

# MacroMate: The Nutrition App Built on Simplicity and Inclusivity

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## ABSTRACT

For our final project in COMP790 - Information Visualization, offered by the Department of Computer Science at the University of North Carolina at Chapel Hill, we created a nutrition app that tracks macro-nutrient and calorie intake in a manner that is easy for all to use. Our preliminary research suggested that tracking macro-nutrients could be a significant tool for improving health, but it also has tendencies to be inaccurate, time consuming, and difficult to keep track of. Food tracking of this nature has also been found to be potentially triggering for those susceptible to eating disorders. As a result, we created MacroMate, a nutrition app that can address all of these challenges at once by focusing on simplicity and customizability.

## 1 INTRODUCTION

Advancements in technology have rendered phones more accessible than ever, making the wealth of information they contain a ubiquitous companion in every individual's pocket. Similarly, advancements in nutrition have elevated our understanding of health data to new heights as well, resulting in a surge in food consumption tracking. Capitalizing off of the intersection of these two trends, nutrition apps have gained popularity even faster than the very advancements that made their emergence possible in the first place. However, despite their prevalence, many of the nutrition apps currently available to the general public have several glaring weaknesses that we will address with the creation of our own nutrition app: *MacroMate*.

We created MacroMate because of a demand for an accessible, simple, and easy to use nutritional tracking app, specially equipped to support users susceptible to eating disorders. This particular demographic is alienated by a nutritional app market that induces stress and even may trigger worsening eating disorder symptoms on account of calorie counting. At the same time, these users could gain a great deal from an app that promotes informed dietary decisions. To resolve this discrepancy between the nature of the demands of those susceptible to eating disorders and the typical functioning of nutritional tracking apps, we have created a prototype of our own nutrition app by using a micro web framework written in Python called Flask. Flask, in turn, empowers users to interactions with d3-driven data visualizations that update in real time as users log food.

In addition to alienating users with eating disorders, top of the line dietary tracking apps, such as nutritionix, Lose It!, MyFitnessPal, Calory, and many others, also tend to alienate those with lower economic statuses. They do this by charging users a costly monthly subscription fee to gain full access to the application's features. We intend to address this alienation with MacroMate as well, by vowing to keep it an entirely free application for all users.

The final product of our work on this prototype is a free, simple, and interactive web app that enables users to log their daily food intake, track their progress towards meeting intake recommendations provided by the United States Office of Disease Prevention and Health Promotion, and even receive helpful dietary recommendation messages based on what they have already logged on a given day. However, what differentiates our apps from others on the market is our unique feature that enables users susceptible to eating disorders to track their intake solely by completion percentages. In other words, these users can ensure they reach their dietary goals without ever needing to count calories or any exact macronutrient measurements. Our research suggests that this could not only aid in dietary tracking without triggering symptoms of eating disorders, but it could even be a powerful tool to aid in the recovery of said disorders.

## 2 RELATED WORK

### 2.1 Nutrition Considerations

Empirical evidence suggests that nutrition apps, particularly those that provide features for intake tracking, can be powerful tools in aiding one's overall state of health. One experiment published in the *Journal of Diabetes Research* examined the role of caloric tracking in individuals with Diabetes that were clinically recommended to lose weight, and it found that consistent use of a dietary tracking tool was consistent with long-term weight loss success [5]. Underscoring these findings, the researchers also found that those that did not track their caloric intake consistently did not achieve statistically significant levels of weight loss. This study speaks to the efficacy of caloric tracking in obtaining healthy body weight.

However, calories are far from being the only significant measure of the nutritional value of food intake. Some nutrition experts consider macronutrients, the nutrients one needs in larger quantities to fulfill energy needs, to be a far more important measure of the health value of food. Macronutrients consist of carbohydrates, fats, and proteins, and in addition to supporting different bodily functions, each also has been shown to prevent a myriad of serious health issues when consumed in recommended amounts.

One study that conducted an in depth analysis into the health benefits of consuming the correct levels of macronutrients [9] found that eating the right amount of carbohydrates decreases an individual's chances of getting diabetes and improves resistance to cardiovascular-related health complications in the long term. It also found that consuming the recommended level of fats led to weight loss in obese populations and decreased rates of health complications caused by harmful metabolism levels across all populations. This study even found that consuming optimal levels of protein, in addition to aiding muscle growth, may protect individuals from Alzheimer's.

