SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Prize Winner

Scientific Inquiry

Year 7-8

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Australian Government
Department of Defence

Government of South Australia
Department for Education

SASTA South Australian Science Teachers Association

Inquiry Question: What negative and positive changes and effects does the human body undergo when abstaining from consuming all added sugars, processed and artificial sweeteners for a period of 4 weeks?

Introduction:

Sugar craving significantly influences how we consume food and what we consume. Sugars can be categorised into three groups: natural, refined and sweeteners. Natural sugars are naturally occurring in whole foods like fruit, milk and honey and often come with nutrients, fibres and antioxidants. Refined sugars like table sugar are sugars extracted and processed from natural sources. Sweeteners are substances added to foods and drinks to give them a sweet taste. They can either be natural or artificial. Natural sweeteners are derived from natural sources, although some can be processed, like stevia, whilst others are completely natural, like honey. Artificial sweeteners are lab-created using chemical synthesis, like aspartame.

Aim:

To find out if abstaining from sweeteners (processed and artificial) and refined sugars, and only eating foods with natural sugars and sweeteners, will improve the overall mental and physical health of a person.

Background Information:

Consuming natural sugar instead of refined sugar can improve metabolism. Natural foods full of sugar, like honey, have been associated with limiting weight gain, improving dyslipidemia (abnormal levels of fat in the blood) and reducing glycemia (the concentration of glucose in the blood). Natural sugars and sweeteners also have molecules like minerals and polyphenols (compounds with anti-inflammatory and antioxidant properties), which could impede the effects of the high sugar content of the food. Foods like honey contain several substances linked to improving hypertension (the force of blood against artery walls is too high) and hyperglycemia (too much sugar in the blood), as well as antimicrobial properties (agents that kill microorganisms).

A study done on Wistar male rats shows refined sugars and natural sweeteners lead to similar obesity, energy intake, weight gain and food efficiency. There were no differences in visceral (fat stored in the abdominal cavity, stores energy, protects organs and produces hormones) and subcutaneous adipose tissue (fat underneath the skin that insulates, provides cushioning and reserves energy). However, the weight of brown adipose tissue (a fat that burns calories to produce heat) was noticeably lower in natural sweetener-treated rats. Rats who ate molasses and brown rice daily were found to display improved fasting glycemia, and, compared to sucrose, fasting insulinemia and insulin resistance were improved by all-natural sweeteners. Most of the natural sugars reduced hepatic (relating to the liver) levels of pro-inflammatory cytokines compared to sucrose, and they also helped liver steatosis (abnormal level of fat in an organ or cell) and inflammation. Researchers propose that daily substituting refined sucrose with natural sweeteners would lower glycemic levels and insulinemic responses, improving metabolic health.

Phytochemicals in natural sweeteners impede carbohydrate digestion and absorption by hindering α-glucosidase, sodium-dependent glucose transporter 1 and sodium-dependent glucose transport in the intestine, by reducing glucose absorption.

If this experiment can determine that a diet consisting of all natural sugars is effective at improving health, then understanding the results can bring valuable insight into the psychological and physical effects when reducing refined sugar and sweetener intake; this can lead to an increased understanding of sugar addiction and its implications on health as well as how we can use this diet as a tool to combat a wide range of health issues. This study can also bring forth a new perspective on our relationship with sugar and the need for sustainable dietary changes.

Hypothesis:

I predict that -

1. The participants (a healthy adolescent male and a healthy adult female) will first experience physical withdrawal with symptoms including but not limited to fatigue, mood changes, cravings, headaches, anxiety and nausea.

2. After withdrawal, participants will gain more focus, higher energy levels, and be in better moods.

3. The final blood test results will show a significant improvement in cholesterol, inflammation, and blood sugar in the participants. The participants will also have lower blood pressure readings and lower weights.

Variables:

Independent Variable: The independent variable in this investigation is the type of diet the participants are on.

Dependent Variable: The dependent variable in this investigation is the results of the blood test taken from the participants, as well as the blood pressure and weight of the participants. The participants' mental and physical state is also a dependent variable.

Materials:

1. A digital scale
2. An automated sphygmomanometer
3. X4 Doctor's request form (blood test)
4. X4 Alcohol wipe
5. A tourniquet
6. X4 Sterile, single-use needle
7. X8 Blood collection tubes

Method:

Participants went on an assigned diet prohibiting foods and beverages with any refined sugars, and processed and artificial sweeteners for 4 weeks. Refined sugars and processed and artificial sweeteners were also not allowed to be consumed separately. This diet focuses on only allowing the consumption of natural sugars and sweeteners.

Procedure:

Baseline Assessment Measurements:

- Body weight (kg) using a digital scale
- Blood pressure (mmHg) using an automated sphygmomanometer by a doctor
- A phlebotomist took fasting blood samples to measure various components of the blood

Observations:

- Participants met with a doctor before and during the study, discussing any symptoms and concerns about their diet and any changes they were experiencing.
- Participants were instructed to keep their usual exercise routines and not to change or add to their previous routine.
- Participants were instructed to keep a log of any symptoms they had during the study; these symptoms were discussed with a doctor during check-ups.

End Assessment Measurements:

- At the end of the study, 4 weeks after the original baseline measurements, all baseline measurements were once again taken, including weight, blood pressure and blood samples.

Data Collection:

Anthropometric Measurements: Body weight was measured to the nearest 0.1 kg, and blood pressure was recorded in mmHg.

Biochemical Measurements: Blood samples were tested by a clinical laboratory for glucose, C-reactive protein, general chemistry, lipid studies, Haemoglobin A1c, haematology and urine.

Symptom log: Symptoms were noted by participants as they went along with the study; these symptoms would later be discussed with a doctor.

