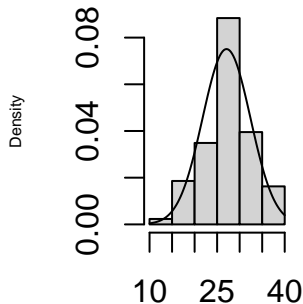Testing if people who consume more outside food have higher BMI (Body Mass Index):

Now, we shall check the distibution of the two variables:

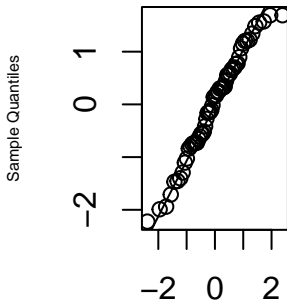**More outside food consumed**

Less outside food consumed

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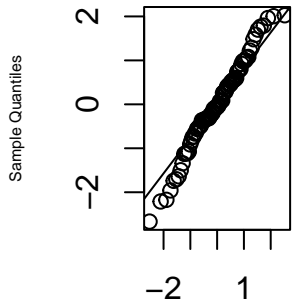
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More outside food consumed

Less outside food consumed

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We note that the distributions are roughly normal, so we shall use t-test owing to the robustness of the test.

```
t.test(bmi.more,bmi.less)


Welch Two Sample t-test

data:  bmi.more and bmi.less
t = -1.2433, df = 135.94, p-value = 0.2159
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -2.6559698  0.6054913
sample estimates:
mean of x mean of y
 26.06167  27.08691
```

Since p-value is > 0.05 we may conclude that there is no statistically significant difference between means of the two variables.

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Now, since the distribution are not perfectly normal, we shall perform a Mann-Whitney U test too:

```
wilcox.test(bmi.more,bmi.less)


Wilcoxon rank sum test with continuity correction

data:  bmi.more and bmi.less
W = 2264, p-value = 0.2727
alternative hypothesis: true location shift is not equal to 0
```

Since p-value is > 0.05 we may conclude that there is no statistically significant difference between the two variables.

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Alternatively, we can perform another test, to check the association between food consumed and BMI.

Here we shall create another categorical random vaiable that checks if BMI is more than $25 kg/m^2$ or less, and use a Pearsonian Chi-Square test with Yate's correction, to test for independence.

We create the contingency table as:

```
          More outside food consumed Less outside food consumed
More BMI                          38                         58
Less BMI                          23                         25
```

```
chisq.test(obs.freq,correct=T)


Pearson's Chi-squared test with Yates' continuity correction

data:  obs.freq
X-squared = 0.60083, df = 1, p-value = 0.4383
```
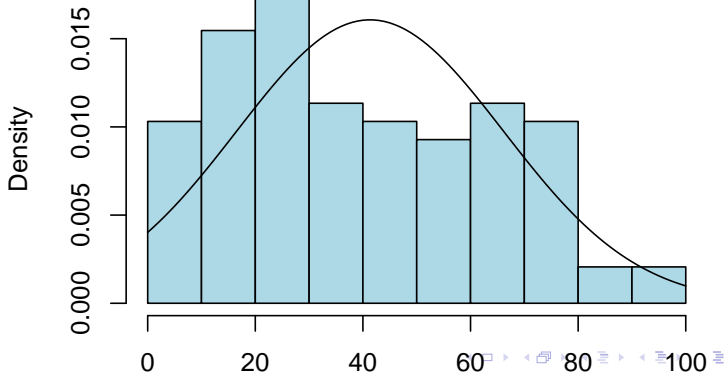
Since p-value is > 0.05, we can conclude that the minor

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We shall first try to identify the distribution of the percentage of money spent by students/researchers on outside food:

Histogram of percentage of money spent of outside food

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As we can see that the distribution is far from normal distribution. So, we shall perfom a non-parametric single sample sign test on the median of percentage of student's money spent on outside food.

```
median(exp.out.p)

[1] 37.5
```

Let μ_e be the population median for the percentage of money spent by students/researchers on outside food.
We want to test $H_0 : \mu_e = 37.5$ against two sided alternative $H_1 : \mu_e \neq 37.5$.
Consider the test statistic:

$$T = \sum_{i=1}^{n} 1_{[x_i \in (37.5, \infty)]} \sim Binomial(N, 0.5)$$

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After omitting exact ties with the median we have

$$N = \sum_{i=1}^{n} 1_{[x_i \neq 37.5]}$$

So, under H_0, $T \sim Binomial(N, 0.5)$.

So, we shall test using binom.test() function.

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Inferential Analysis

Testing on what percentage of student's money is spent on outside food:

```
T=sum(exp.out.p>37.5)
N=sum(exp.out.p!=37.5)
binom.test(T,N,0.5)


Exact binomial test

data:  T and N
number of successes = 48, number of trials = 96, p-value = 1
alternative hypothesis: true probability of success is not equal to 0.5
95 percent confidence interval:
 0.3961779 0.6038221
sample estimates:
probability of success
                  0.5
```

Since p-value is> 0.05, we may accept the null hypothesis, that
the population median is 37.5

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We consider a food consumption > 10 per month to be more outside food consumption.

Hence, we have two categorical variables- "Frequency of outside food consumed" having categories "More", "Less", and "Whether a person reside away from family" having categories "Yes" and "No"

Hence, we compute the odds ratio to test for association.

Odds ratio (OR) $= \frac{f_{AB} \cdot f_{ab}}{f_{Ab} \cdot f_{aB}}$

- Where f_{AB} denote the cell containing people who reside away from family and consume more outside food
- f_{Ab} denote the cell containing people who reside away from family and consume less outside food
- f_{aB} denote the cell containing people who do not reside away from family and consume more outside food
- f_{ab} denote the cell containing people who reside do not away from family and consume less outside food

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	More outside food	Less outside food
Reside away from family	22	33
Reside with family	24	67

[1] 1.861111

Since the Odds ratio is 1.86111 which is > 1, we can conclude "Staying away from family" and "More food consumption" are positively associated.

Hence, if a person is residing away from family he/she is more likely to consume outside food.