How Does Nutrition Affect Depression?

New Mexico

Supercomputing Challenge

Final Report

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JMS 11

Multi-schools (EHS, MHS, SHS)

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Table of Contents

Executive Summary

The treatments for Depression are many: the influence of diet, exercise, and medication all play a part in helping treat depression. We opted to investigate the effects of diet choice on the presence of an increase of Dopamine, Endorphin, Oxytocin, Serotonin in the Human Brain. The increase of these neurotransmitters in the brain occurs in individuals in a non-depression state.   Two Netlogo models were created to compare and contrast a healthy brain and a brain affected with depression. As of right now, we are improving our current model from the base (landmarks are placed on the interface) to adding collisions and graphs to collect data.

Our initial assumption was that depression decreases the chemicals and hormones in our brain and that certain food choices had some kind of link. Disregarding physical fitness and medicine, there are studies and articles proving that nutrition plays a role in depression. We are only focusing on the nutritional part.

Definition of the problem

We understand the impact of nutrition on our health. Depression, a mental health issue which can be difficult to manage medically can respond to nutrition. We looked at various diets and are continue to look into them. We focused on three main diets. The DASH (Dietary Approaches to Stop Hypertension) diet, the Harvard Diet, and the Hyman diet. We are looking for a diet that increases the amount of Dopamine, Endorphin, Oxytocin, and Serotonin (the feel good hormones) or a decrease in the amount of depression. However; not all of the above are hormones. Oxytocin is a neurotransmitter and a hormone, In the brain, dopamine functions as a neurotransmitter—a chemical released by neurons (nerve cells) to send signals to other nerve cells. Endorphins are hormones, Serotonin is most commonly believed to be a neurotransmitter, although some consider it to be a hormone. A Neurotransmitter is a chemical substance that is released at the end of a nerve fiber by the arrival of a nerve impulse and, by diffusing across the synapse or junction, causes the transfer of the impulse to another nerve fiber, a muscle fiber, or some other structure. A hormone is a regulatory substance produced in an organism and transported in tissue fluids such as blood or sap to stimulate specific cells or tissues into action.

Different Diets

Each diet that we picked has its different components. The Harvard Diet uses the my plate nutritional guidance graphic. The Harvard diet is similar to a mediterranean-type diet that includes fruits, vegetables and low fat- dairy products as shown in the table **Figure 1.** The Hyman Diet is a cross between a paleo and vegan diet as shown in **Figure 3.** The Paleo Diet gets

its name from the Paleolithic era (2.5 million years ago) where cavemen ate foods that were

available only during the Paleolithic era.A vegan diet restricts all animal byproducts from your

diet. The Hyman Diet contains mostly plant based foods with little to no meat and dairy. The

DASH Diet (Dietary Approaches to Stop Hypertension). The DASH Diet contains nutrient rich

foods that lower blood pressure such as potassium, calcium, and magnesium as shown in **Figure**
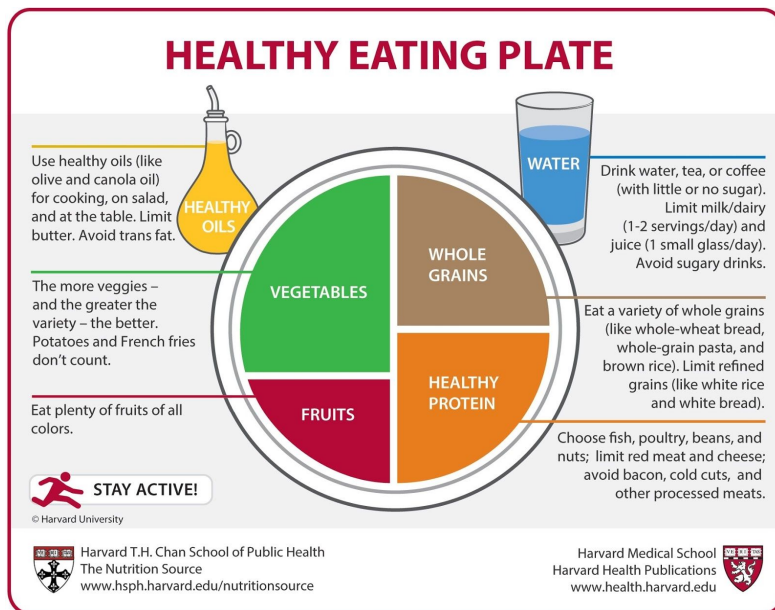
2.

