CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Shilpa P. Argade

Project Number
J0401

Project Title
Which Milk Is the Best for Your Baby?

Abstract

Objectives/Goals
This project was done to determine the contents of Sialic Acid present in human milk and infant milk formulas. Sialic Acid is an important sugar for the development of a baby's brain, immunity against infections, and development of their digestive system. It is known that there is a high amount of Sialic Acid in human milk, but many babies are fed infant milk formulas instead of their mother's milk. This project is a comparison study of the total Sialic Acid contents present in infant milk formulas vs. human milk at the various stages of lactation.

Methods/Materials
For this project, six cow's milk based infant milk formulas and five human milk samples were analyzed for their total sialic acid contents. The experimental procedure consisted of the release of sialic acid using a mild acid hydrolysis. The released sialic acid was then derivatized using DMB to obtain a fluorescent tag on the Sialic Acid. Then, the tagged Sialic Acid was analyzed and quantified using the HPLC system with the fluorescence detector.

Results
Results indicated that the total Sialic Acid detected in human milk was at least 3 times higher than that in the infant milk formulas. Out of the infant formulas, Nestle Good Start had the most Sialic Acid, while Isomil, a soy-based formula had none. Out of the human milk samples, Colostrum (milk at day 4) had the highest amount of Sialic Acid and the amount decreased with the stages of lactation over a 12-week period.

Conclusions/Discussion
My results show that human milk is the best source of nutrition for an infant especially in the early days of infancy and also for pre-term babies since it has a significantly higher amount of Sialic Acid. This study is important because it helps people undertstand the importance of sialic acid and helps them make a right choice in selecting the most nutritious milk for an infant, especially because this information is relatively new and is not on the milk cans of the infant formulas that are avaliable in the supermarket.

Summary Statement
This project is a comparitive study of the total Sialic Acid contents in infant milk formulas vs. human milk at the various stages of lactation.

Help Received
Mother helped guide me in the lab; Father helped me with graphs; Teacher gave me suggestions; Used lab equiptment at UCSD under the supervision of Dr. Sulabha Argade.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Jordan Bambas; Caitlin Gannon; Stephanie Hernandez

Project Number

J0402

Project Title

Effects of Acidic Juices on Apples over Time

Abstract

Objectives/Goals

The objective is to observe and compare the effect of acidic fruit juices on apple slices to determine which juice will be the most effective in preventing oxidation (browning.) We believe lemon will perform the best.

Methods/Materials

Five fresh fruit juices, (pineapple, kiwi, orange, lemon and lime) were prepared undiluted and diluted, coated on apple slices and observed over a 48-hour period. The control group consisted of untreated apples. Visual observations were recorded using a scoring system of 0-5, along with a photograph, at Hours 0, 1, 3, 15, 24 and 48, for three complete trials.

Results

The lower the pH, the better the juice performed as an antioxidant compared to Controls. Lemon and lime proved to be the most effective. Lemon lasted longer over time, but lime was most consistent in all trials. Trial-to-trial results were not all consistent for a given juice. All juices prevented oxidation to some extent, compared to the control group.

Conclusions/Discussion

The diluted juices performed almost as well as the undiluted juices, and sometimes better, an unexpected finding. We learned oxidation is the reaction between oxygen in air and the juice substrate in the fruit. When this reaction is combined with the enzyme in apples,(Polyphenyl Oxidase), the apples turn brown. We discovered that the ascorbic acid in the fruit, acting as a conservative, is the actual substance that coats the apple, preventing the oxygen from reacting with the enzyme and juices.

Summary Statement

To compare the effect of fruit juices on apple slices to determine which juice will be most effective in preventing oxidation (browning.)

Help Received

Advisor and Mother (Gannon) gave suggestions and coaching.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Jack Bayless; Gian Pepe

Project Number
J0403

Project Title
How Does Xylitol Affect the Acidity of Plaque?

Abstract

Objectives/Goals
The objective of our project was to test the effectiveness of xylitol in reducing the acidity of the plaque.

Methods/Materials
We tested five subjects. The night before the testing they did not brush their teeth. Then in the morning we tested the acidity of the subjects# mouths. Then they ate Frosted Flakes, and we recorded their mouth#s acidity every five minutes for the next thirty minutes. On a different occasion, we had the same subjects repeat the experiment chewing Spry gum with xylitol after eating the Frosted Flakes. We ran these trials twice on five subjects to ensure the integrity of the data.

