

# A Business Model Proposal based on Customer Feedback

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## Abstract

This article is a short analysis of the data collected from thecourse participants of the **Fundamentals of Data Analytics using R programming**. A baseline descriptive analysis is conducted and the results are tested using hypothesis testing for generalization.

*Keywords:* Baseline analysis, categorical data, Likert scaled items, correlation testing, regression models, box plot, bar plot, percentage analysis,  $\chi^2$ -test, ANOVA., Baseline analysis, categorical data, Likert scaled items, correlation testing, regression models, box plot, bar plot, percentage analysis,  $\chi^2$ -test, ANOVA.

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## 1. Introduction

This article is prepared during the add-on course- **Data Analytics using R programming**. A questionnaire is prepared and administered through *Google form*. Total number of samples collected in the study is 255.

## 2. Data cleaning and Wrangling

As the first stage of the data pre-processing, the row data is cleaned and wrangled to make it ready for statistical analysis. Main processes involved are:

1. Removing unnecessary columns
2. Rename the attributes for make them clear and precise
3. Mapping of data types for statistical analysis
4. Re-frame the structure of the data if required

### 2.1. Rename the attribute names

Since the column titles obtained through the *Google forms* are the questions given in the questionnaire, it will be not suitable to represent an attribute. There are two ways to correct it- manually correct in the downloaded excel file or rename the column names programatically.

In this article, the later approach is demonstrated.

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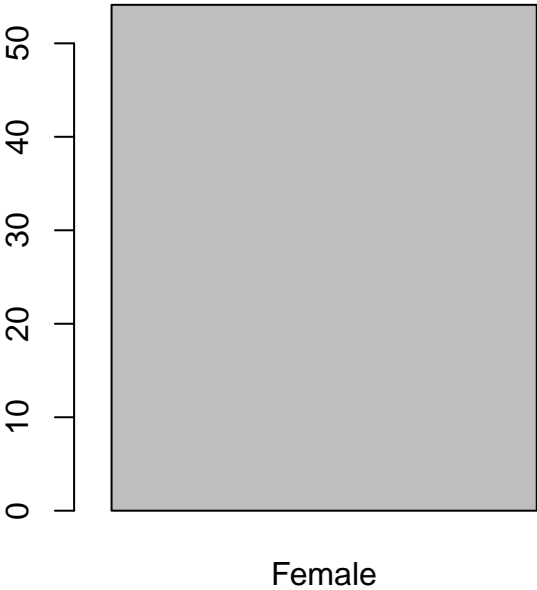
<sup>2</sup>Another author footnote.

2.2. Descriptive Analysis

A cleaned data is examined with basic statistical tools to understand the distribution of various attributes and its relationship between control variables. At this initial stage, fundamental tools like frequency tables, cross tabulations and percentage analysis followed by proper visualizations will be used. All the socio-demographic variables and control variables will be analysed statistically.

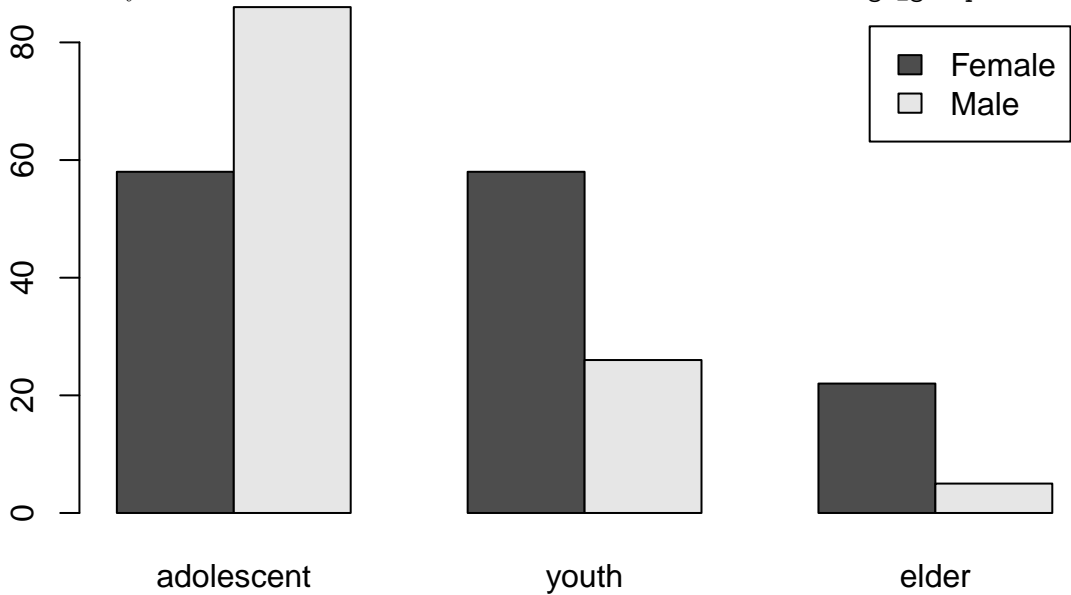
Gender

The gender-wise distribution of the responses is shown in the following Table.  
The percentage analysis shows that majority of the respondents are from Female category.



A barplot showing this distribution is shown in the following Figure.  
>Age

Completed age of the respondents are collected through the form. Interest of respondents may be varied over age range rather than individual ages. So the continuous variable **age** shall be converted to a categorical variable for reasonable use of this attribute. Respondents with age upto 20 is consider as 'adolescent', between 20 and 30 as 'youth' and above 30 is considered as the 'elder'. A new variable **Age\_group** is created as follows.



