



# The Effects of Varying Types and Amounts of Ingredients in Vegan, Gluten-Free Fudge

Shane Chilson  
Fontbonne University

## Abstract

Fudge is typically comprised of refined sugars and animal products. Rising demands for plant-based confectionary products signifies a niche market for vegan fudge products. This experiment will utilize four experiments with three samples each of vegan fudge. The experiment's build upon the preferences from respondents.

## Introduction

- Fudge is typically comprised of processed sugar, butter, milk (typically whole or sweetened condensed) and cacao (in any form, typically sweet or semi-sweet chips). Many fudge recipes use additives (such as walnuts) to provide additional texture and color.
- The interest in veganism in the United States has steadily been on the rise, as many as 2-6% of American consumers consider themselves vegan. Evidence has shown that veganism may have an increase of up to 300% between 2004 and 2019, accounting for nearly 10 million people or 3% of the population (Sentient Media, 2021).
- The Vegan chocolate is a niche market experiencing rapid growth. It comprises 40% market share of total vegan confectionary market and is currently valued at \$1 billion U.S.
- The expected compound annual growth rate (CAGR) is 12% from 2020 to 2027, outpacing the traditional chocolate market, which has a predicted 4.6% CAGR in the same timeframe.

## Purpose and Methods

**Purpose:** The purpose of this study is to continuously alter a vegan fudge recipe to increase its overall likability. The experiment will utilize four trails, each building upon the preferences from respondents.

**Target Population:** In order to refine the experiment to target a larger population vegan and other consumers who would like healthier chocolate desserts, this experiment is designed to test multiple ingredients to replicate fudge that is: plant-based and free of refined sugar.

**Null hypothesis:** By using a series of four experiments and building upon the scores of each sample from each experiment, the mean overall likability of the fudge will increase with each experiment.

**Alternative Hypothesis:** There is no correlation between the overall likeability scores of the experiments and the previous experiments

### Methods

- Exp.1** - Sampled three dried fruits as the main sweetener in fudge, including medjool dates (Sample.1), deglet noor dates (Sample.2) and jujube. (Sample.3). The consistencies were made even by the addition of water and then compared side-by-side visually and physically.
- Exp.2** - Sampled varying amounts of butter between the samples of plant-based fudge, including; 3 Tbsp (Sample.1), 6 Tbsp (Sample.2) and 9 Tbsp (Sample.3).
- Exp.3** - Sampled varying amounts of high fat-containing nuts (macadamia) between samples; 1/3 Cup Sample.1), 2/3 Cup (Sample.2) and 1 Cup (Sample.3).
- Exp.4:** Sampled the addition of 2/3 Cup of various chopped nuts pressed into the top of the fudge, utilizing hazelnuts (Sample.1), walnuts (Sample.2) and pistachios (Sample.3).

### Objective Evaluations

- For all four of the trial's participants filled out score cards to evaluate the products color, appearance, small, texture, taste and overall likability. The scores for each category ranged from 1 to 5, with 1 being the most desirable and 5 being the least desirable.

### Subjective Evaluations

- Participants were encouraged to leave notes/feedback along with the scorecard.

### Nutrition Analysis

Food Processor

## Objective Experimental Results

**Exp. 1** - The preferences of color was the darkest. The sample most consistent in texture and appearance was rated the lowest. The taste of scores between the dates were near equal.

**Exp.2** - The preferences in color was the darkest, the preferred appearance preferred was the sample 2.. The texture of the sample with the highest fat was preferred, although the sample with lower fat scored lowing in taste and was similar in results for overall likability.

**Exp.3** - The preference of overall likability was sample.2, which scored significantly higher in texture and taste. The color, appearance and smell were not significantly impacted.

**Exp.4** - The preference for overall likability was the pistachios, while the preference for taste was hazelnuts.

## Subjective Experimental Results

**Exp.1** - Participants mentioned "not sweet enough", "too sticky/dense", and "lack of uniform shape" between all samples. The Jujube seemed to be harder and more fibrous than the dates and did not form similar consistency like the other samples.

**Exp.2** - Participants claimed sample.3 was "not dense enough" and "resembled a cream more than fudge", yet its taste and overall likeability scored the lowest. Sample.1 was more dense and darker in color, while sample 2 had a density and color between sample 1 & 3.