Results
In the #Without Xylitol# graph, the acidity level slowly increases until a certain point (usually around 15 minutes), where it goes back to normal. Our hypothesis stated that the xylitol would affect the acidity of the mouth. In the graph that includes the average of all subjects, the trials with xylitol have a consistently lower acidity than the trials without xylitol. The plaque without xylitol reached a pH of 5.8, and the plaque with xylitol reached a pH of only 6.45. The graph of the plaque tested directly after the consumption of the complex carbohydrate, without the introduction of xylitol, illustrates the Stephan Curve.

Conclusions/Discussion
Having the cariologist Dr. Featherstone, run tests on our data, it was concluded that the baseline (before chewing the gum) was not statistically significant between the two groups, from a Student t-test, showing that they do not differ at the baseline ($p > 0.05$, by the Student t-test, two tailed. The p value was 0.008). After ten minutes the data did show to be statistically different between the two groups ($p > 0.05$ by Student t-test, two tailed. The p value was 0.008). The trials with xylitol did show a significant difference overall between the two groups, with the acidity not increasing a great amount, and when it did, coming back down fairly quickly as shown by the t-test with $p > 0.05$. Xylitol does affect the plaque, hindering its growth and by-product of acid. Our experiment is pertinent to our daily lives, because we should each brush our teeth, but many people cannot find time to do so, or are away from a place where they are able to do so. Our experiment shows that if people are unable to brush their teeth, they can chew xylitol, which will reduce the acidity in their mouth, and hopefully prevent cavities.

Summary Statement
In our project, we tried to find out the effect that xylitol gum has on the acidity of plaque.

Help Received
Dr. Featherstone ran a statistical analysis for us; Dr. Bayless consulted with us about our project.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Meg C. Dadourian

Project Number
J0404

Project Title
Fundamentals of Fermentation

Abstract

Objectives/Goals
"How does changing the temperature affect how long it takes Chinese cabbage to ferment into kimchee reaching a pH of 3.5?"
It is hypothesized that the kimchee in the 32o C will ferment faster than the kimchee in 21 o C or at 4 o C.

Methods/Materials
Approximately equal amounts of Chinese cabbage, salt, garlic and chilly powder were placed in 15 sterilized containers. Then, five containers are placed in environment with a temperature of 4 o C; five containers were placed in environment with a temperature of 32o C; and five containers were placed in at room temperature of 21 o C. At approximately 12-hour intervals, the pH level was measured. Once the pH level dropped to 3.5 the experiment was complete. However, the last recording of the pH level was taken after 372 hours even if a pH level of 3.5 was not reached.

Results
The results supported the hypothesis.

Conclusions/Discussion
It is recommended that if this experiment was to be repeated that prior to extracting sample juice, the contents of each jar should be thoroughly mixed to make sure that all the juice represents the actual overall pH level in the jar. Also, a chemically non-reactive weight should be placed in all the trials to ensure that the juices completely cover the cabbage at all times ensuring an anaerobic environment.

Summary Statement
How does changing the temperature affect how long it takes Chinese cabbage to ferment into kimchee reaching a pH of 3.5?

Help Received
My parents assisted me with purchasing the materials and cutting the cabbage and general supervision. Mrs. Hoffman, my teacher, helped me with organization of the project. and Dr. Daub, Chairman Chemistry Department, Harvey Mudd College, for his consultation on my science fair project.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
James A. Fraser

Project Number
J0405

Project Title
Digestion Is the Question: Part 2

Abstract

Objectives/Goals
I recreated the digestive system and enzymes. My project is a continuation of last year which I have done 288 more tests. I wanted to see if starch would combine with glucose and exit the semi-permeable membrane of a sausage casing representing an intestine. I tested for fat to see if it could break down without bodily fluids. If it does this proves that glucose,starch,and fat are able to break down in your intestines,exit the membrane and give nutrients to your cells. I tested foods with no additives,and foods with additives to see if any of the adding#s affected the output of the nutrients. I chewed the foods and tested for the three nutrients to see if salivary enzymes affected the output. I hypothesized that the starch and glucose would be able to exit the membrane because of past results. I didn't believe the fat would be able to break down because it takes a lot of energy and needs bodily juices and acids which were not in my tests.

Methods/Materials
Materials:Cornstarch,white bread,any type of soft pasta,yellow corn,potato,Cheerios,grinder to crush foods,glucose,starch,and fat test strips,apple juice with natural sugars,48 sausage casings,pudding,potato chips,honey nut cheerios,chef boyardee,french toast,peanuts,popcorn,beef and pork hot dogs.
Procedures:Collect all materials. Fill sausage casing with ¼ cup of the food mixture,¼ cup of the apple juice,and ¼ cup of distilled water,tie the end tight. Fill the jar with distilled water and place the sausage casing on the bottom of the jar. Every fifteen minutes for an hour check the water for glucose, fat, and starch.