A contingency

table of the gender-wise distribution over age-group is shown in the Table below:

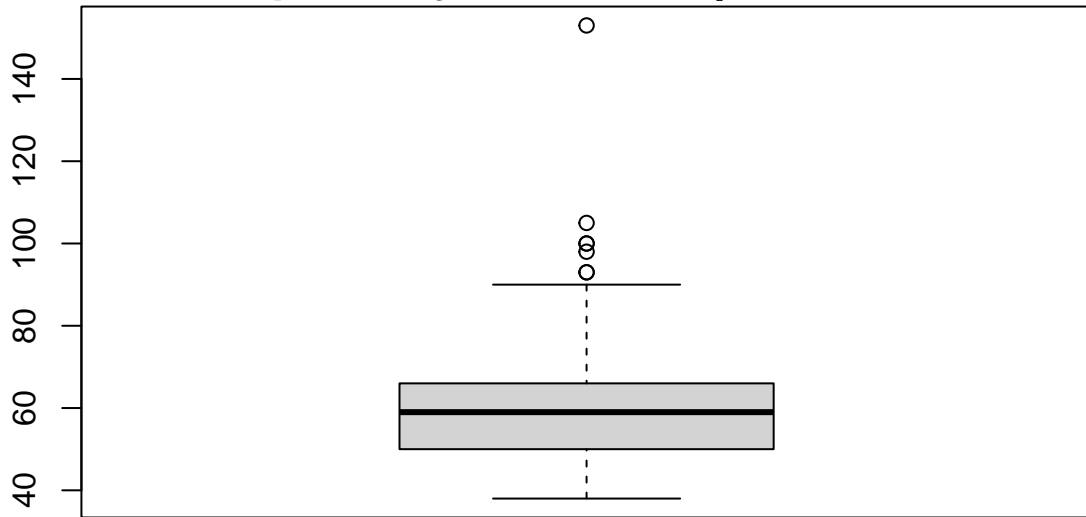
|            | Female | Male |
|------------|--------|------|
| adolescent | 58     | 86   |
| youth      | 58     | 26   |
| elder      | 22     | 5    |

### 2.2.1. Conversion of data into long format

The basic objective of this work is to compare the respondent preference of fruit based on their interest shown in the survey. So responses regarding preference of various fruits under the study should be brought together before statistical investigations. To achieve this goal, the \*wide formatted\*\* data is transformed into the long format with a column for fruits and the corresponding preference level.

#### Weight

The distribution of respondent's weights is shown in the Boxplot shown below:



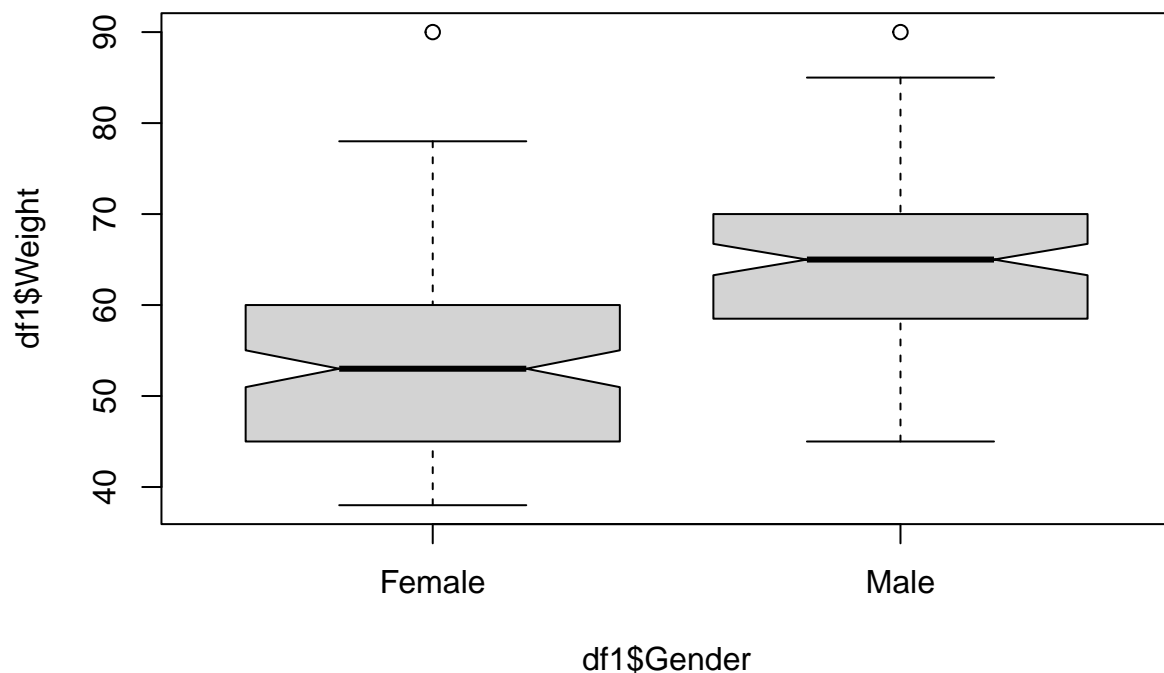
The five point

summary of the attribute 'weight' is shown in the Table below:

| ## | Min.  | 1st Qu. | Median | Mean  | 3rd Qu. | Max.   |
|----|-------|---------|--------|-------|---------|--------|
| ## | 38.00 | 50.00   | 59.00  | 59.86 | 66.00   | 153.00 |