**Exp.3** - Participants mentioned the samples seemed "nearly identical" in all aspects.

**Exp. 4** - Participants mentioned "nuts do not stick well to fudge".

## Discussion

The color of samples in Exp.1 were darker than Exp.2, while Exp.3 was darker than Exp.1, signifying the preference was darker. Exp.3 and Exp.4 were nearly identical in color, yet Exp.4 was more preferred possibly due to the addition of nuts. The appearance was rated better throughout each experiment as the sample sizes grew, indicating larger portions were preferred. The smell continually improved apart from Exp.2, indicating a higher presence of fat may improve the smell.

### Overall Discussion

The texture continually improved, possibly due to a variety of factors such as length of processing, amount of time in a freezer, and addition or subtraction of ingredients. The texture in Exp.1 was inconsistent in all samples, yet the medjool dates scored higher due to a finer consistency. The addition of fats are correlated to a higher taste preference, although the butter had a great impact on the consistency

## Limitations & Recommendations

### Limitations

The quality of some ingredients were noticeably different by brand. The time frozen also varied. In Exp.4, ingredients were missing so the recipe was adapted to exclude a topping and 1/3 of nuts.

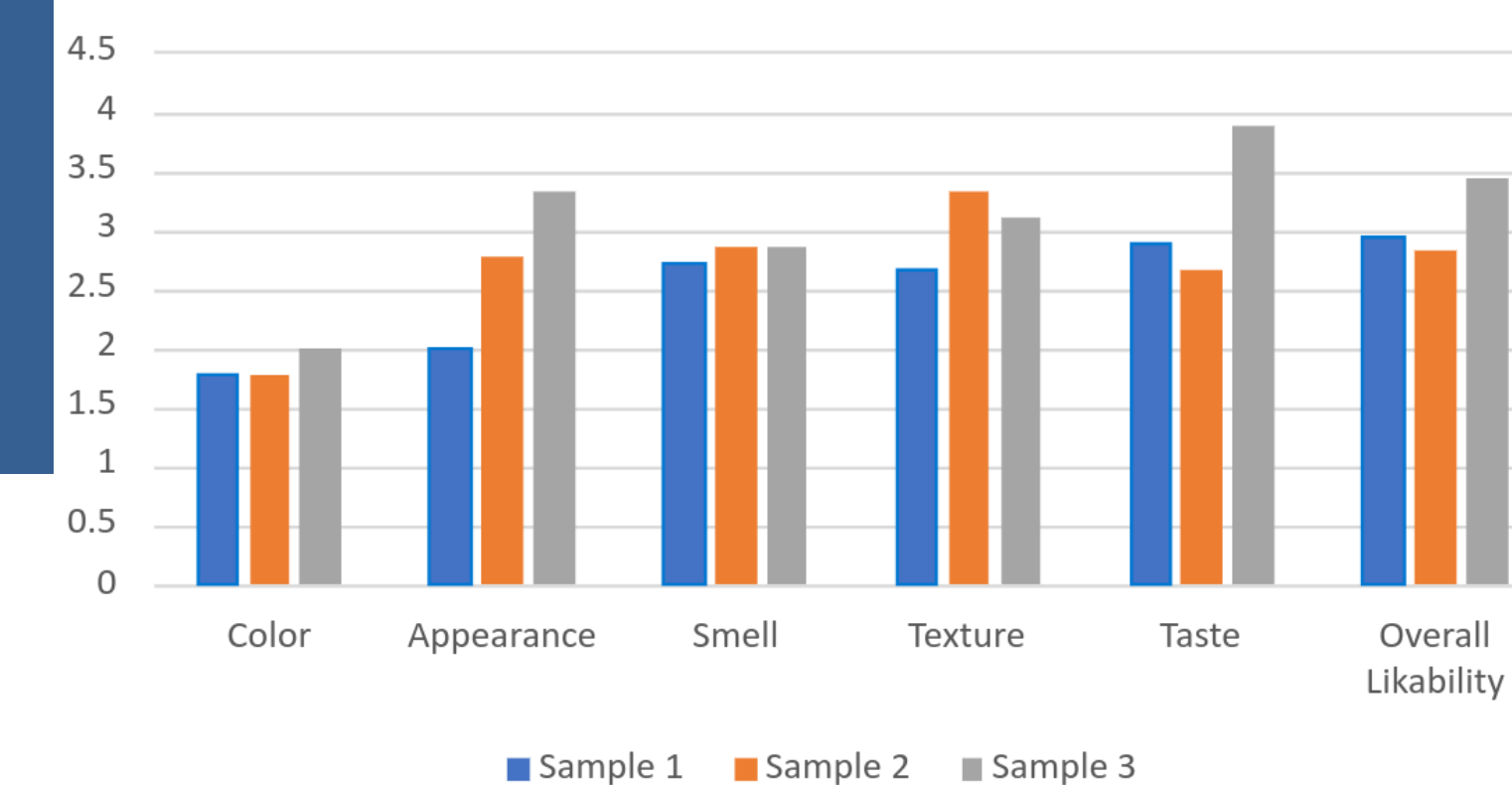
### Recommendations

The score cards would have provided more data if tailored to the objectives of each experiment. The sample's sizes and shapes could have been more consistent better understand the preference. The brand of some ingredients should have been consistent with every experiment. The amounts of nuts in Exp.3 could have been larger to better understand its effect, as all samples were nearly similar. Having the correct amount of ingredients for Exp.4 would also have provided greater details of preference.

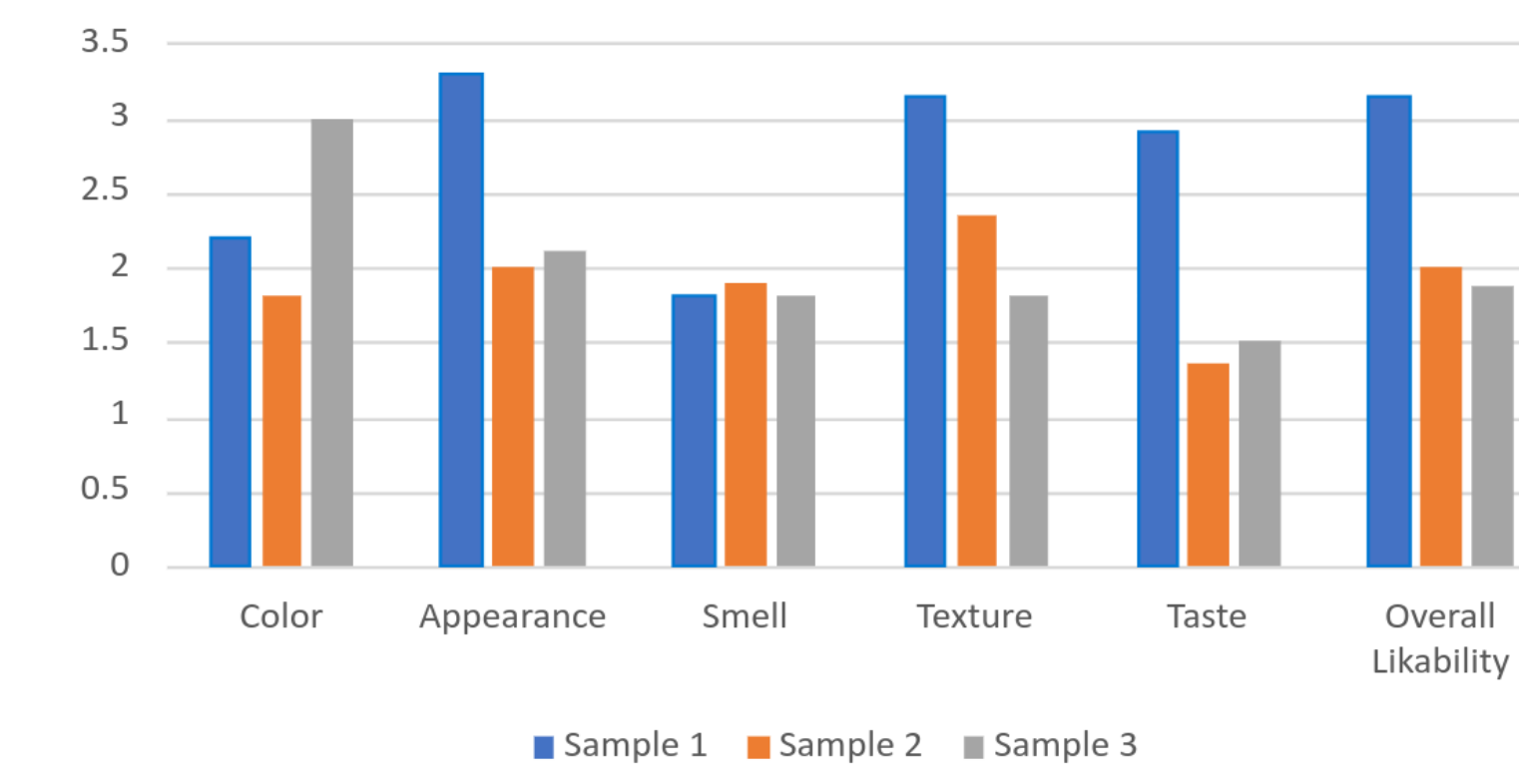
## Conclusions

- A vegan fudge recipe was created using trials and methods to improve overall likability.
- The data provided has shown that samples which are larger, higher in fat, finer in consistency and with multiple textures and colors were preferred.