Results
My tests showed a big difference in the output of starch,glucose,and fat with non additive foods and additive foods. The tests proved the additives get in the way and block the membrane.Tests also showed the chewed foods broke down faster then the unchewed foods. This proves salivary enzymes play a huge part in your digestion. My tests proved that creating a meal with whole foods without additives is healthier than one with additive foods.

Conclusions/Discussion
My hypothesis was incorrect. The fat was digested like the glucose and starch. This proves that fat molecules are too big to exit the membrane until they are broken down. The glucose molecules were not as big as the other molecules and did not have to break down as much as the other molecules; they were already small enough to leave the membrane and the exit was faster.

Summary Statement
The breakdown and exit of glucose, starch, and fat molecules through the semi-permeable membrane of your intestines.

Help Received
My parents for purchasing my materials.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Arman A. Hamamah

Project Number

J0406

Project Title

How Do Substrate Amount, Temperature, pH, Enzyme Amount, and Inhibitor Affect Catalase Activity?

Abstract

Objectives/Goals

The purpose of my experiment is to determine the effect of hydrogen peroxide amount, temperature, pH, enzyme amount, and inhibitor on catalase activity. The independent variables are: substrate amount (ml), temperature (celsius), pH, enzyme amount (ml), and copper sulfate (mmoles). The dependent variable is rate of oxygen production (mmoles/sec). The hypothesis is: 1) If the substrate amount increases, the rate of reaction will increase, until point of catalase saturation. 2) If the temperature increases, the rate of reaction will increase, until point of enzyme denaturation. 3) Catalase activity has an optimum pH. 4) If the enzyme amount increases, the rate of reaction increases. 5) Adding copper sulfate decreases rate of reaction

Methods/Materials

Catalase (from dry yeast) catalyzes hydrogen peroxide to produce water and oxygen . The amount of the substrate (3% H(2)O(2)) used ranged from 20-240ml. Temperatures used ranged from 10-70 degrees celsius in increments of 10. pH used ranged from 2-12 in increments of 2. Amounts of enzyme used: 5, 10, 15ml. Amount of CuSO(4) used ranged from 0.063-3.125mmoles The rate of reaction was measured by the rate of oxygen production in mmoles/sec.

Results

1) Rate of reaction was directly proportional to H(2)O(2) amount used until point of catalase saturation at 180ml. 2) Rate of reaction was directly proportional to the temperature until catalase denaturation at 60 degrees celsius. 3) Optimum pH for catalase was 6. 4) Rate of Reaction was directly proportional to enzyme amount. 5) Increasing Copper Sulfate amount decreased rate of reaction until point of maximum enzyme inhibition at 0.313 mmoles. My hypothesis was supported for all categories tested.

Conclusions/Discussion

Catalase is made of a central heme and four polypeptide chains. Its active site binds to hydrogen peroxide and decomposes it to oxygen and water. My data suggests that enzyme activity depends on several modifiable variables. Factors that increase binding of H(2)O(2) to catalase, such as increasing substrate and enzyme amounts, and increasing temperature, will increase the rate of reaction. After all active sites are occupied, adding more hydrogen peroxide will not affect the rate of reaction. Factors that cause catalase denaturation, such as high temperatures, extreme pHs, and non-competitive inhibitors, can change its 3-dimensional structure, rendering it less active.

Summary Statement

I tested the effect of hydrogen peroxide amount, temperature, pH, catalase amount, and the inhibitor copper sulfate on catalase activity.

Help Received

Parents guided me through experiment and purchased necessary equipment and chemicals.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Lorraine James; Alyssa Windle

Project Number
J0407

Project Title
Plant Genetic Function Study through Virus Induced Gene Silencing

Abstract

Objectives/Goals
To determine if it is possible to dysfunction a gene through gene silencing, or in our case virus induced gene silencing. We believe that gene silencing will occur.

Methods/Materials
Using gloves and syringes, two Nicotiana benthamiana plants were inoculated with an agrobacterium which contained the Tobacco Rattle Virus. This virus contained the gene fragment Pds.

Results
In the plants that were previously inoculated, the gene fragment Pds silenced the host gene. This was expressed in the host plant as a photo-bleached phenotype. Our hypothesis was correct. Virus induced gene silencing occurred.

Conclusions/Discussion
Virus induced gene silencing was evident by the expression of a photo-bleached phenotype. The host gene was silenced. Our hypothesis was correct.