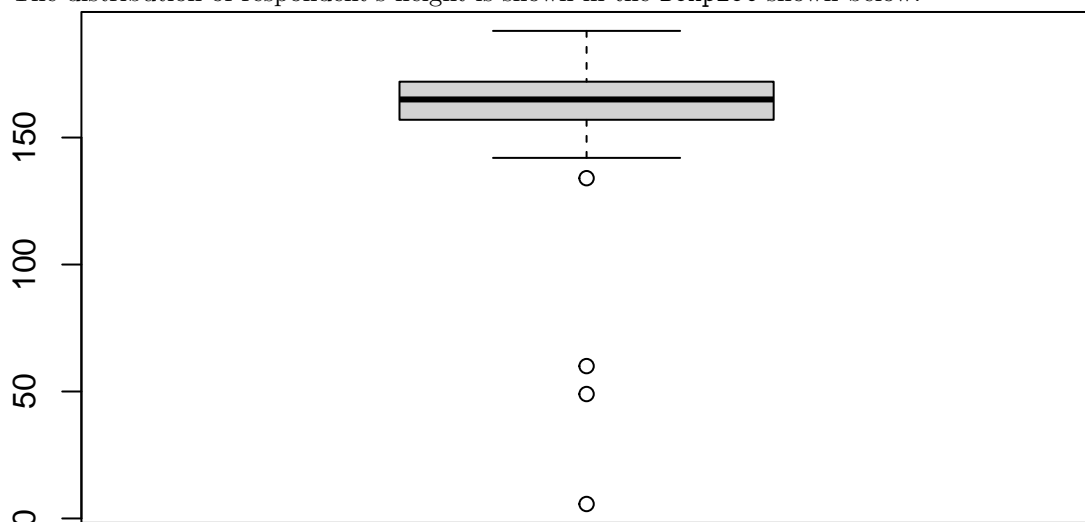
It is noted that the box plot shows the presence of outliers in the weights. These samples can be removed as follows:

A gender-wise comparison of weights is shown in the following figure. It is clear from the plot that, the majority of the female category is above the average body weight category!



Height

The distribution of respondent's height is shown in the Boxplot shown below:



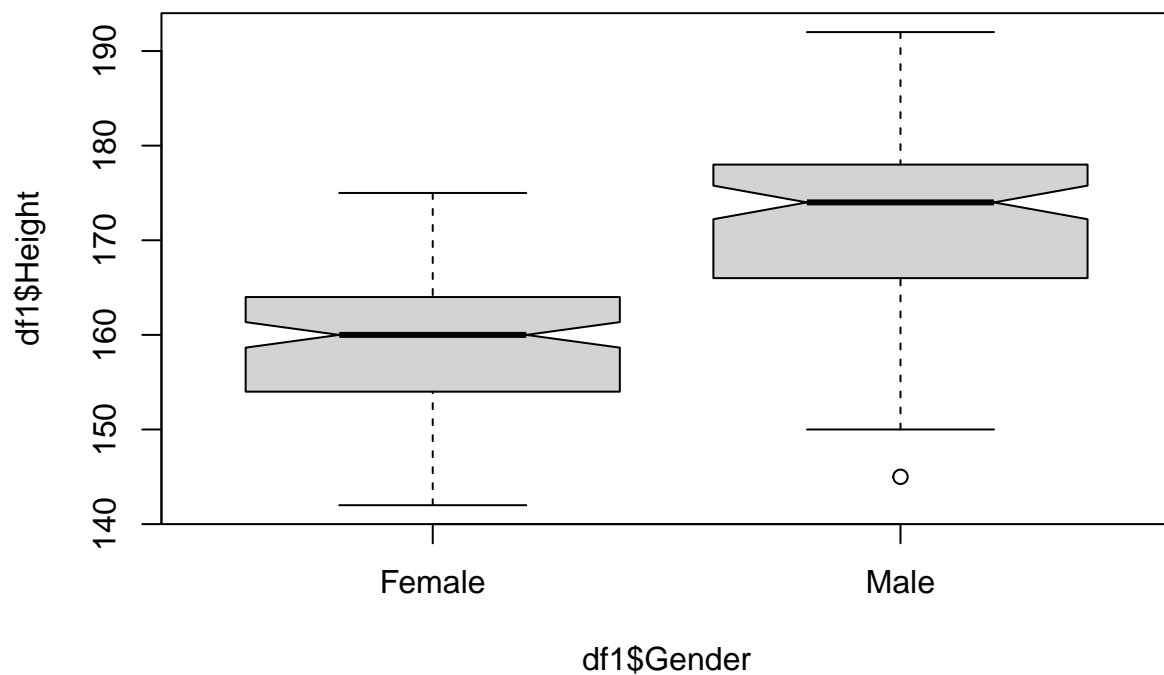
The five point

summary of the attribute 'Height' is shown in the Table below:

| ## | Min. | 1st Qu. | Median | Mean  | 3rd Qu. | Max.  |
|----|------|---------|--------|-------|---------|-------|
| ## | 5.7  | 157.0   | 165.0  | 163.5 | 172.0   | 192.0 |

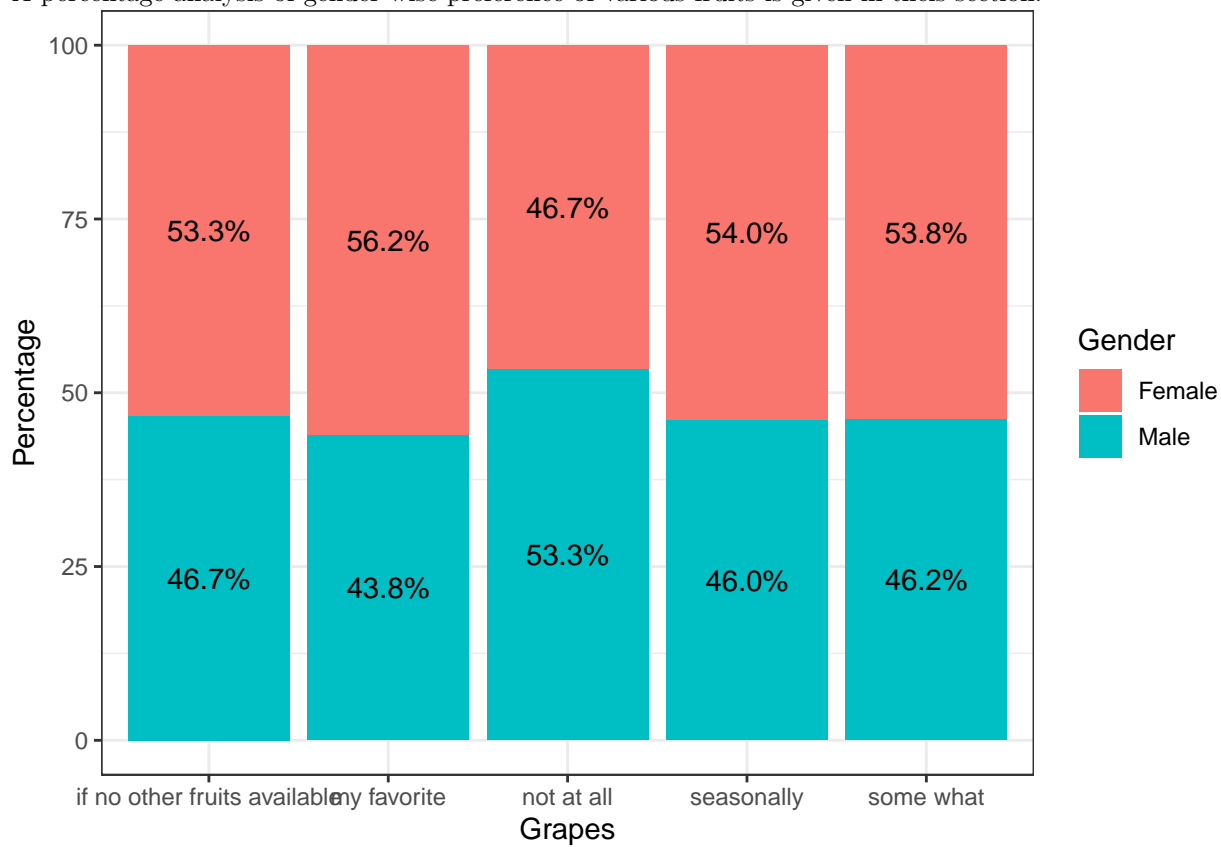
It is noted that the box plot shows the presence of outliers in the weights. These samples can be removed as follows:

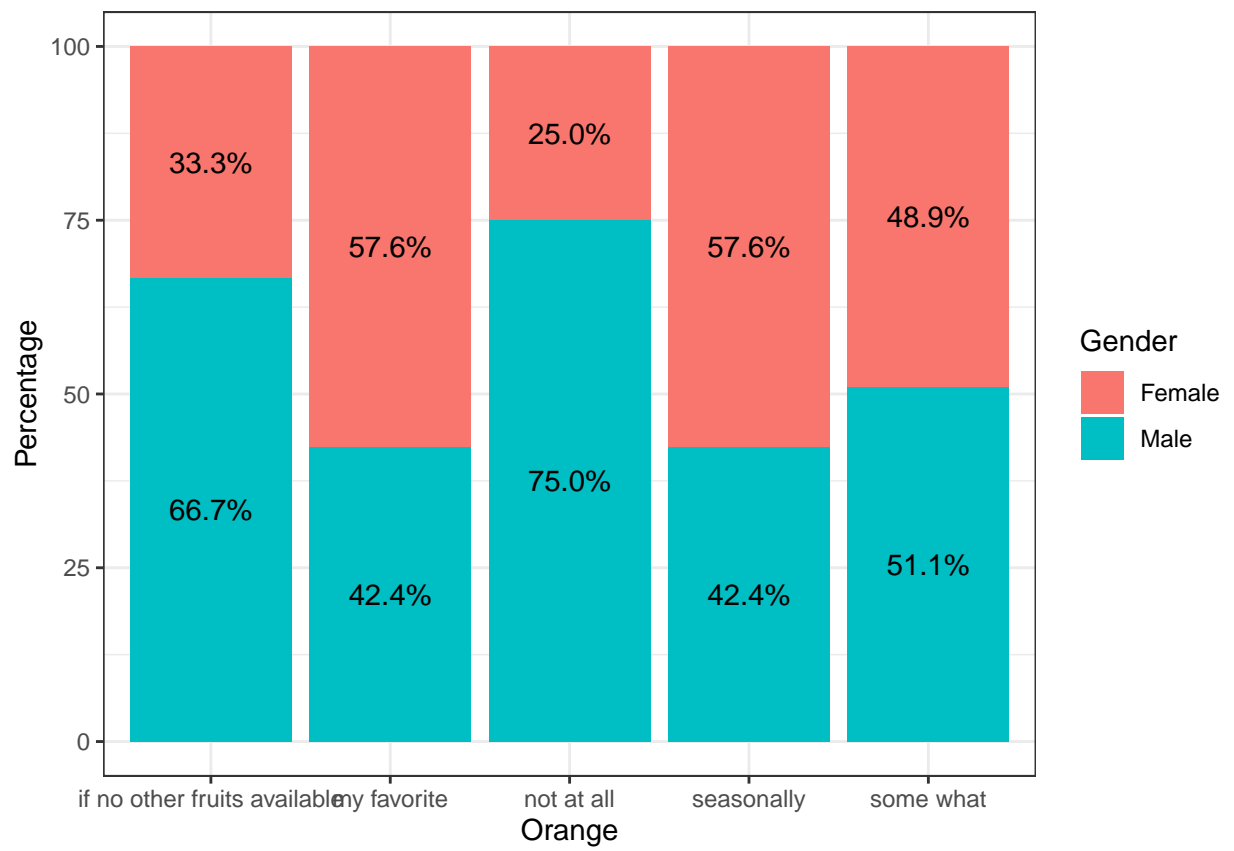
A gender-wise comparison of heights is shown in the following figure. It is clear from the plot that, the majority of the female category is below the average height category!