### 2.2 App Considerations

In addition to establishing the importance of tracking dietary consumption, there is also empirical evidence that suggests mobile apps could be the best medium for the task. For example, in an experiment conducted by Carter et. al., mobile phone apps were found to be both more effective and more feasible for maintenance of diet records when compared to paper diary or website-based methods [3].

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There is also a multitude of research into specific design elements that has been gathered from users themselves, of which MacroMate tries to incorporate all of in some manner.

A study published in the *Journal of Medical Internet Research* found from focus groups that users typically rank accuracy, security, effort required, and immediate effects on mood as the most important factors users look for in a dietary tracking app [4]. Regarding the contents of nutrition apps, the same focus groups reported wanting to be able to track progress towards their intake goals, while also receiving periodic advice to help achieve them. The research team also found that, among features reported to discourage app usage, difficulty-of-use was a major commonality. In other words, users need an app that is easy to use, accurate, and mood boosting.

What truly sets MacroMate apart from other eating apps is that it is tailor-made to suit the needs of those susceptible to eating disorders. These individuals, as Simpson and Mazzeo found in 2017, can actually experience ‘more harm than good’ when using traditional dietary tracking apps. Despite noting that these apps are advantageous for some that have struggled with eating disorders, the two authors noted that, for others, these apps can actually trigger worsening symptoms or even promote the development of new ones [8]. Adding to this dichotomy, Levinson and her colleagues found one specific app, MyFitnessPal, to be simultaneously widely used in eating disorder populations while also being perceived as contributing to eating disorder symptoms by the same populations [6]. This emphasizes the need for a nutrition app designed with the unique needs of individuals with eating disorders in mind.

### 2.3 Data Considerations

In order to create an app that satisfied all the demands specified above, we needed to find reliable data sources to power MacroMate. First, we found a Kaggle dataset that compiled almost 9,000 different foods, complete with measurements of calorie counts, carbohydrate levels, fat levels, and protein levels which have all proved highly accurate in our preliminary testing [1]. Next, to obtain recommended intake values across gender and age demographics, we obtained a dataset provided by the United States Office of Disease Prevention and Health Promotion (ODPHP) [7]. The decision to select this source was informed by a study published in India which found that it is imperative for the effectiveness of nutrition apps that they are based on national guidelines and other food data culturally relevant to its users [2].

### 3 DESIGN

As noted in the relevant work section, overly complex designs have been found to discourage app usage. For our web app, the most important elements of the design are its simplicity and accessibility. We have a legible, green MacroMate logo and a welcome message in the top center portion of the page, greeting the user and briefly explaining the app’s role as a “personal Macronutrient tracker” (Figure 1 in Appendix). We opted for a bright green logo and a lighter green background. Since MacroMate is a health app and green is a color associated with health, we believed this was an appropriate color scheme. We chose to use the Comic Sans font for our app’s front end on account of reports that individuals with dyslexia find it easier to read than other fonts. It is worth noting that we were not able to find empirical support to substantiate these claims. However, we still opted to use it as our font choice, acknowledging that even if the benefits are not yet fully substantiated, the potential positive impact outweighed any perceived risks.

Below the welcome message is a drop-down selection for the user to select their age and gender (See Figure 2 in Appendix). We gave this selection its own line since it is a fixed value for the user’s log (unlike the food selection, which needs to be continuously re-entered). Once the user has inputted their demographic, they are able to begin tracking their food. To log a food, they search and select

a food (See Figure 3 in Appendix), enter the amount consumed in grams (See Figure 4 in Appendix), and then click the add food button. To the right of the add food button is a restart button that allows the user to clear their logged food. The logging ability is an important feature of the design because it allows the visualization to be customized to the user and their diet. By selecting their age and gender, users establish a baseline for their data representation. The personalized input features ensure that the visualization accurately reflects the user’s nutritional intake and patterns over time. In essence, the logging functionality and customized visualizations allow users to engage with the visualization on a deeper level, transforming static, traditional dietary statistics into a dynamic display used for understanding and managing their diet.