Harvard Diet Daily Intake

Figure 1 The average food to eat while on a Harvard diet.

DASH Diet Calorie Intake

| Food Group	Servings Per Day			Serving Sizes	Examples and Notes	Significance of Each Food Group to the DASH Eating Plan
	1,600 Calories	2,000 Calories	2,600 Calories			
Grains*	6	6–8	10–11	1 slice bread 1 oz dry cereal† ½ cup cooked rice, pasta, or cereal	Whole wheat bread and rolls, whole wheat pasta, English muffin, pita bread, bagel, cereals, grits, oatmeal, brown rice, unsalted pretzels and popcorn	Major sources of energy and fiber
Vegetables	3–4	4–5	5–6	1 cup raw leafy vegetable ½ cup cut-up raw or cooked vegetable ½ cup vegetable juice	Broccoli, carrots, collards, green beans, green peas, kale, lima beans, potatoes, spinach, squash, sweet potatoes, tomatoes	Rich sources of potassium, magnesium, and fiber
Fruits	4	4–5	5–6	1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit ½ cup fruit juice	Apples, apricots, bananas, dates, grapes, oranges, grapefruit, grapefruit juice, mangoes, melons, peaches, pineapples, raisins, strawberries, tangerines	Important sources of potassium, magnesium, and fiber
Fat-free or low-fat milk and milk products	2–3	2–3	3	1 cup milk or yogurt 1½ oz cheese	Fat-free (skim) or low-fat (1%) milk or buttermilk; fat-free, low-fat, or reduced-fat cheese; fat-free or low-fat regular or frozen yogurt	Major sources of calcium and protein
Lean meats, poultry, and fish	3–6	6 or less	6	1 oz cooked meats, poultry, or fish 1 egg†	Select only lean; trim away visible fats; broil, roast, or poach; remove skin from poultry	Rich sources of protein and magnesium
Nuts, seeds, and legumes	3 per week	4–5 per week	1	⅓ cup or 1½ oz nuts 2 Tbsp peanut butter 2 Tbsp or ½ oz seeds	Almonds, hazelnuts, mixed nuts, peanuts, walnuts, sunflower seeds, peanut butter, kidney beans, lentils, split peas	Rich sources of energy, magnesium, protein, and fiber

Hyman Diet Food Chart
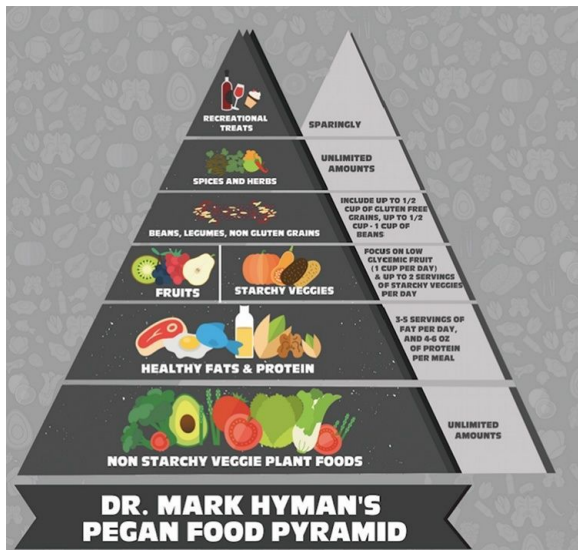
Figure 3 This shows the hyman diet and food intake.

Problem Statement

Finding a healthy diet as an alternative or in conjunction with medication shows promise in assisting patients with depression. Both aspects of our projects-depression and nutrition-have been researched. However, when it comes to mind, the two are not normally linked. Through the research of depression it is stated that any physical activity that is given to the body can and has shown to assist the treatment of depression. However, there is only a small handful of articles that focus on the connection between nutrition and depression. Our solution to the problem statement was to collect as much data as we can on depression, the brain, and nutrition.