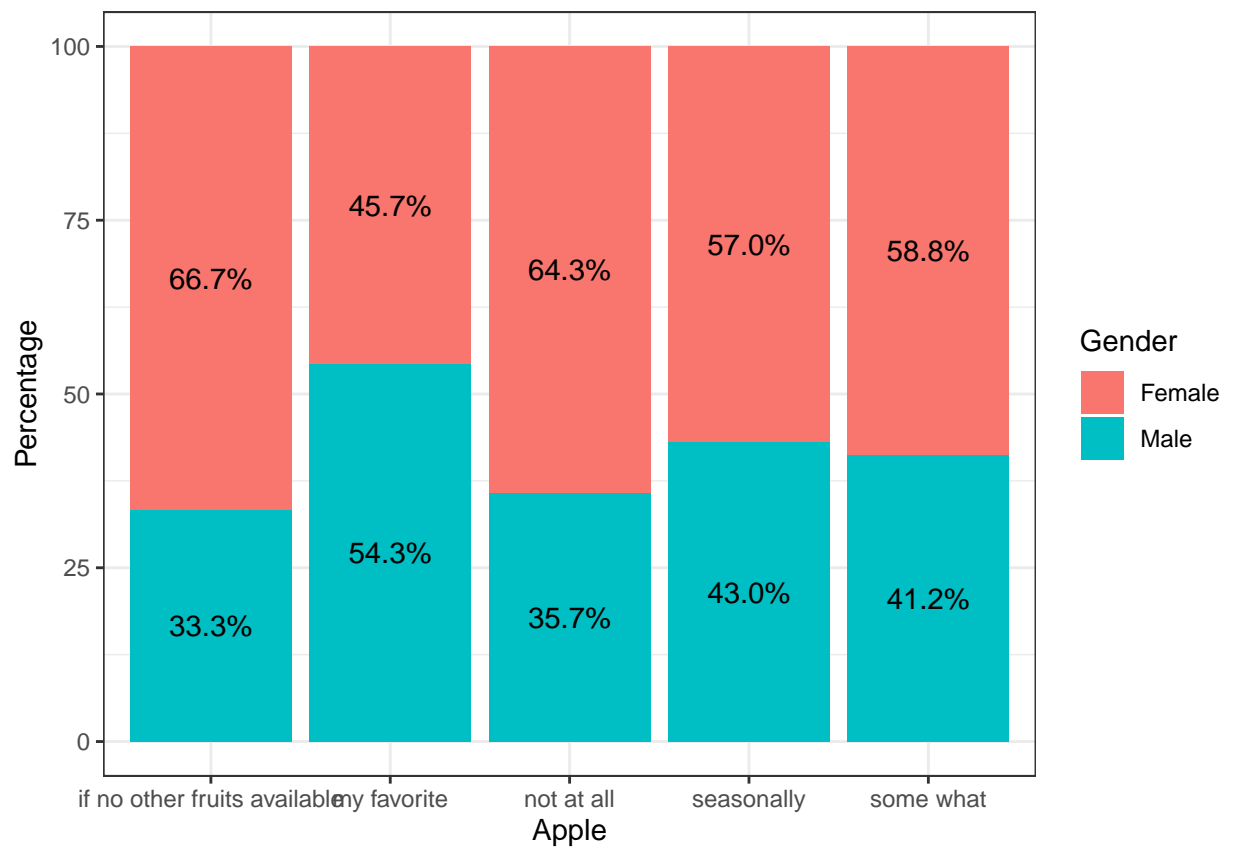


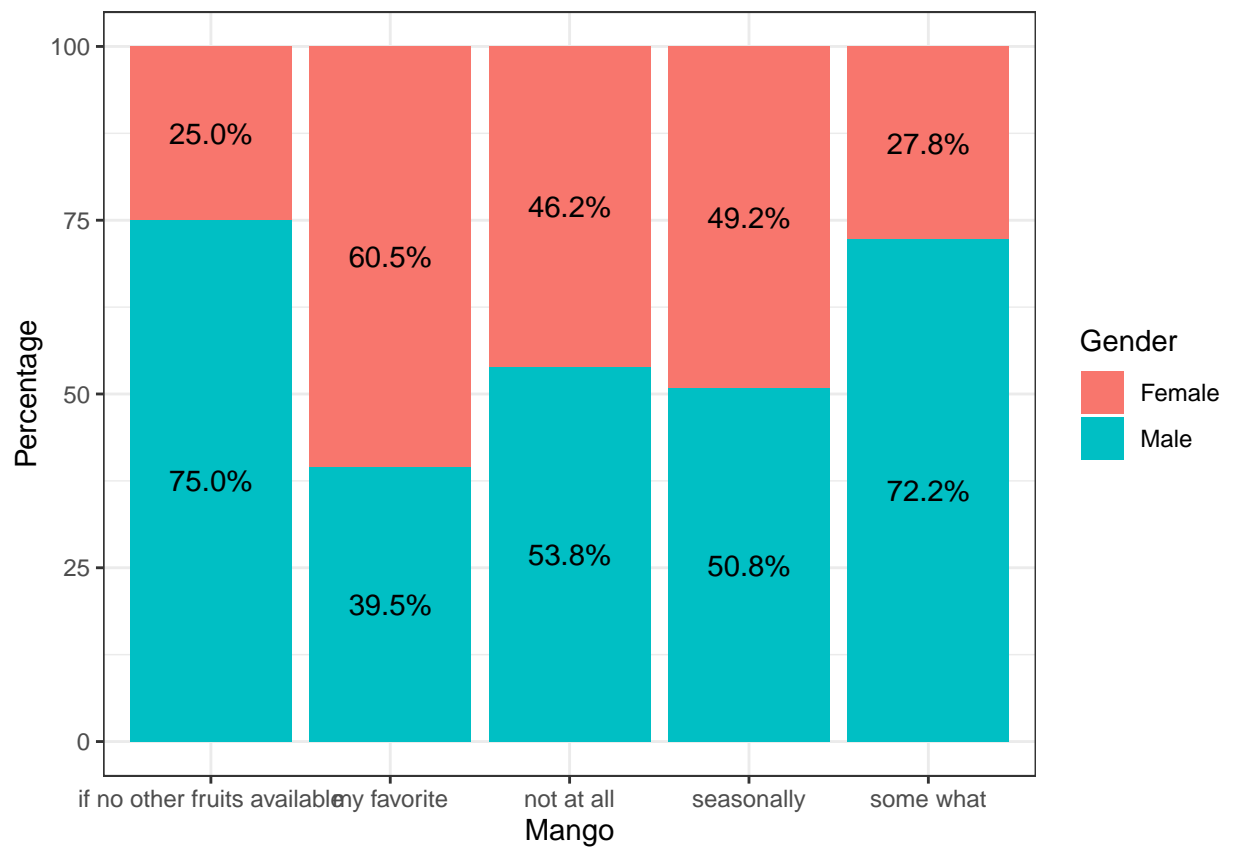
### 2.3. Gender-wise preference of fruits

A percentage analysis of gender-wise preference of various fruits is given in this section.