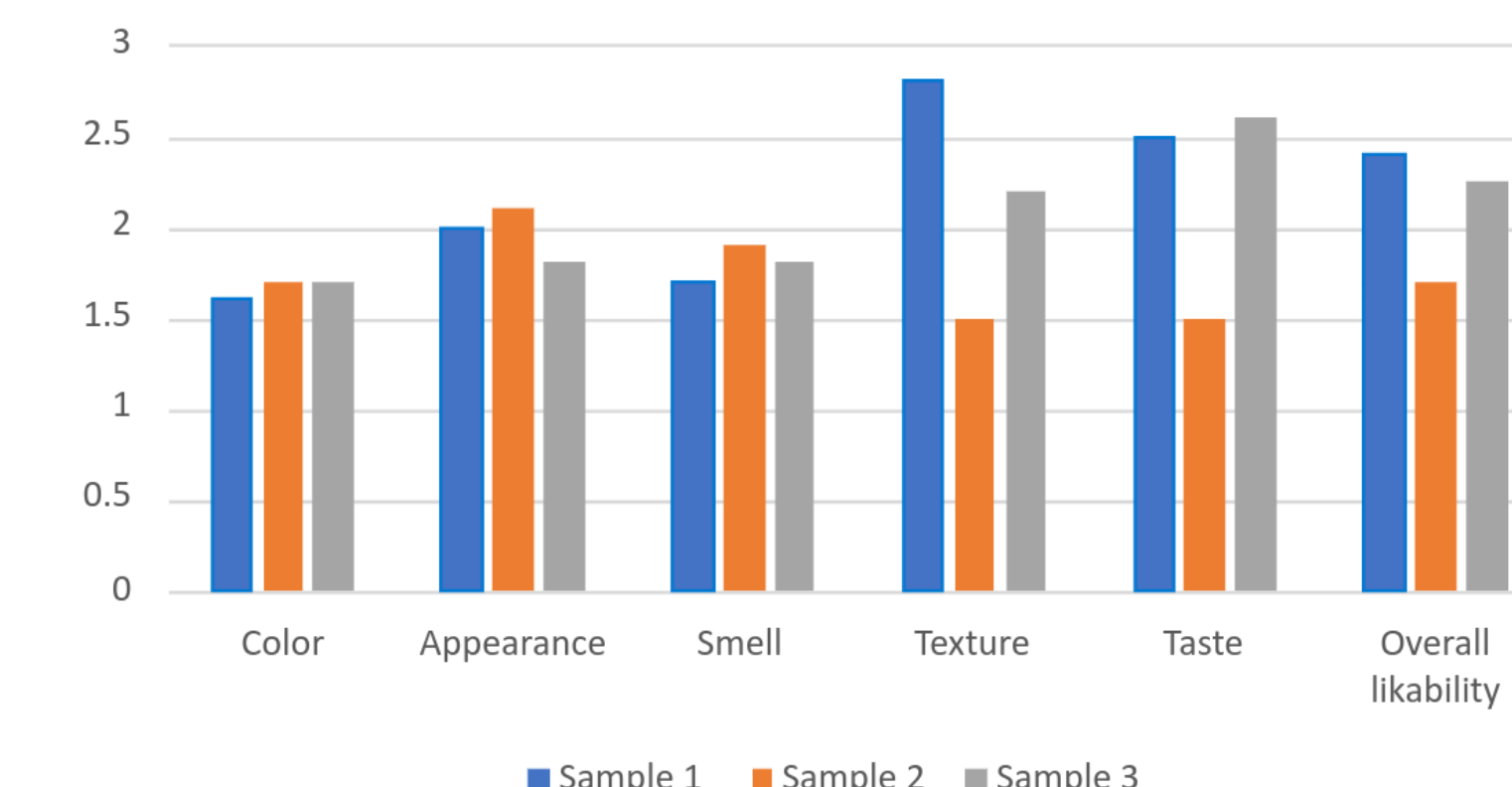
Experiment 1 - Score Card Result Averages