Method

Our team engaged in a discussion to clarify our problem. We wanted to find the perfect diet to decrease the emotional side effects of depression. We all settled on a subject in which we were quite familiar. At first, we focused more on research than our code to understand what wewere attempting to do. After we had gone more in-depth than basic knowledge of understanding depression, we gave ourselves jobs: code, writing, and research. As a resource, we spoke to our health teachers. They responded to our questions with standard caloric intake values, macronutrients, and basic information about depression. It wasn't enough to build our code so we went more into depth using articles and graphs we found online. One member of our team contacted a member of a Mental Health organization that focused on informing people about mental health. Currently, we are collecting details that we overlooked or set to the side in our notes and resources.
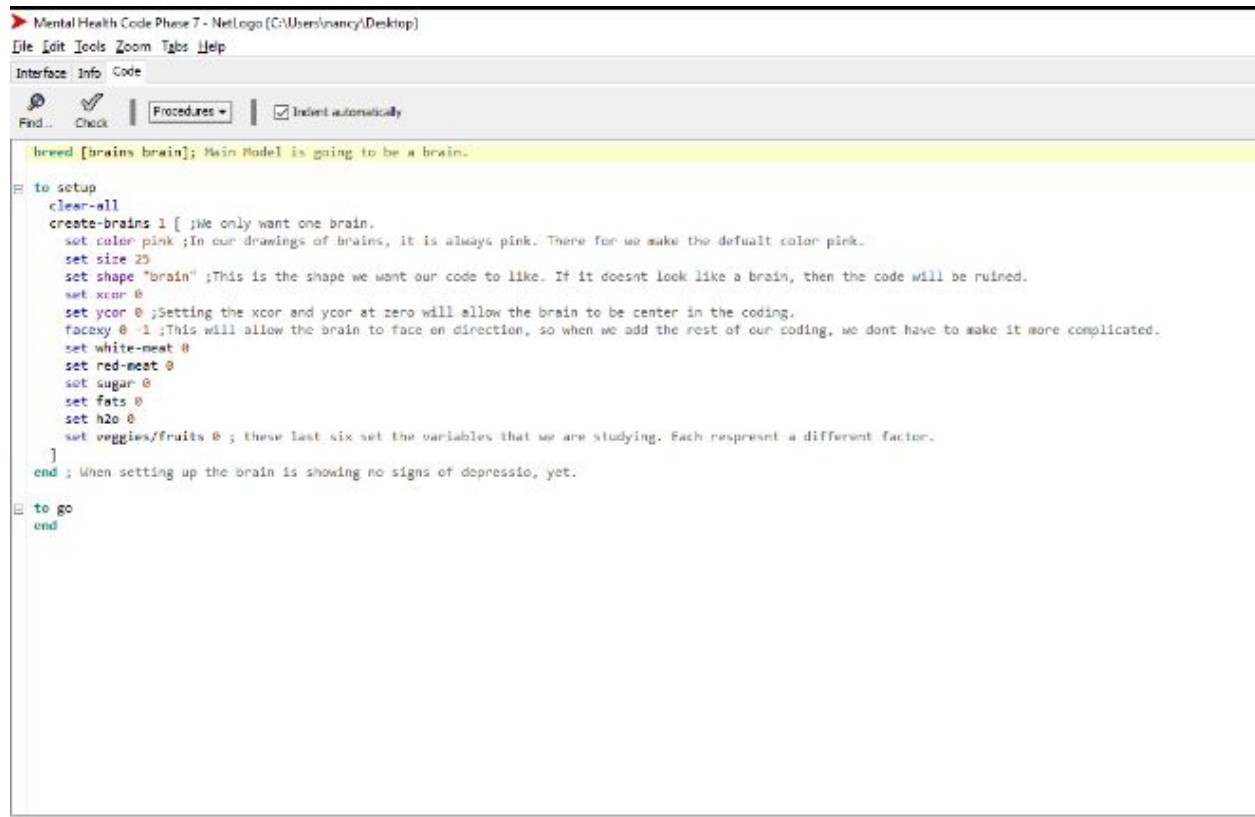
Code

Our code has changed considerably over the year. The code has yet to be finished, we are planning to work on it throughout the summer and next year. We have set up our model with one brain and the variables of a diet. Some of the variables include micro and macro nutrients (because that is how the diets differ), age of the individual , and the absence of the four neurotransmitters. We are working on our model so that it more accurately measures the increase of neurotransmitters and hormones that are present in the brain or the decrease in the presence of these elements when we introduce the nutrients of each diet. We have some unresolved variables such as whether   the age of the brain affects neurotransmitter production. We want to find a way to effectively measure the endorphins (or neurotransmitters) in the brain within our model so that it functions like a real-life brain.