Data Analysis:

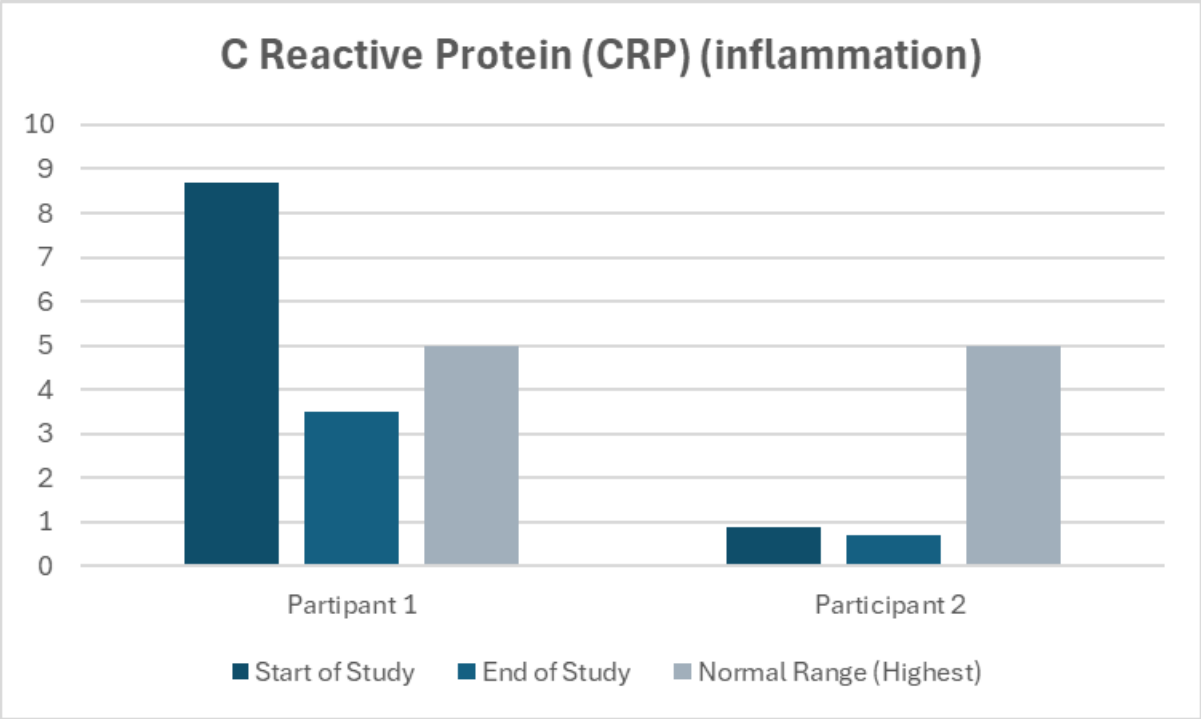
The baseline data was compared with the data collected at the end of the study for both participants. Weight, blood samples and blood pressure were compared from baseline to the end of the study, and the two participants' results were compared to observe any differences. The blood samples were discussed with a doctor, and any significant changes were made clear, as well as changes that the doctor thought might have been caused by other factors, like illness. The participants' symptoms were also discussed with a doctor.

Results:

Laboratory Measurements -

C Reactive Protein (CRP) (inflammation) - Units: mg/L

	participant 1	participant 2
Start of study	8.7*	0.9
End of study	3.5	<0.7

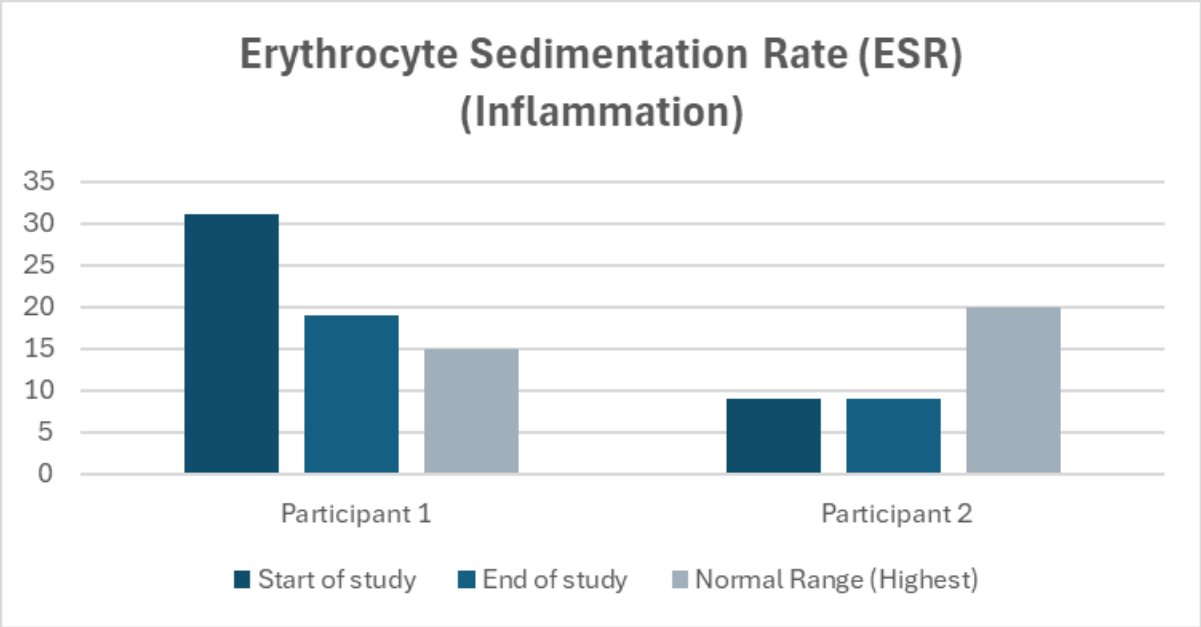


Footnotes:

- ** : Probably Lurking Variable - most likely caused by an underlying illness according to a medical professional.*
- *Note that the highest normal range is different between participants 1 and 2 because participant 1 is a male and participant 2 is a female; there is a difference in the highest normal range for males and females.*

Erythrocyte Sedimentation Rate (ESR) (Inflammation)- Units: mm/h

	participant 1	participant 2
Start of study	31*	9
End of study	19	9



Footnotes:

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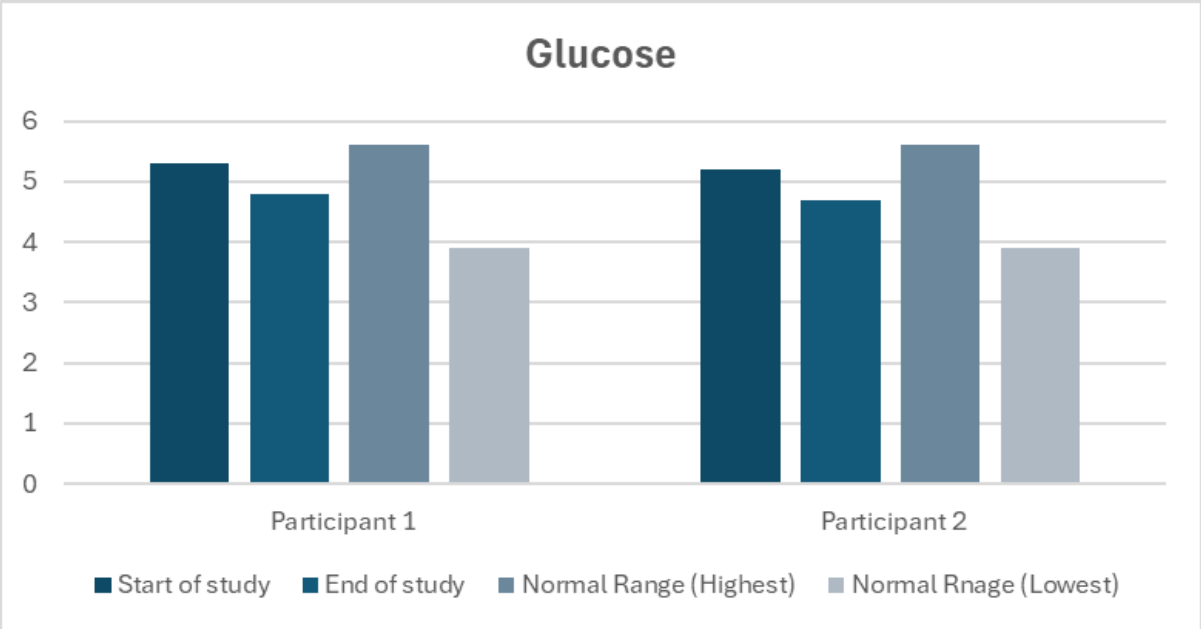
- *Note that the highest normal range is different between participants 1 and 2 because participant 1 is a male and participant 2 is a female; there is a difference in the highest normal range for males and females.*

Glucose - Units: mmol/L

	participant 1	participant 2
Start of study	5.3	5.2
End of study	4.8	4.7



Total Cholesterol - Units: mmol/L

	participant 1	participant 2
Start of study	4.3	5.6
End of study	4.1	5.2

HDL Cholesterol - Units: mmol/L

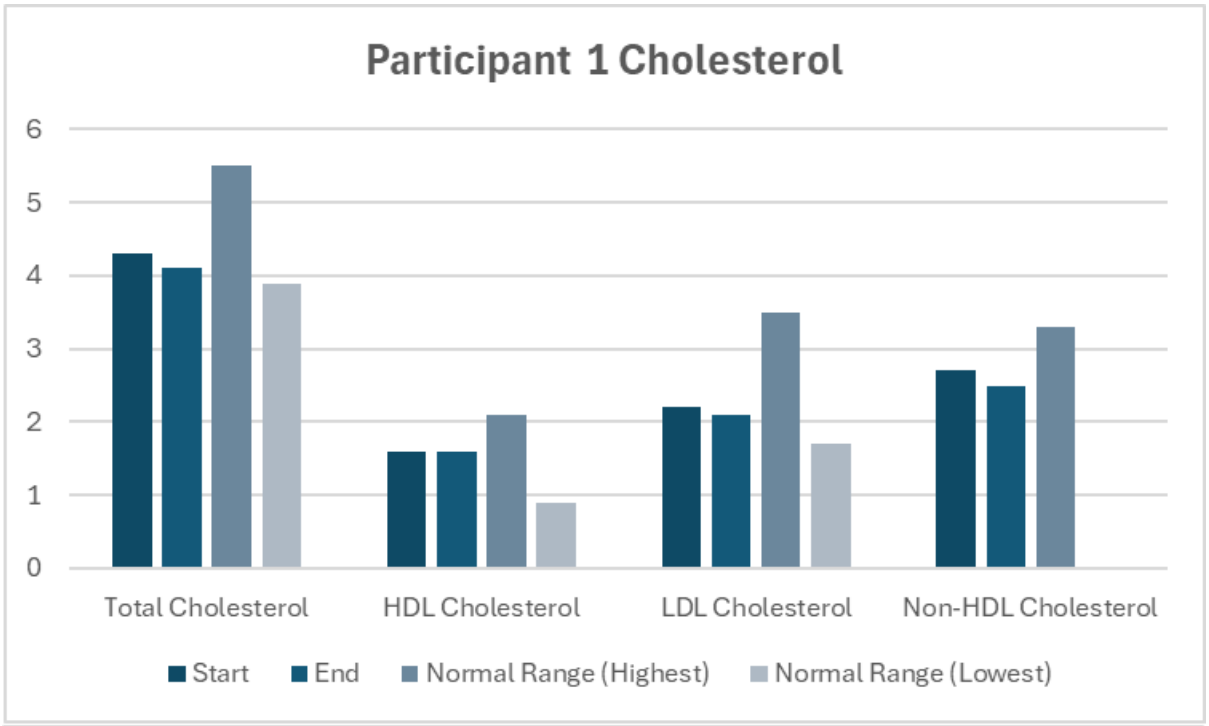
	participant 1	participant 2
Start of study	1.6	1.4
End of study	1.6	1.3

