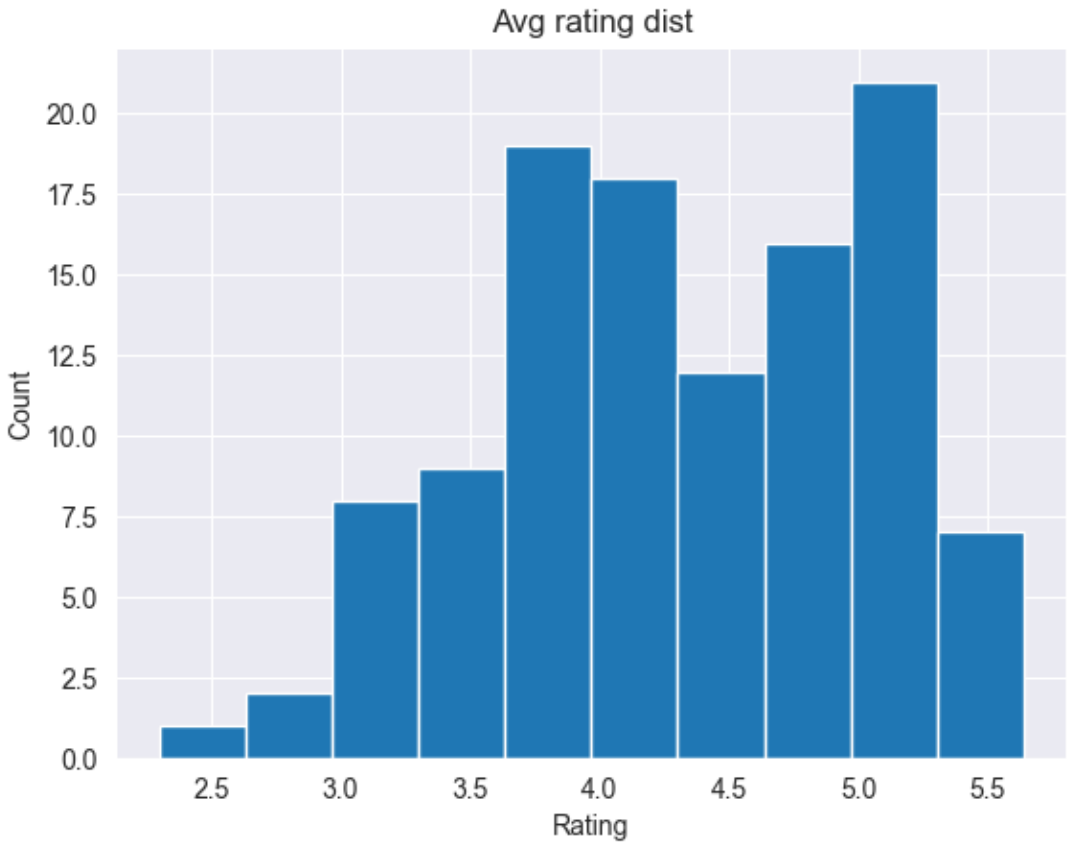
User Perception for Food Image: Summary

User Study:

We performed a user study with **N=202** (35% female) that give rating to **200** recipes in terms of how the recipes pictures is attractive in addition to how user perceive the attractiveness in terms of judgment.

The Proposed Research Questions:

The average rating distribution for images show in figure bellow:



[RQ1] How do user demographics, food knowledge, and recipe healthiness contributes, food category to the user perception of food images?

From the literature it has been found that basic image features have a significant predicted power for the image attractiveness. In the same direction, the result of a hierarchical linear model shows that **Brightness, Colorfulness, Saturation** and **Naturalness** are significant features that affect the image attractiveness as shown in table below:

Basic Image Features	$\beta(std)$
Brightness	2.21 (0.12)***
Contrast	8.56 -(.09)
Colourfulness	7.13 (0.28)***
Entropy	1.02 (0.16)
RGBContrast	-1.94 -(0.06)
Sharpness	-.35 -(0.01)
Sharpness Variation	-.52 -(0.04)
Saturation	-4.21 -(0.22)***
Saturation Variation	-.45 -(0.01)
Naturalness	2.06 (0.12)***
R^2	0.11***
$RMSE$	9.01

We extracted high level image features using three different stat of the art deep learning models **VGG16, ResNet,** and **ClipOpenAI**. To compare those features, we used three linear models to predict the attractiveness of a recipe image in terms of ratings. Results are shown in table below:

Image features extractor	VGG16	ResNet	ClipOpenAI
R^2	0.35***	0.34***	0.35***
$RMSE$	2.15	2.17	2.16

The next phase we use the user feature to predict the attractiveness of recipes images, overall, **cooking skills** is the only user factor that is significantly correlated with how user react to recipes image attractiveness. Table below shows the results of a linear model to predict user attractiveness in terms ratings.