Code Interphase
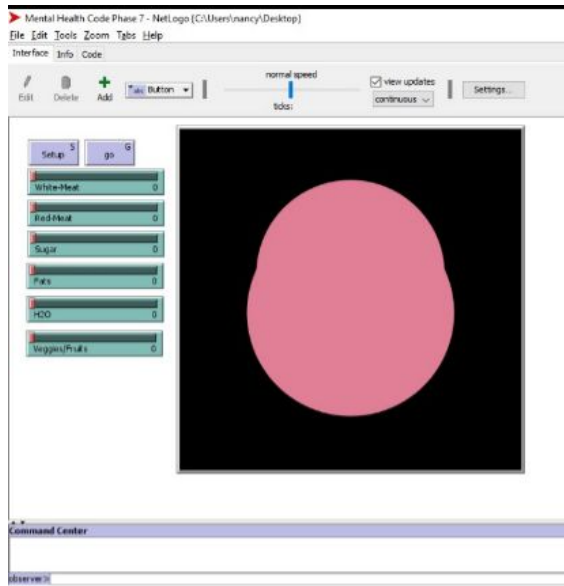
This is the setup of our brain. We are using the language; Netlogo to code everything. The setup just places the brain, in the center. The sliders on the code represent the variables that that could affect nutrition (Micro and Macro Nutrients).

Code

File Edit Tools Zoom Tabs Help

Interface Info Code

Find...   Check | Procedures ▾ | ☑ Indent automatically

```
breed [brains brain]; Main Model is going to be a brain.

to setup
  clear-all
  create-brains 1 [ ;We only want one brain.
    set color pink ;In our drawings of brains, it is always pink. There for we make the defualt color pink.
    set size 25
    set shape "brain" ;This is the shape we want our code to like. If it doesnt look like a brain, then the code will be ruined.
    set xcor 0
    set ycor 0 ;Setting the xcor and ycor at zero will allow the brain to be center in the coding.
    facexy 0 -1 ;This will allow the brain to face on direction, so when we add the rest of our coding, we dont have to make it more complicated.
    set white-meat 0
    set red-meat 0
    set sugar 0
    set fats 0
    set h2o 0
    set veggies/fruits 0 ; these last six set the variables that we are studying. Each respresnt a different factor.
  ]
end ; When setting up the brain is showing no signs of depressio, yet.

to go
end
```

Research

Our research is comprised of different sections of biology, nutrition, and psychology. We started off by understanding nutrition and its effects on the human body and depression as a chemical process. The information gathered allow us to understand that there was no possible way to measure depression as a whole, but it was only measurable through levels of our happy chemicals (Dopamine, Endorphin, Oxytocin, Serotonin). After understanding that depression was not a genetic trait, but it was a type of chemical imbalance, we began to research the outcomes of diet's impact of mental health. We looked at three diets that gave different impacts on your health such as the DASH diet, the Harvard diet, and the Hyman diet (Resources 1,8,9). At the moment we have not gotten any results that have shown its impact on mental health, but it has been proven to affect adolescents who have skipped out on meals, exercise, and sleep.

Conclusion

Depression is not mainly genetics, nor does it have one answer of why someone has depression. Nutrition is very important to our daily life; it affects our brain activity. Depression is a disorder that is characterized as a periodic occurrence of complete and total sadness that lasts for longer than two weeks. The brain is constantly working with depression decreasing hormones (Dopamine, Endorphins, Oxytocin, and Serotonin), it's a constant struggle to do simple tasks and maintain a balanced social life. We didn't know the definition of nutrition until we really researched about it. In conclusion, this project has greatly expanded our knowledge of nutrition, how the brain works, and mental health.