For displaying the macronutrient values, we chose to use a donut chart to visualize users progress. The donut chart provides a simple representation of totals and a very intuitive way to see your progress in reaching your daily nutritional totals. Individual macronutrient consumption is represented by a green portion of the chart, remaining recommended levels of the macronutrient are represented by the remaining red portion of the chart. With this design, users can continue tracking progress towards their intake goals of both calories and macronutrients until the donut chart is fully green (See Figure 5 in Appendix). Representing the consumed macronutrients as a green bar implies that the consumption of these nutrients is healthy and good for the user. Also, the default display shows the percentage of the macronutrient total that the user has consumed. We felt that a percentage representation helps shift the mindset of consuming food away from counting values. However, we also have the option to display the visualizations and the consumed macronutrients as their number values (See Figure 6 in Appendix). To adjust between Percentage and Numerical tracking, there is a simple dropdown provided in the top right-hand corner of the app (See Figure 7 in Appendix). We believe this approach encourages consumers to consume a well-balanced diet. This is unique to traditional food-tracking apps, which often encourage calorie reduction. While this is a useful approach for some people, it is potentially harmful to those with eating disorders. MacroMate stands apart by encouraging users to eat a full, balanced diet.

Additionally, we have a list that shows the logged foods and their amounts (See Figure 8 in Appendix). This allows the user to quickly check what foods they have eaten and logged for the day. This is a useful design feature since this will likely be an app that users use throughout the day, and it is easy to forget what you have eaten or tracked.

The final design element we have incorporated in MacroMate, and perhaps the most experimental, are user-specific food recommendations. As users progress through the day, our recommendation messages will prompt users to consider specific foods that could help them reach any of their intake recommendations that they have not yet reached (See Figures 9, 10 in Appendix). In the future, we aim to add the software architecture required to customize these recommendations based on a user’s own eating patterns. This would further the connection our app can foster between users and healthy eating patterns, and provides a unique level of support to the app that truly gives form to the ‘Mate’ part of MacroMate.

### 4 DISCUSSION

In this study, we developed a prototype nutrition app named MacroMate to address the shortcomings of existing nutrition tracking applications, particularly in catering to individuals susceptible to eating disorders. MacroMate stands out by offering a simplified approach to dietary tracking, focusing on completion percentages rather than precise macronutrient measurements or calorie counts. Leveraging Flask and d3-driven data visualizations, our app provides users with an intuitive interface to log their daily food intake, track progress towards recommended intake goals, and receive personalized dietary

recommendations.

#### 4.1 Further Improvements and Iterations

While MacroMate represents a significant step towards providing a more accessible and user-friendly nutrition tracking solution, further development and testing are essential to optimize its effectiveness and usability. For one, we plan to convert our online prototype into an app, as has been discussed throughout this paper. Another crucial avenue for improvement is the incorporation of user feedback through focus groups. By engaging with target users, particularly those susceptible to eating disorders, we can better understand their needs and preferences that are not well documented in existing academic literature, ensuring that MacroMate meets their expectations and effectively supports their dietary goals.

As development continues, we plan to continue testing our app with focus groups to verify that it accomplishes the vision that we and users alike have for it, while gaining additional valuable user feedback along the way. Engaging focus groups will allow us to evaluate MacroMate's performance in real-world scenarios and identify areas for refinement. Specifically, we will continue to focus on the app's ease-of-use, accuracy, and impact on users' mood and well-being. By soliciting feedback on features such as completion-based tracking and personalized recommendations, we can iteratively improve MacroMate to better serve its target demographic.

##### 4.1.1 Identified Courses of Action

One such area that we have already identified through feedback from some early users of our prototype is that more customizability would go a long way towards increasing user favorability. One user suggested we incorporate a range of choices for application color schemes, while another requested a customizable avatar to represent said user's very own iteration of a MacroMate. While such examples are purely cosmetic, the mood boosting properties they could produce may prove to increase the app's usage rates, and thereby its effectiveness for users.