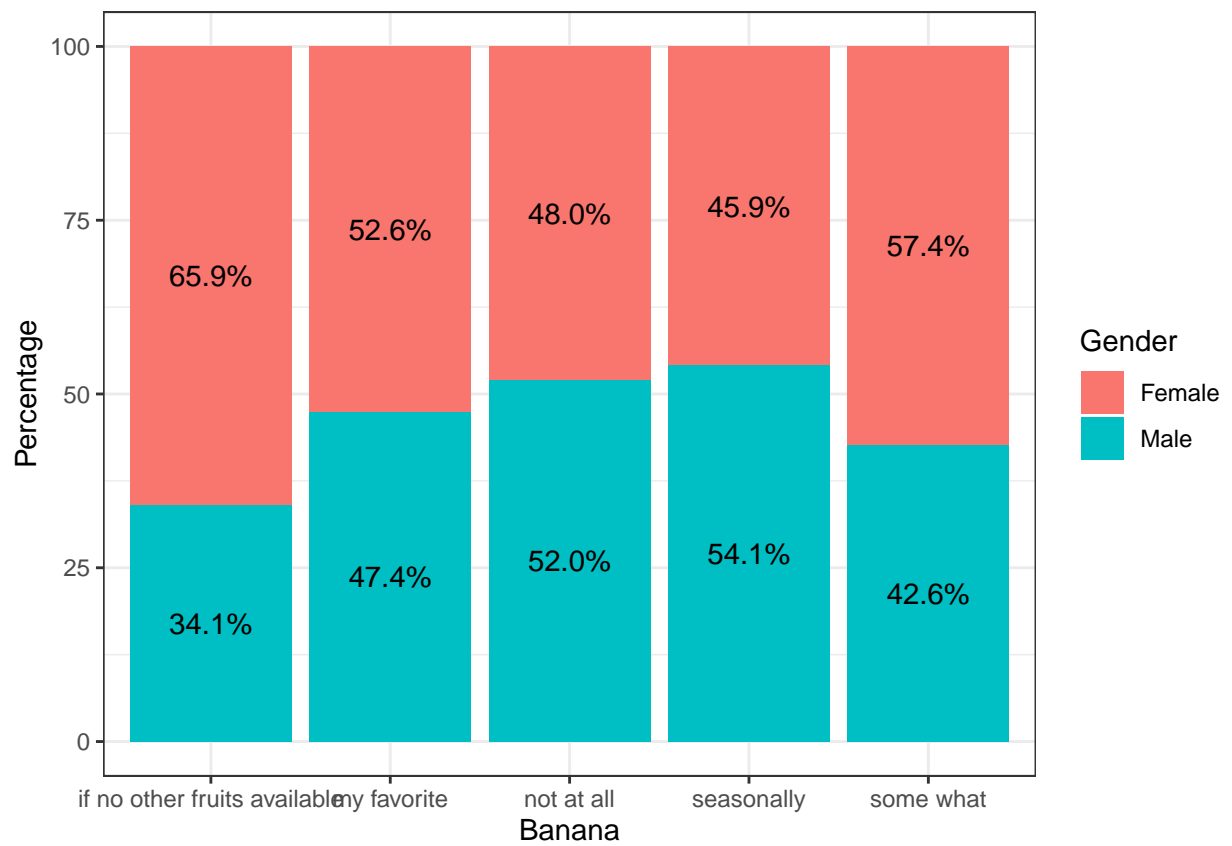






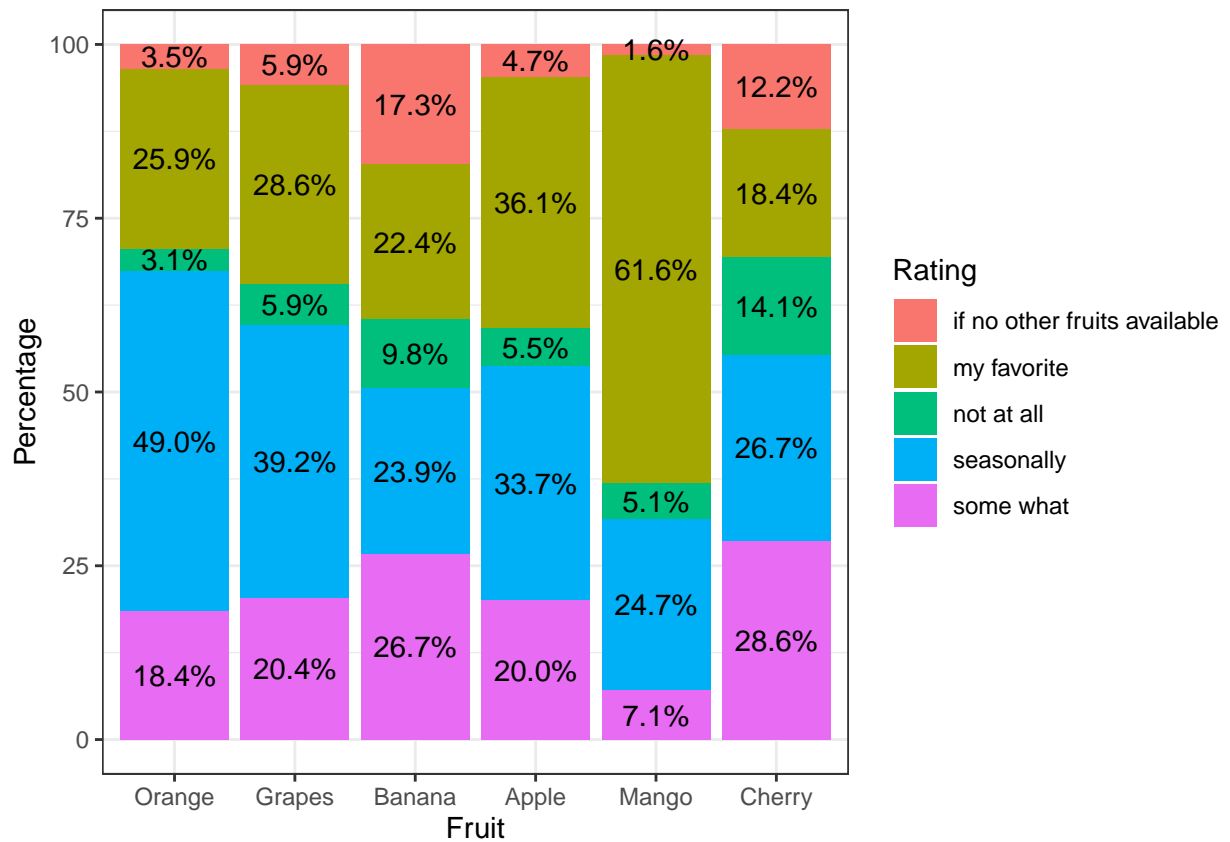






#### 2.4. Overall preference over fruits

A percentage analysis of overall preference over various fruits is shown in the following figure.



## 2.5. Finding descriptive statistics of continuous variables

### Weight over Gender

| Gender | count | mean  | sd    |
|--------|-------|-------|-------|
| Female | 138   | 54.80 | 12.96 |
| Male   | 117   | 65.83 | 11.88 |

### Height over Gender

| Gender | count | mean   | sd    |
|--------|-------|--------|-------|
| Female | 138   | 158.42 | 11.34 |
| Male   | 117   | 169.40 | 20.58 |

### Height over Age Group

| Age_group  | count | mean   | sd    |
|------------|-------|--------|-------|
| adolescent | 144   | 164.56 | 19.09 |
| youth      | 84    | 162.55 | 15.42 |
| elder      | 27    | 160.41 | 8.85  |

| Gender | count | mean  | sd   |
|--------|-------|-------|------|
| Female | 138   | 23.41 | 6.40 |
| Male   | 117   | 20.65 | 3.39 |

### 2.5.1. Rename the levels ( For Numerical calculation)

```
##      Gender Age Weight Orange      Grapes      Banana      Apple
## 1  Male  42    68      5 some what      seasonally some what
## 2 Female 39    63      4 seasonally      seasonally seasonally
## 3  Male 36    65      4 some what      my favorite seasonally
## 4  Male 21    60      4 seasonally      seasonally seasonally