Summary Statement
Our project is about Virus Induced Gene Silencing and how it can be applied in the real world.

Help Received
Dr. Jin allowed us the use of her laboratory and tools

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Adel M. Kamal

Project Number
J0408

Project Title
Got a Bone to Pick

Abstract

Objectives/Goals
My goal was to answer the question "Can Bones resorb calcium". My Hypothesis was yes, bones can resorb calcium.

Methods/Materials
First I decalcified the bones using Vinegar, is 6% Acetic acid (CH(3)COOH). Then I used Calcium Oxide (CaO), Pickling lime, to provide the calcium for the bones to resorb. I used chicken bones to conduct the experiment.

Results
My results showed that all the bones, when put in Vinegar, lost their calcium; the calcium in the bones reacted with the acetic acid and formed calcium acetate. Later on in my experiment I noticed that pickling lime, calcium oxide, helped the bones regain calcium. I also noticed that not all the calcium lost was regained.

Conclusions/Discussion
My hypothesis was correct. From my research I learned that osteoporosis is a disease that causes bone loss. Bone loss is the loss of calcium and minerals in a bone. I found that bone density is how tightly packed bones are or how many minerals are in a bone. I also learned about prevention methods and medication for osteoporosis.

Summary Statement
The focus of my project is to explore the possibility of reversing osteoporosis.

Help Received
Mother helped with cutting bones.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Sarah B. Levin

Project Number
J0409

Project Title
Genetically Modified Plants: Are Your Foods Wearing Designer Genes?

Abstract

Objectives/Goals
U.S. agencies do not require labeling of foods containing genetic modifications. In Europe, however, label regulations require that any genetically modified plant DNA be identified. The purpose of this experiment was to see if genetically modified plants could be detected in foods sold in local grocery stores, and if foods labeled as #organic# were truly free of genetically modified plants. Foods having the #organic# label by label definition cannot contain plants that are genetically modified or sprayed with pesticides.

Methods/Materials
A variety of commercial and organic foods containing soy and corn ingredients were purchased from local grocery stores, as well as fresh papaya. In a laboratory setting, I extracted DNA from the plant foods using a Qiagen#s DNeasy Kit. After extraction, I mixed the DNA with polymerase chain reaction (PCR) buffer and reagents. I then placed the samples in a PCR machine and amplified for 54 cycles over 3 hours. After the PCR was completed, a technician loaded the DNA on an agarose gel. The results of the gels were then photographed and I analyzed the results.

Results
Gel results showed that some of the samples contained the NOS gene, which is only found in genetically modified plants. Samples of health food store bin products: #Wild Oats Soy Flour# and #Wild Oats Corn Meal#, as well as #Albers Yellow Corn Meal#, #Boca (soy) Burger#, #Gardenburger#, and papaya fruit all contained the NOS sequence, meaning they were also genetically modified. The food samples with organic labels such as #Arrowhead Mills Corn Meal#, #Arrowhead Mills Soy Flour#, #Organic Boca Burger# and one sample of non-organic soybean (Safeway Select Shelled Edamame) did not possess the NOS gene.

Conclusions/Discussion
Although foods specifically labeled as organic were not genetically modified, the results of this experiment demonstrate that many foods sold in local grocery stores are indeed genetically modified, including bin products sold in local health food stores and commercial vegetarian products.

Summary Statement
This project investigated bin products sold in health food stores, commercial vegetarian foods, and food products labeled as "organic" for evidence of genetic modification in plant DNA.

Help Received
Dr. Madeline Butler allowed me to use her lab at UCSD and assisted me when I was unable to perform various tasks due to GSDSEF/CSSF regulations.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Alexandra G. Moyzis

Project Number
J0410

Project Title
Do the Ends Fortell the End?

Abstract

Objectives/Goals
Is a variation in the DNA sequence of telomerase, the enzyme that adds telomeres to the ends of chromosomes, responsible for longevity? Based on previous correlations between telomere length and aging, it can be hypothesized that a specific genetic variation in telomerase will be found more frequently in individuals reaching 90 years old.

Methods/Materials
The mutation was analyzed using Polymerase Chain Reaction (PCR), which makes many copies of the DNA of interest, coupled with DNA sequencing. Approximately 50 children and 50 Senior Citizens over 90 years of age were looked at for this project.
General: micropipets, pipettors, microcentrifuge tubes, test tube racks, centrifuge, ice bucket/ice.
Polymerase Chain Reaction: DNA, primers, DNA polymerase, deoxynucleotides, tris buffer, water, PE 9700 polymerase chain reaction machine.
Gel Electrophoresis: Agarose, tracking dye, gel apparatus, power supply.
Gel Staining: pyrex dishes, ethidium bromide stain, water.
DNA Sequencing: PCR product, deoxynucleotides, terminator nucleotides, DNA polymerase, water, ABI 3100 DNA Sequencer.