On the actual data side of MacroMate, one notable weakness we have identified is its current inability to differentiate between processed and unprocessed foods. While the app provides valuable insights into overall dietary intake, it lacks granularity in assessing the nutritional quality of foods consumed. Addressing this limitation will require the integration of additional data sources or algorithms to classify foods based on their processing status. By enhancing MacroMate's ability to distinguish between different food types, we can provide users with more accurate and actionable information to support healthier dietary choices. After all, macronutrient consumption and caloric intake can only paint a partial image of one's dietary health, so we can continue to refine and improve this 'image' with new updates to MacroMate over time.

#### 4.2 Closing Statement

Ultimately, MacroMate represents a promising step towards addressing the unique needs of individuals susceptible to eating disorders while providing a user-friendly nutrition tracking solution for a broader audience. Through ongoing development and testing, we aim to refine MacroMate into a valuable tool for promoting informed dietary decisions and supporting overall health and well-being. As the body of data that surrounds and informs the effectiveness of nutrition apps continues to grow, MacroMate is determined to grow with it.

## 5 APPENDIX

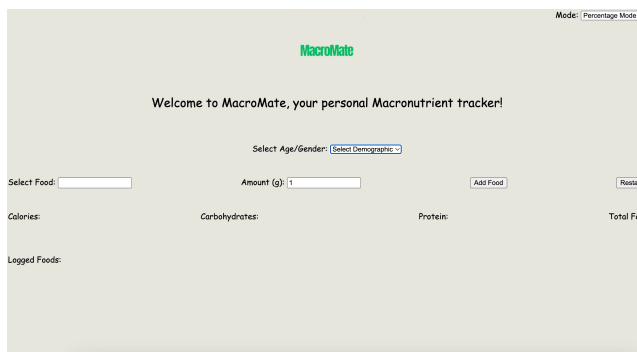


Figure 1: The initial display of MacroMate

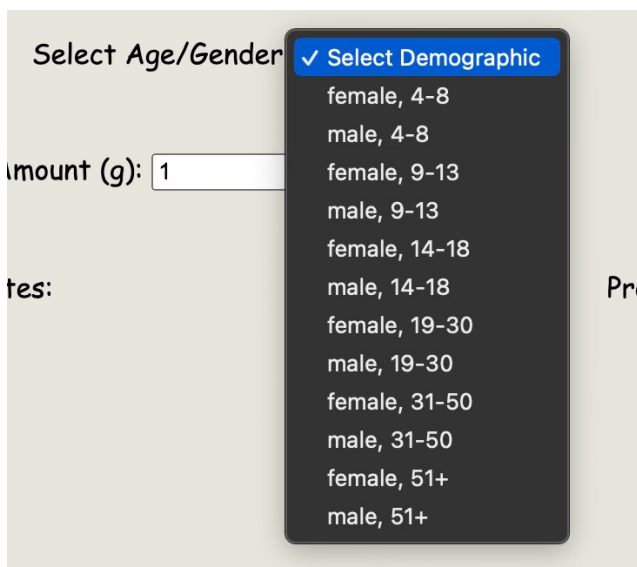


Figure 2: Demographic dropdown

### 5.1 Access our Prototype

To access and run our web-app prototype of Macromate locally:

- Clone our github repository, which can be found at <https://github.com/nholmes26/d3NutrApp>, using 'git clone git@github.com:nholmes26/d3NutrApp.git'
- Navigate to the d3NutrApp directory you just cloned in a terminal, and then run 'python app.py'
- If you encounter an access error on Google Chrome despite correctly following the above steps to run locally, try navigating to `chrome://net-internals/sockets` in your browser and then click 'Flush socket pools'
- Finally, if you run into any new errors or have any feedback relevant to your user experience with MacroMate, we would love to hear from you. Please feel free to reach out to any of the authors of this paper at our UNC email addresses, provided as a footnote on page 1.