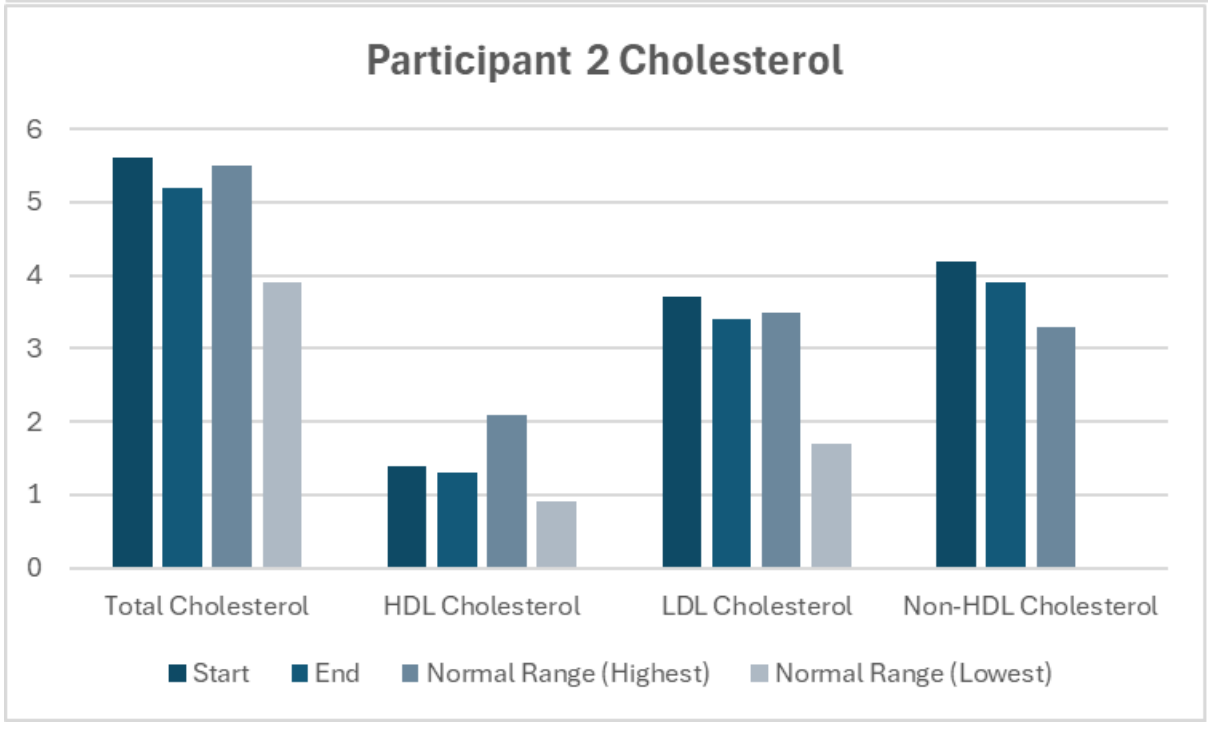
LDL Cholesterol - Units: mmol/L

	participant 1	participant 2
Start of study	2.2	3.7
End of study	2.1	3.4

Non-HDL Cholesterol - Units: mmol/L

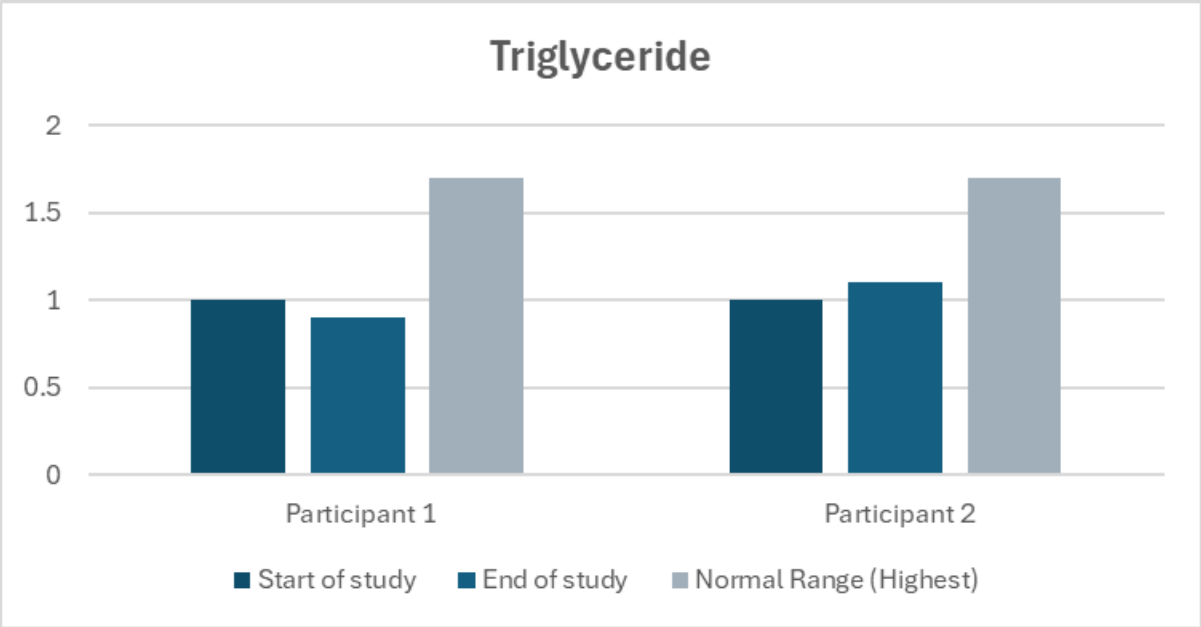
	participant 1	participant 2
Start of study	2.7	4.2
End of study	2.5	3.9


Participant 1 Cholesterol
6
5
4
3
2
1
0
Total Cholesterol
HDL Cholesterol
LDL Cholesterol
Non-HDL Cholesterol
Start
End
Normal Range (Highest)
Normal Range (Lowest)


Participant 2 Cholesterol
6
5
4
3
2
1
0
Total Cholesterol
HDL Cholesterol
LDL Cholesterol
Non-HDL Cholesterol
Start
End
Normal Range (Highest)
Normal Range (Lowest)