Results
It was found in the over 90 population that there are fewer homozygous A/A and G/G individuals and more heterozygous A/G individuals than expected.

Conclusions/Discussion
When genetic results do not match the Hardy-Weinberg prediction, it can mean there is an advantage to one of the genetic combinations over the others. In this case, it appears that the heterozygous A/G genotype in telomerase is advantageous in some way and is enriched in individuals over ninety.

Summary Statement
A specific variation in the DNA sequence of telomerase, the enzyme that adds telomeres, is found more frequently in individuals reaching 90 years old.

Help Received
I used my parent's laboratory at the UCI School of Medicine. Simin Hakim ran my samples on the ABI 3100 DNA sequencing machine.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Krista L. Owens

Project Number
J0411

Project Title
Controlled Atmosphere Storage Affects Malic Acid in Apples

Abstract

Objectives/Goals
The purpose of the project is to determine the effects of controlled atmospheric conditions on malic acid production in apples.

Methods/Materials
Apples were stored in 3 different temperature environments (refrigerator, room, freezer) over a period of time. Juice was extracted from each group and titrated to determine concentration of malic acid produced.

Results
Malic acid concentration was slightly higher in the apples stored in the freezer.

Conclusions/Discussion
The results did not support the hypothesis or research. I believe that storing the juice from each group in the refrigerator for 3 days before titration may have caused the results to be different from what is found in the research.

Summary Statement
The effects of controlled atmospheric storage on malic acid production in apples.

Help Received
Teacher helped with supervising. Local market donated apples. Grandmother helped with materials, etc.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Michelle K. Reed

Project Number
J0412

Project Title
Glutathione Antioxidants Protect Living Organisms from Fenton Oxygen Free Radical Damage

Abstract

Objectives/Goals
When antioxidants are advertised, they claim that they can work miracles- but are they telling the truth? The goal of my project is to test sulfur-based antioxidants to see if they could actually protect planarian worms from oxidation. I tested GSH (glutathione; gamma glutamyl-cysteine), Reduced GSH (also in capsule form), Oxidized GSH, and R-DHLA (a reduced form of Lipoic acid). This is my 3rd year of experiments and I am using a new assay to show the oxidation getting into the Planarians.

Methods/Materials
The overall procedure is to generate free radicals (Copper Sulfate plus Hydrogen Peroxide) and see if the antioxidants can protect the worms from the oxidation damage. Planarians are placed in wells of a 12 or 96 well dish with water. Next, antioxidants are added, then the copper sulfate and hydrogen peroxide. In the 12 well assay I observed the worm between 4 to 24 hours and assigned them a health score. The 96 well assay is called Image-iT. A chemical called Carboxyl-H2DCFDA is added to the wells and turns green in a biochemical reaction when there are free radicals present in the worm cells. The worms that are harmed by the free radicals take in the dye and with a special wave length of light the green dye is turned into numbers by a machine called a fluorometer. I used a fluorescent microscope with a digital camera and I also used a special Intel microscope to collect time lapsed pictures of the free radical attack on Planarians.

Results
R-DHLA was too toxic, so I dropped it from the rest of my experiments. So, now my experiments became a comparison of Red. GSH capsules, Red. GSH, and Oxidized GSH. In my visual score experiments the Red. GSH worked best, followed by the Red. GSH capsules and then Oxidized GSH. In the Image-iT experiments, the Red. GSH and capsules were very similar. However, the Oxidized GSH worked best.

Conclusions/Discussion
I had hypothesized that the Red. GSH would protect better then the capsules. In one set of assays that is the case, but in the other they tied. I expected the oxidized GSH wouldn#t work at all since it is already oxidized. However, my Image-iT results led me to research more about the biochemistry of oxidized GSH. I realized that it makes perfect sense, the worm must have actually taken the oxidized form and reduced it in its tiny body so it could scavenge free radicals again and again. This also helps prove the antioxidants are getting into the planarian too.

Summary Statement
I am determining which sulfur-based antioxidants protect planarian worms the best from free radicals created in a Fenton Reaction.

Help Received
My mom and dad both helped me get supplies and supervised my experiments. My dad helped me with the LIVE-iT dye and chemical information. I used equipment at my mom and dad#s work.