User Factors	$\beta(std)$
User Demographics	
Age	-0.06 (-0.01)
Education	0.36 (-0.02)
Gender	-0.08 (0.34)
User Knowledge	
Subjective Food Knowledge	-0.18 (-0.32)
Cooking Skills	0.35 (0.11)***
User Profile	
Eating Goals	0.01 (0.00)
Cooking Experience	-0.01 (0.02)
Cooking Time	0.178 (0.01)
Home Cooking	-0.04 (-0.01)
Recipe Website Usage	0.19 (0.05)
Depression	-0.01 (-0.01)
Physical Activity	0.02 (0.01)
Sleeping Hours	0.03 (0.01)
Cooking Time	0.05 (0.01)
BMI	8.49 (.03)
R^2	0.01***
RMSE	2.98

The next steps is to investigate how the healthiness measure with **FSA score** affects the attractiveness:

Healthiness	$\beta(std)$
Fsa score	0.08 (0.08)
R^2	0.005
$RMSE$	1.08

[RQ2] To what extent do different human food factor choices contributes to user perception?

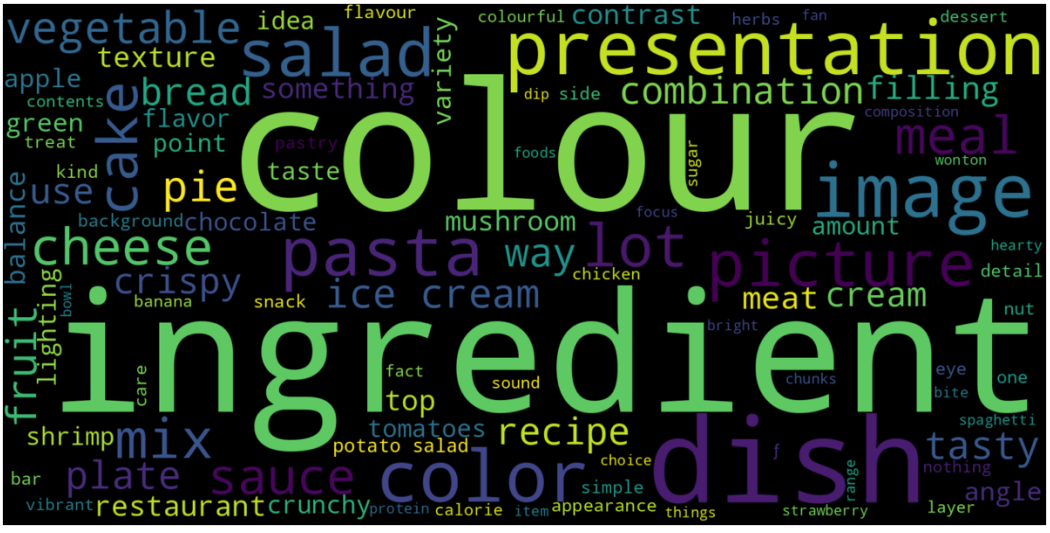
In this research question we asked participant to state which of food choices factor effect their recipes image ratings, including recipe **appearance, taste, healthiness or familiarity.**

Food Choice Factors	$\beta(std)$
Appearance	3.48 (0.18)*
Taste	0.01 (0.17)
Healthiness	0.07 (0.12)*
Familiarity	0.02 (0.33)
R^2	0.01*
$RMSE$	1.85

[RQ2] How people judge the recipes image attractivness?

To do so I have looked and categorized the recipes into attractive and non-attractive based on a rating threshold. And I showed a word cloud for what user said.

Attractive Judgment



Unattractive Judgment