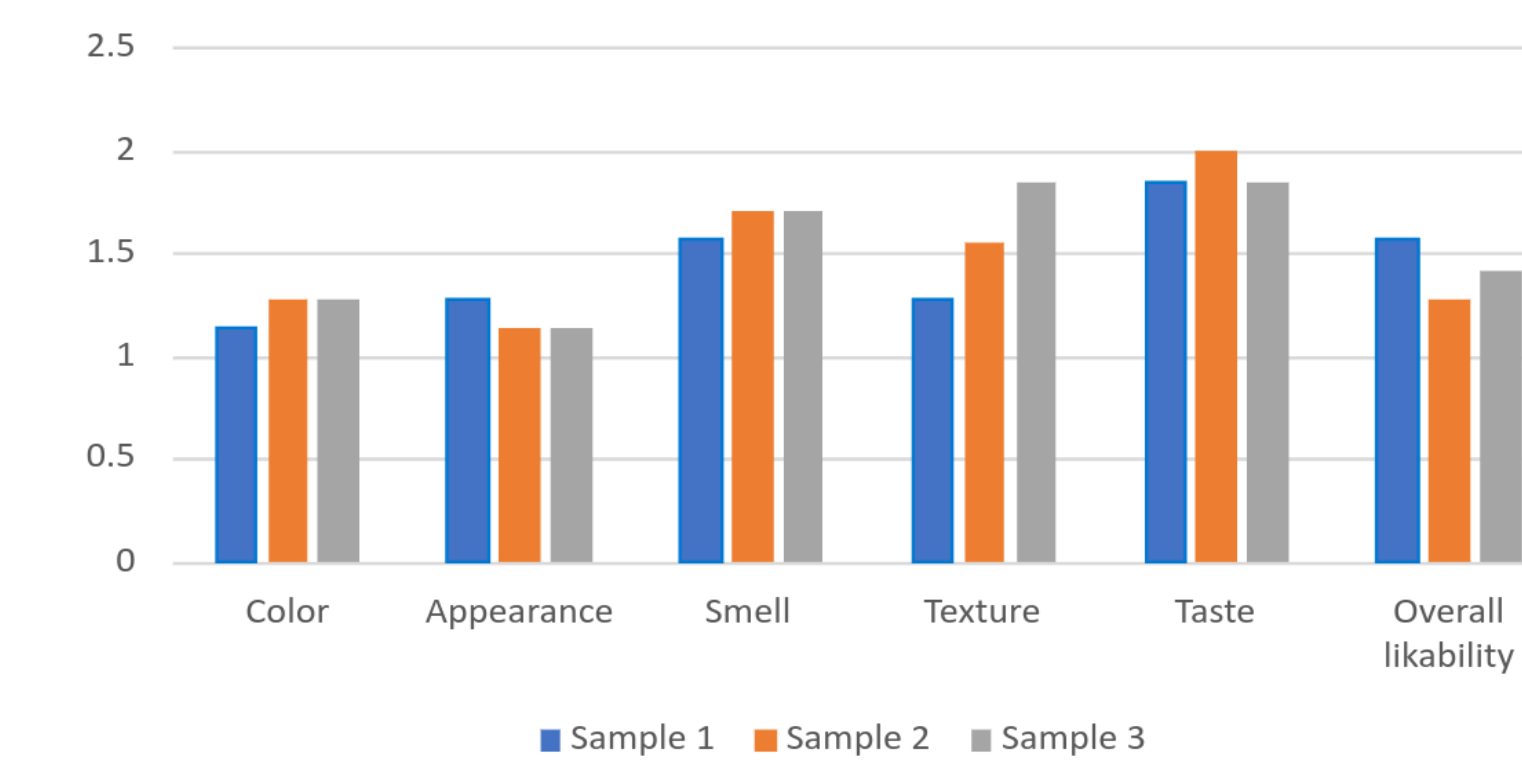
Experiment 2 - Score Card Result Averages