Triglyceride - Units: mmol/L

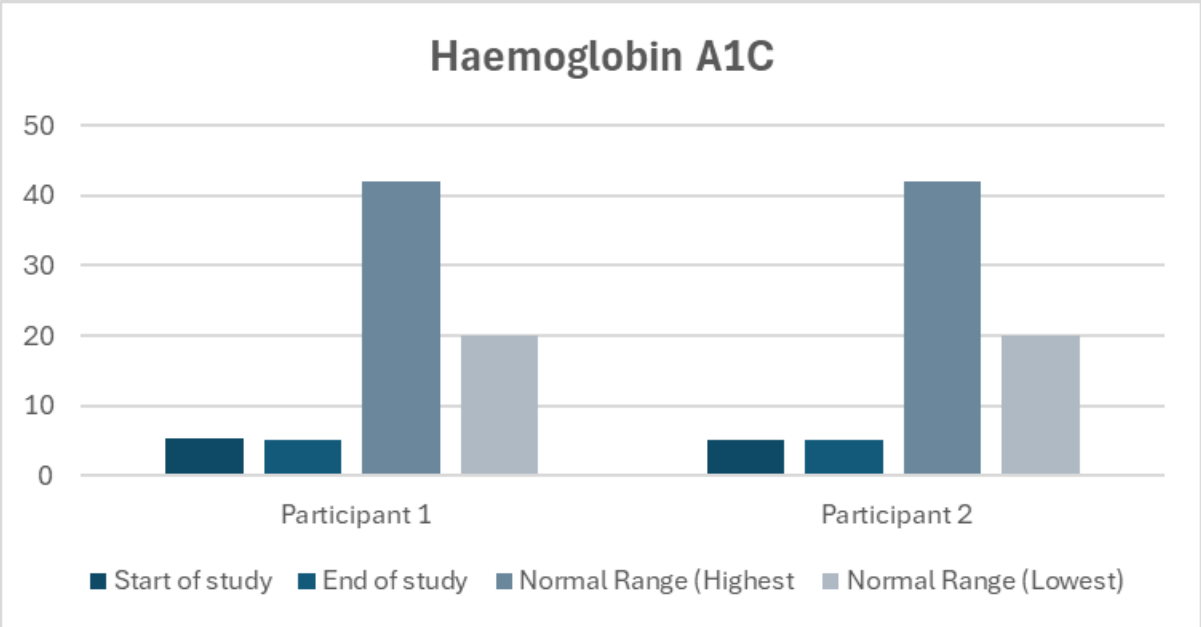
	participant 1	participant 2
Start of study	1.0	1.0
End of study	0.9	1.1



Haemoglobin A1C - Units: mmol/mol

Parameters used to measure blood glucose levels

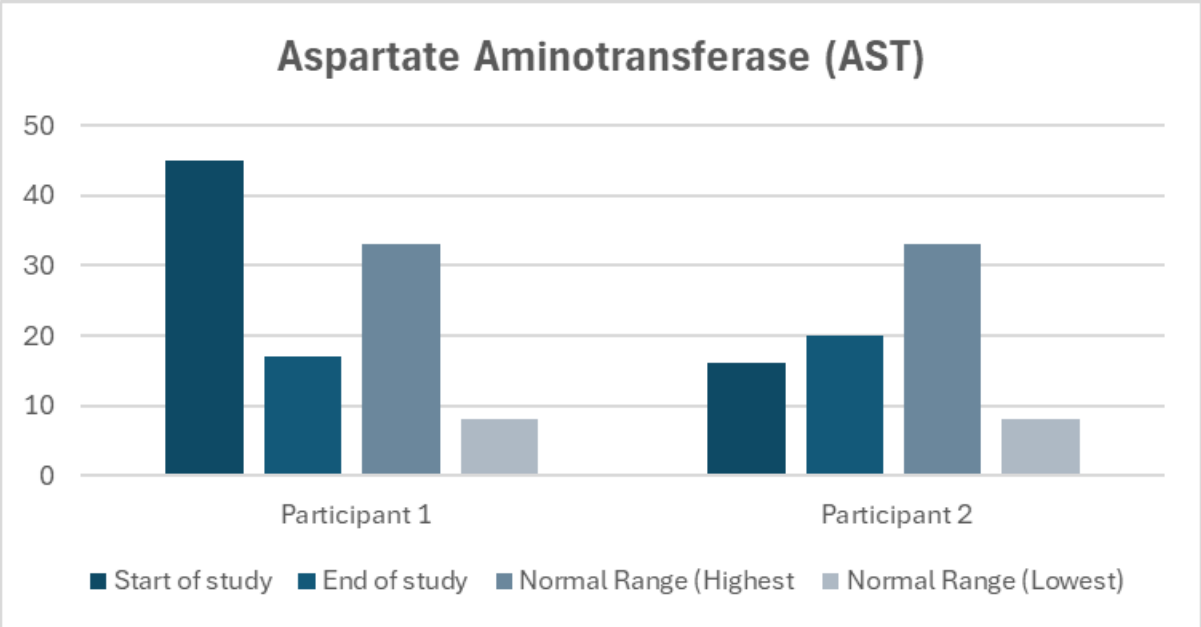
	participant 1	participant 2
Start of study	5.3	5.0
End of study	5.1	5.0



Aspartate Aminotransferase (AST) - Units: U/L

Parameters tested to check liver function

	participant 1	participant 2
Start of study	45*	16
End of study	17	20



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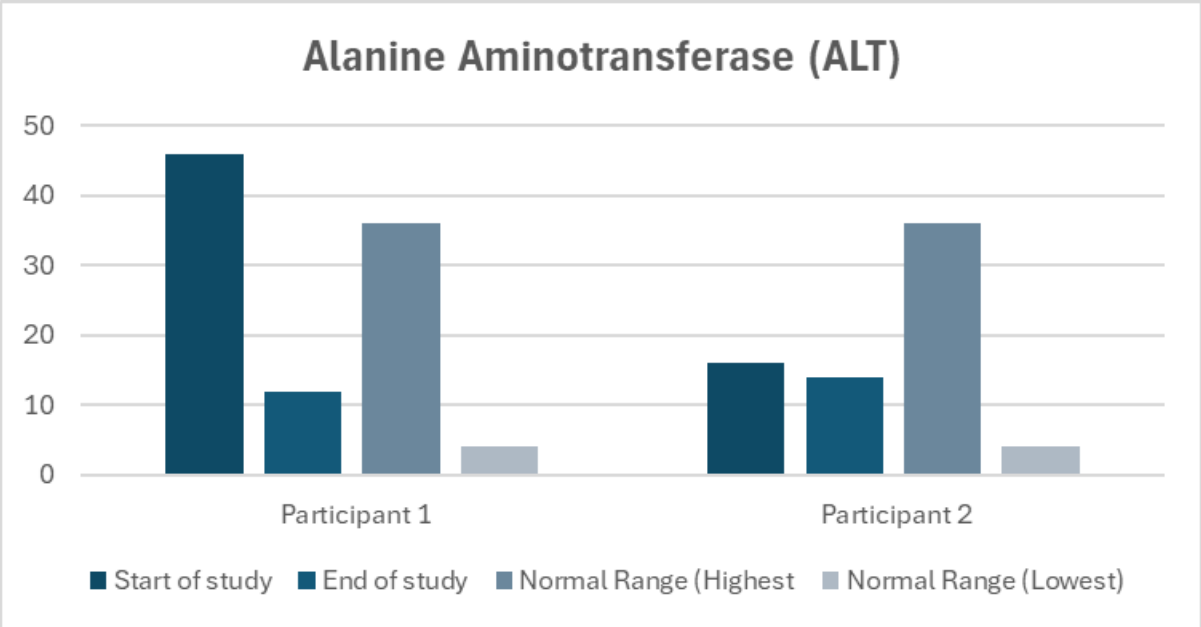
Alanine Aminotransferase (ALT) - Units: U/L