## 5  Male 21   105      4 seasonally      not at all seasonally
## 6  Male 21    65      3 seasonally if no other fruits available my favorite
##      Mango      Cherry Height Age_group
## 1 seasonally      not at all    145    elder
## 2 my favorite      seasonally    155    elder
## 3 my favorite if no other fruits available    162    elder
## 4 seasonally      seasonally    174    youth
## 5 my favorite      seasonally    172    youth
## 6 seasonally      not at all    175    youth

## [1] 3.909804
```

## 2.6. Inferential Analysis

The inferential analysis is the generalization part of statistics. This phase focuses on possibilities of generalization of observations in the descriptive analysis. This is achieved through the **hypothesis testing** aspects of inferential statistics.

### 2.6.1. Testing of significance of difference in mean weight over gender

Significance of difference in mean of continuous variable over two categories can be tested using the **t-test**. The null hypothesis of the t-test is;

$H_0$  : there is no significance difference in the mean

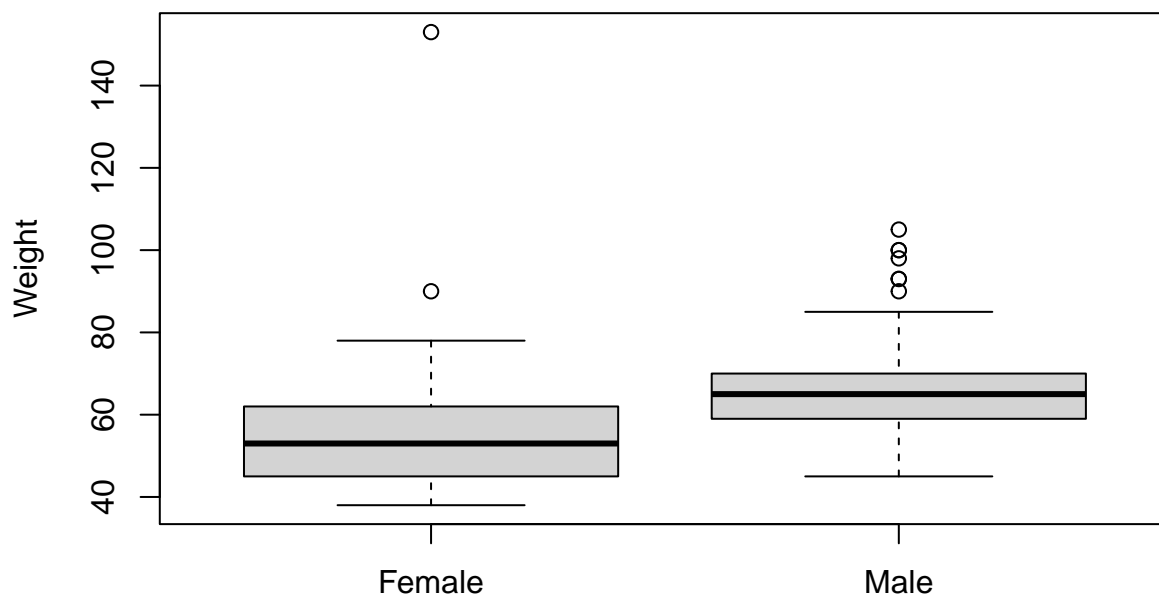
The alternative hypothesis is:

$H_1$  : there is significance difference in the mean

If the **p-value** of the test result is less than 0.05, the null hypothesis is rejected at 5% level of significance. Otherwise the null hypothesis can't be rejected.