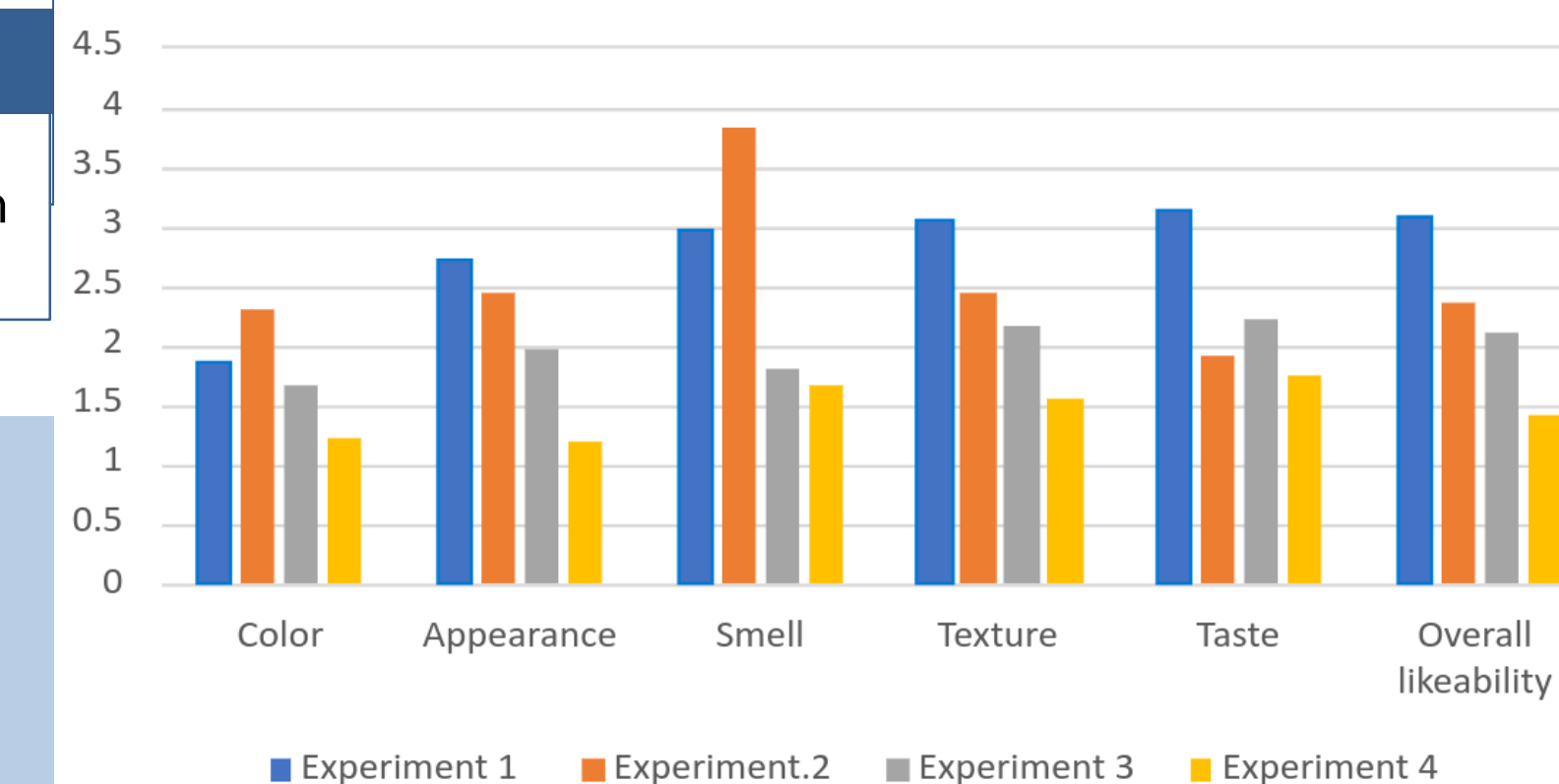
Experiment 3 - Score Card Result Averages



Experiment 4 - Score Card Result Averages



Average Ratings Per Experiment



## Contact

Shane Chilson  
Fontbonne University  
Email: [schils00436@fontbonne.edu](mailto:schils00436@fontbonne.edu)  
Phone: 314-489-2431

## References

Sentient Media. (2021, June 25). Increase in veganism: Why is veganism on the rise in 2021? Sentient Media. Retrieved October 11, 2021, from <https://sentientmedia.org/increase-in-veganism/>.  
Abillion. (2021, January 4). Biting into the vegan chocolate market. data.abillion. Retrieved October 7, 2021, from Kris-Etherton, P. M., & Hill, A. M. (2008).  
Bourassa, L., Vegan, A. T., & Cudmore, D. (2021, January 13). Vegan and plant-based diet statistics for 2021. PlantProteins.co. Retrieved October 7, 2021, from <https://www.plantproteins.co/vegan-plant-based-diet-statistics/>.