Parameters tested to check liver function

	participant 1	participant 2
Start of study	46*	16
End of study	12	14

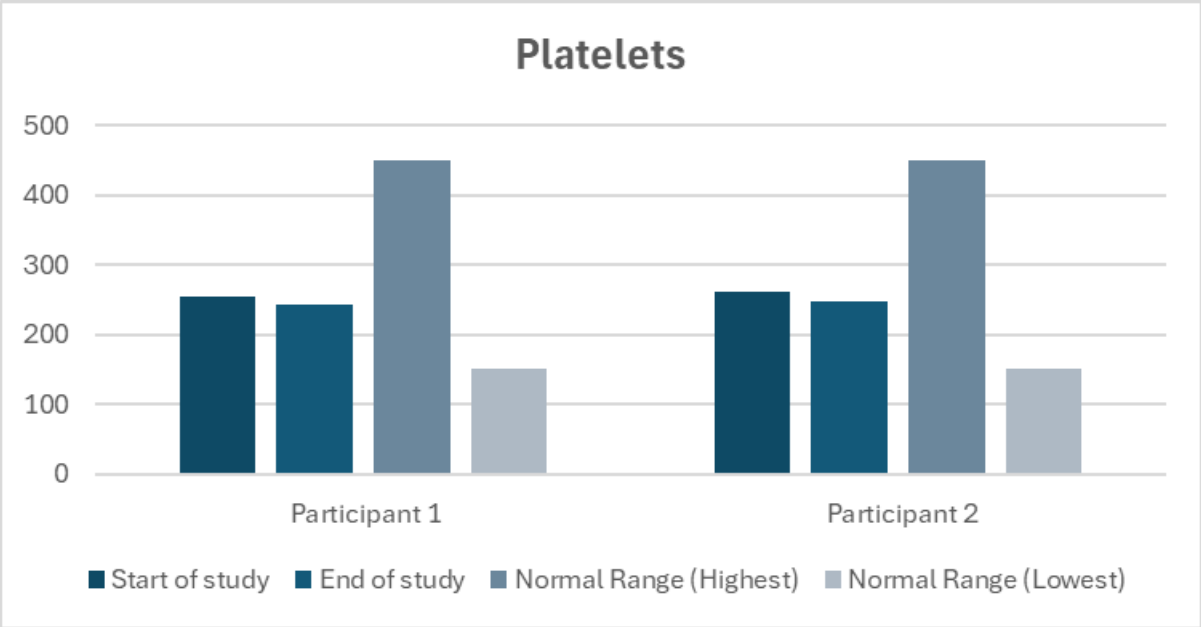


Footnotes:

- ** : Probably Lurking Variable - most likely caused by an underlying illness according to a medical professional.*
- *Note that the highest normal range is different between participants 1 and 2 because participant 1 is a male and participant 2 is a female; there is a difference in the highest normal range for males and females.*