Significant Achievement

Gwenevere:

A significant achievement that I achieved is how far we got into research. We were able to look up new information on the brain that we have never actually heard before we got into the project. This was important for us to look into as much information as we could find because it gave us a better understanding of our health and our brain. I'm prepared with more knowledge about the brain than I have my entire life. Throughout this project, I kept informing my mom, who is a nurse, about information she has never even heard before.

Kyreen:

We have achieved a lot this year including me. I think I now have a better understanding of our project. We all started out with a rough idea of a lot of different ways and things to do. I think because we have known each other for a while now we all understand and know how to do things. The only obstacle we all struggle with is coding we don't that much experience with it and are just trying to help each other out. My personal achievements are all about doing a large amount of research. I didn't notice how much research goes into this project and it is very interesting to find out new things you never knew. In all it has been a great year and project with Supercomputing Challenge.

Nancy:

During this year's challenge, I was able to improve my information gathering skills. I learned what information would be useful and which ones would not be a good resource to use. Throughout this year I was able to find ways of analyzing codes and how to show what I information can be gathered from those codes. At the moment I am still trying to make my coding ability better by taking classes during the summer. This year has allowed me to understand every section that I have researched, written, analyzed, and partly coded. I believe that this year I was able to step in and help each and every one of my teammates and that in doing so, we were able to not only work together and get everything done but also bond over the past months of working with this project.

Tiffany:

My biggest achievement was learning how to stay committed and improve my writing skills. Not too long ago, I realized I have commitment problems and I wanted to prove to myself that I could work on something without quitting later. I didn't expect my involvement with sports at school would be more of a challenge to on top of my mission to stay committed to the challenge but I endured. I am proud of myself for staying this long in the challenge and already looking forward to the expo and next year. On top of that, my writing has gotten better. There are a few grammar mistakes here and there, but writing reports allow me to stop and think about what I want to say before I type it and submit.

Acknowledgments:

Karen Glennon: Mrs.Glennon is like the all seeing eye. She knows everything about Supercomputing Challenge. She has definitely helped a lot with the planing and the approach of our project. We loved all the support we gained from her telling us "It doesn't have to be perfect just perfect enough." She has been a great help with the project all together.

Patty Meyer: Mrs.Patty has been a great help telling us how to improve and think about our project. She always tells us new information she learned about our project. Every Monday Mrs.Patty tells us new ways and information we could put into our project.

Jane Haagensen: Jane helped us with the most part of developing and deciding what to do with our project. She helped us with what we wanted to do our project on. Also, how to make our project make sense. She gave us many ideas she thought would make a lot of sense that helped us a large amount. We all loved the great ideas she had for us. She made or brains start working when in a slump.

Drew Einhorn: Drew always helped us with our coding and project evaluations. He continuously helped us with finding different code models to use as a guide whenever we first started the project. He helped us find a coding plan when we were confused with our coding plan. Drew also gave us different sources to gather different information based on nutrition and depression as a whole.

Sharee Lunsford: Ms. Lunsford has helped us in our writing and cognitive skills. She has helped us understand what improvements are needed to be done for our projects and what things must be of our priority. She has always put our needs on the top of her list and always made sure that we understood what we are doing. We would not be at the place we are now in our project had it not been for her.

Geoff Danielson: Mr. Danielson was our first project mentor. He is the reason that we were able to move ahead in our project. He provided us with flashcards that contained step by step plans that helped us take this project in bite sized pieces.

Lee Danielson: Lee Danielson advised us when we were trying our best to understand the way the brain works. She helped us to efficiently research the brain and depression as a chemical process. She also helped us with writing an accurate report on the brain and nutrition and what steps we should use to further our knowledge of it.

Sheila Ortega: Sheila was our viewer for our interim. She helped us with a better understanding to how our project was going and how to further with our project. There was a bit of confusion, but it still helped in the end and we thank her for reading our project with her free time.

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12. Lee Danielson - Ldaniels@unm.edu (505) 220-3736 She helped us understand the effects of nutrition and the carbohydrates, proteins.