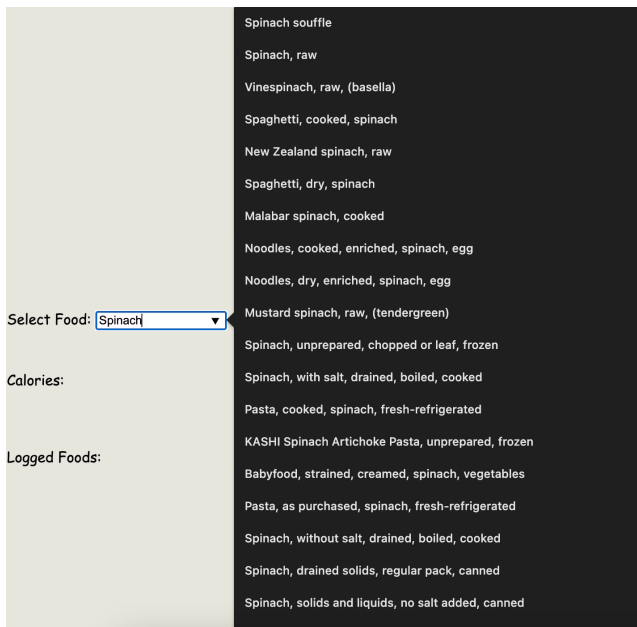


Figure 3: Food dropdown

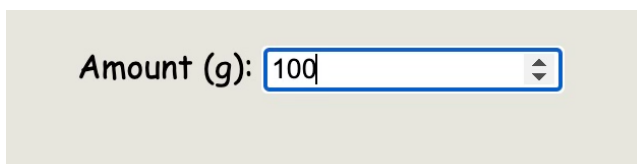


Figure 4: Input field to enter consumption amount (g).



Figure 5: MacroMate in use, portraying both complete levels (Protein, Carbohydrates) and incomplete levels (Calories, Fats)

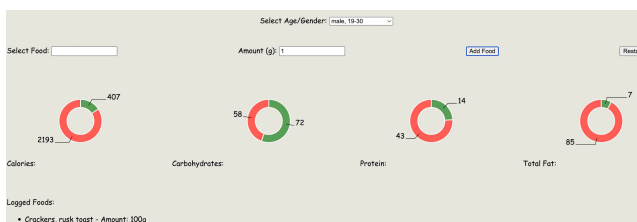


Figure 6: Numerical setting of MacroMate displaying intake levels

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Figure 7: Dropdown to toggle between Percentage and Numerical mode, provided in the top right corner

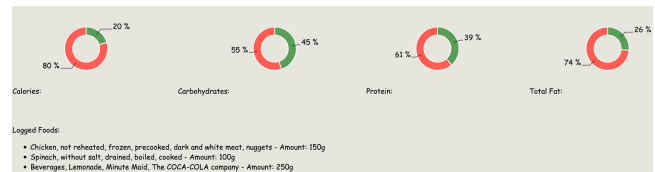


Figure 8: Sample running food log for a given day so far

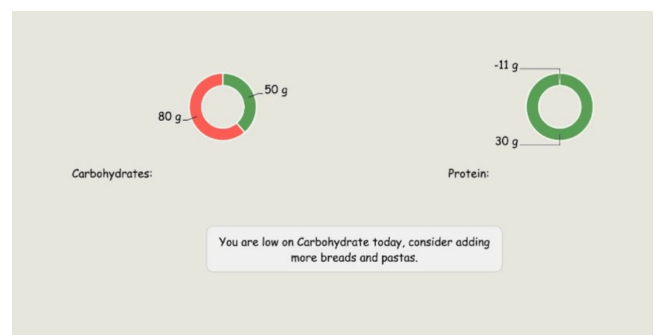


Figure 9: In this example, a user is low on carbohydrates so they receive a polite message advising them to consider eating some carb-heavy foods

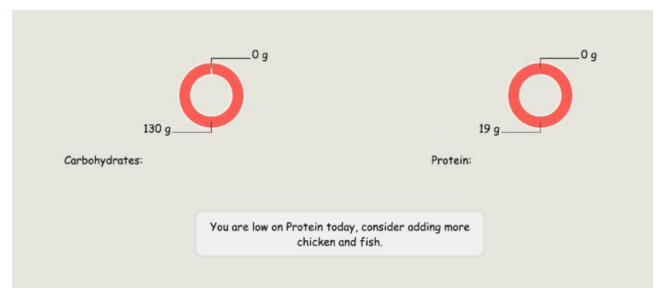


Figure 10: In this example, a user is low on carbohydrates and protein. To make this seem more manageable, MacroMate advises they start by adding more high protein foods

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