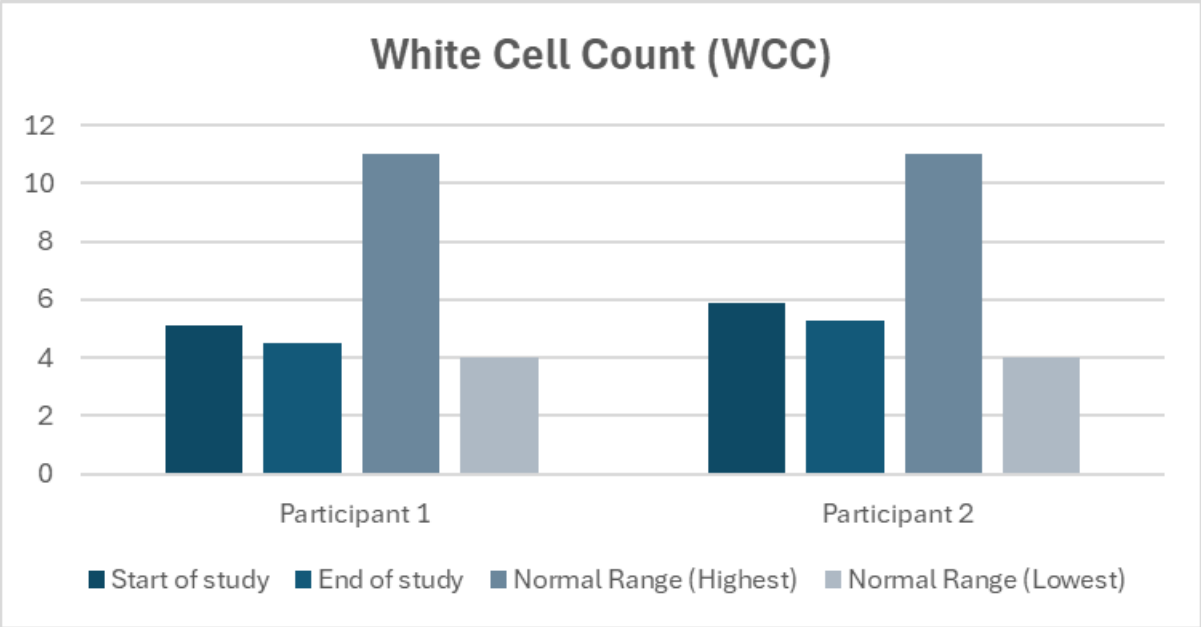
Platelets - Units: x10^9/L

	participant 1	participant 2
Start of study	255	261
End of study	242	247



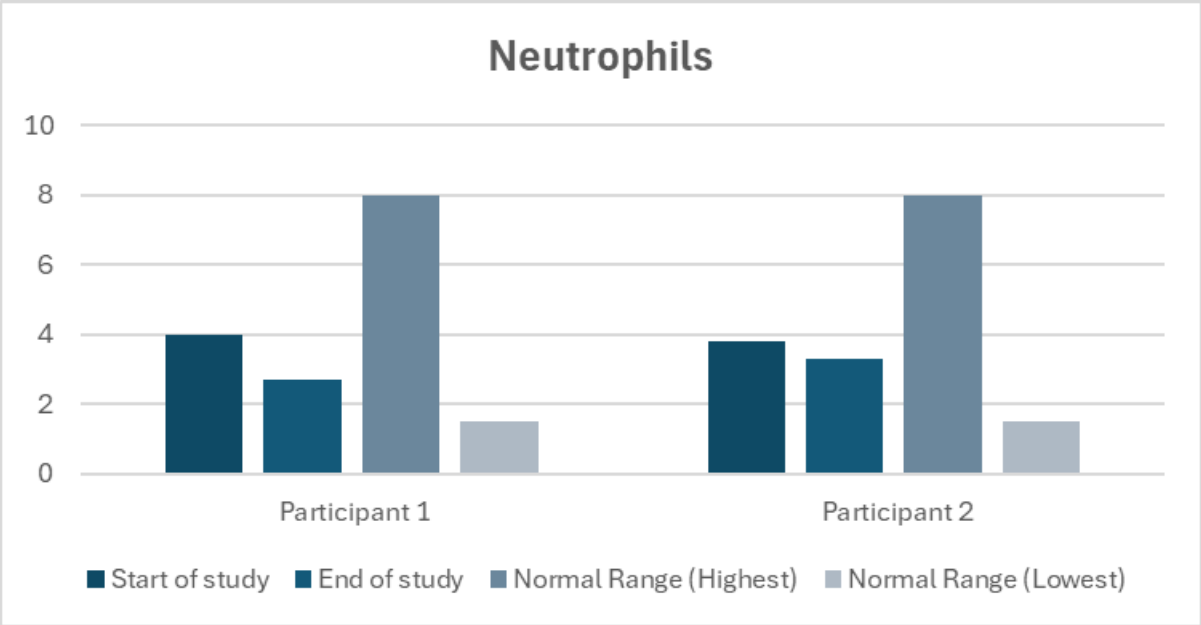
White Cell Count (WCC) - Units: x10^9/L

	participant 1	(participant 2
Start of study	5.1	5.9
End of study	4.5	5.3



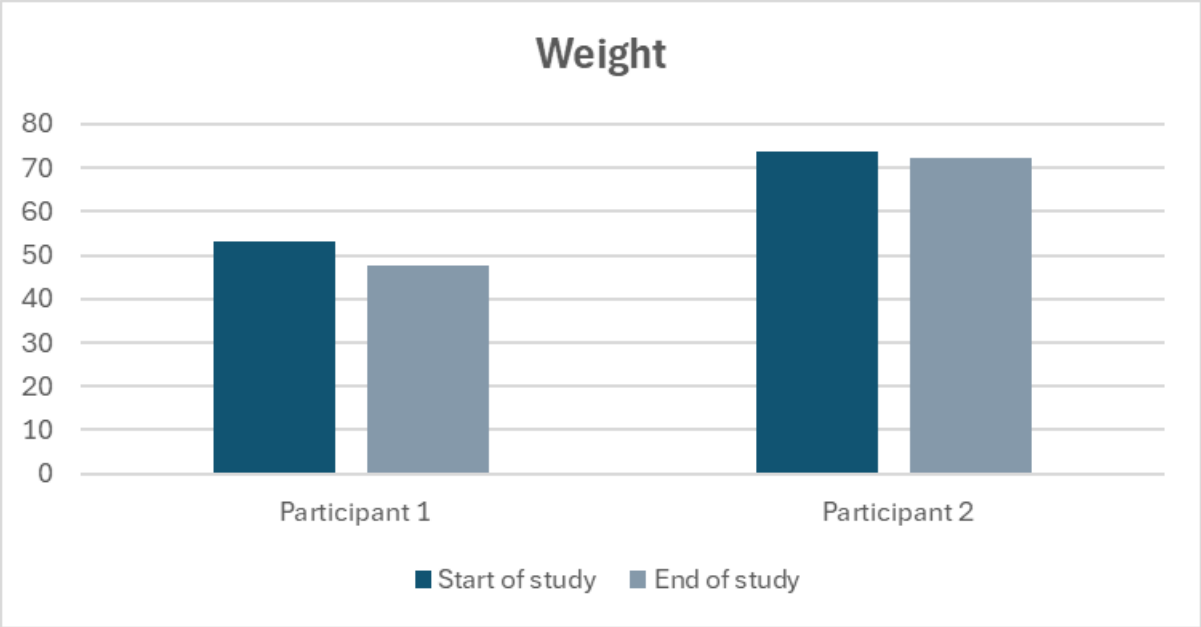
Neutrophils - Units: x10^9/L

	participant 1	participant 2
Start of study	4.0	3.8
End of study	2.7	3.3



Weight - Units: kg

	participant 1	participant 2
Start of study	53.1	73.7
End of study	47.5	72.2



Blood Pressure - Units: mmHg

	participant 1	participant 2
Start of study	126/81	124/85
End of study	115/67	111/83

Participants' Symptoms

Week 1-2:

- Feeling sick, dizzy, queasy and nauseous
- Feeling more tired than normal and having mood changes often
- experiencing Headaches and stomachaches

Weeks 3-4:

- After the withdrawal, the participants started feeling more energised, focused and healthy during the day.
- Participants felt less hungry
- Participants' tastes changed, and things became sweeter
- Participants experienced no acid reflux, which they would normally

Discussion:

This experimental case study investigated the impact of a no refined sugar and no processed and artificial sweetener diet on participants over four weeks. The findings revealed a statistically significant decrease in weight, blood pressure, blood glucose levels, cholesterol, and inflammation. The findings also revealed a boost in energy, satiety, and mental awareness after the participants had experienced withdrawal. Withdrawal symptoms included fatigue, mood changes, cravings, anxiety, nausea, and dizziness. Additional effects, such as a reduction in acid reflux and increased sensitivity to sweet-tasting foods, were also noted during the period. Therefore, the results support all hypotheses, which were:

1. The participants will first experience physical withdrawal with symptoms including but not limited to fatigue, mood changes, cravings, headaches, anxiety and nausea.
2. After withdrawal, participants will gain more focus, higher energy levels, and be in better moods.
3. The final blood test results will show a significant improvement in cholesterol, inflammation, and blood sugar in the participants. The participants will also have lower blood pressure readings and lower weights.