As an example, let us investigate whether there is significant difference in the mean weight over gender.

```
##
## Welch Two Sample t-test
##
## data: Weight by Gender
## t = -7.0845, df = 251.45, p-value = 6.99e-12
## alternative hypothesis: true difference in means between group Female and group Male is less than 0
## 95 percent confidence interval:
##      -Inf -8.459822
## sample estimates:
## mean in group Female mean in group Male
##      54.79710      65.82735
```



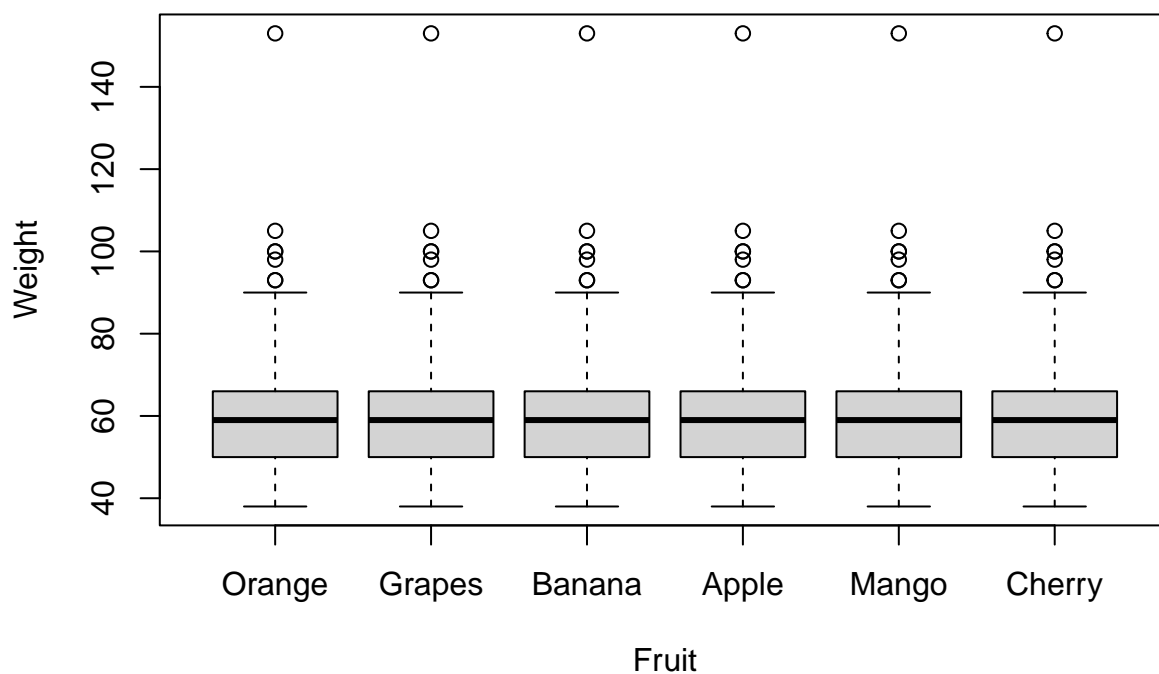
Gender

Since

the p-value is less than 0.05, the null hypothesis is rejected. So it is statistically reasonable to conclude that the mean weight of female respondents is less than male respondents.

#### 2.6.2. Significance of difference in mean weight over Fruit interest

| ##           | Df   | Sum Sq | Mean Sq | F value | Pr(>F) |
|--------------|------|--------|---------|---------|--------|
| ## Fruit     | 5    | 0      | 0.0     | 0       | 1      |
| ## Residuals | 1524 | 282596 | 185.4   |         |        |



#### 2.7. Testing of significance difference in rating over Fruit category

As a first step a percentage analysis is conducted on the fruit preference data as shown below:

### 2.7.1. Percentage analysis of the rating of fruit category

```
##
##           if no other fruits available my favorite not at all seasonally
##   Orange           0.5882353    4.3137255    0.5228758    8.1699346
##   Grapes           0.9803922    4.7712418    0.9803922    6.5359477
##   Banana           2.8758170    3.7254902    1.6339869    3.9869281
##   Apple            0.7843137    6.0130719    0.9150327    5.6209150
##   Mango            0.2614379    10.2614379   0.8496732    4.1176471
##   Cherry           2.0261438    3.0718954    2.3529412    4.4444444
##
##           some what
##   Orange           3.0718954
##   Grapes           3.3986928
##   Banana           4.4444444
##   Apple            3.3333333
##   Mango            1.1764706
##   Cherry           4.7712418
```

### 2.7.2. $\chi^2$ test for confirmation of difference in rating over fruit category

```
##
##   Pearson's Chi-squared test
##
## data:  table(data_long$Fruit, data_long$Rating)
## X-squared = 259.37, df = 20, p-value < 2.2e-16
```

Since the p-value is less than 0.05, the null hypothesis that there is no significant difference in rating over fruit category is rejected. So it is statistically reasonable to conclude that the respondent's preference over fruits is statistically significant.

### 2.7.3. Fruit preference over Age group

Significance of difference in fruit rating over age group is tested using the chi-squared test.

```
##
##   Pearson's Chi-squared test
##
## data:  table(data_long$Fruit, data_long$Age_group)
## X-squared = 0, df = 10, p-value = 1
```

Since the p-value is greater than 0.05, the null hypothesis that there is no significant difference in the fruit rating over age group.

## 2.8. Conclusion

Based on the statistical analysis the following findings are elicited.

1. There is significant difference in the mean weight of the respondents
2. There is significant difference in the mean weight over fruit preference.
3. There is significant difference in the fruit ratings over fruit type.
4. There is no significant difference in the fruit preference over age group.