The observed effect could be attributed to the absence of added sugar's harmful effects. High sugar intake can slow down the breakdown of bad cholesterol, like VLDL, which can increase LDL cholesterol and cause the liver to make more LDL as well; this lowers good cholesterol, like HDL cholesterol. The higher levels of refined sugar intake can also cause blood glucose levels to spike and be elevated, as well as cause insulin resistance, which leads to glucose not being absorbed by cells and accumulating in the bloodstream. Additionally, the higher levels of sugar also cause oxidative stress on cells and destroy them, which increases inflammation. Not only that, but also excess sugar can trigger an immune response, increasing inflammation. The diet decreases all these effects by restricting any added sugar and sweetener intake. In turn, this increases insulin sensitivity, reducing blood sugar levels, decreases oxidative stress and increases gut health, reducing inflammation, and reducing LDL, which improves cholesterol levels.

The weight loss can be attributed to the reduction in foods high in calories. Most of the high-calorie foods we eat often contain high amounts of added sugar, for example, sweets, soda and processed foods, and so restricting foods with added sugar also reduces calorie intake. One of the ways the diet reduces blood pressure is by reducing inflammation, which has already been discussed. Another way the diet reduces blood pressure is by helping the body to produce nitric oxide more efficiently. Nitric oxide is critical for blood vessel function, and a reduction can lead to the narrowing of blood vessels (vasoconstriction). Added sugars can affect nitric oxide levels, which can cause higher blood pressure, and so cutting out added sugars helps restore nitric oxide levels, reducing blood pressure.

Gains in satiety, energy and mental awareness were also observed. Added artificial or processed sweeteners can disrupt the brain's energy and satiety signals, and they also change how the hypothalamus sends signals to the parts of your brain, like those involved in motivation and reward. Cutting down on these makes us feel fuller and less likely to eat more. The often high amounts of added sugars to foods, especially processed, can cause an energy spike and crash, which can increase the appetite. Gains in energy and mental awareness can be attributed to a more stable blood sugar level that doesn't crash, and therefore doesn't cause tiredness, mood swings and reduced focus. Added sugars can cause spikes in blood sugar levels, which causes a crash, whilst natural sugars often raise sugar levels gradually and keep them more stable, which allows for better focus and being more energised.

Whilst this research is promising, several limitations should be considered. The small sample size of this study limits the generalisation of the results to other contexts. Furthermore, the researcher's participation in the study could have inadvertently influenced the outcomes observed. Moreover, the study only lasted four weeks; further investigation is required to determine its effectiveness over a prolonged period. Further research could investigate the long-term effects of a no-refined-sugar and sweetener (processed and artificial) diet on health and chronic health conditions, as well as the effect of the diet on mental well-being. A larger number of participants is needed to increase the

generalisation of this study's findings. New research could also explore what degree of sugar restriction in the diet is optimal to not only increase and promote health but also lessen withdrawal from sugar for those for whom the diet might be too intense.

Conclusion:

In this experiment, I aimed to find out if abstaining from sweeteners (processed and artificial) and refined sugars, and only eating foods with natural sugars and sweeteners, would improve the overall mental and physical health of a person.

The findings revealed a statistically significant decrease in cholesterol, inflammation, blood sugar levels and blood pressure, as well as a decrease in weight and an increase in energy and mental awareness. The findings also revealed a decrease in aspartate aminotransferase, alanine aminotransferase, platelets and neutrophils. Although participants experienced symptoms of withdrawal before gaining increased energy and mental awareness. These findings support my hypothesis in that the participants first experienced withdrawal before feeling more energised, being in better moods and being more focused. The blood tests also showed a medically significant improvement in several areas.

These results show that a diet devoid of sweeteners (processed and artificial) and refined sugars can significantly positively affect mental and physical health.

In conclusion, this experiment demonstrated the effectiveness of a no-refined-sugar and sweetener (processed and artificial) diet on cholesterol, inflammation, blood pressure, weight, blood sugar levels, energy and mental awareness levels. This highlights its potential to be an effective method for increasing physical and mental health.

Word count: 2037 words

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Logbook

January 30th: I started brainstorming ideas for my Year 8 passion project. I ultimately decided to conduct a diet experiment that I had seen online (a Food Theory video), as I am passionate about experimentation and the physical and mental health of myself and others. I thought experimenting with cutting out sugar and sweeteners would be interesting to get a perspective on how much diet impacts health. Throughout the rest of the week, I brainstormed how I would experiment and what I needed.

February 17th - March 3rd: I researched about my topic for my passon project, researching things like the history of the topic, professionals related to the topic, what skills are relevant to create a good outcome, how will I create my best possible outcome, what are some tips for creating my project and has anyone else done something similar to my project.

The Research:

History - What is the history of your topic?

Several medical professionals have studied and researched the effects of not having sweeteners and refined sugar, for an extended period of time, on the mind and human body. Like the CDC, the National Health and Nutrition Examination Survey, in 2005–06 and the National Institute of Health, using case studies and scientific research. Historically, overconsumption of sugar hasn't always been a concern and studies of the topic were often ignored or changed due to bribery by major corporations. Only in recent decades has it become a concern, and the research is benefiting many who don't know the effects of refined sugar. What significant events are connected to it? 1. Scientist John Yudkin publishes Pure, White and Deadly, warning that sugar

What significant events are connected to it?

1. Scientist John Yudkin published Pure, White and Deadly, warning that sugar was not only a cause but the primary cause of obesity, diabetes and heart disease; however, his work was dismissed but later proven to be true.
2. Documents that show the Sugar Research Foundation paid Harvard scientists in the 1960s to understate the effects of sugar and blame saturated fat have been found.
3. Studies and research find that high fructose corn syrup in foods and beverages corresponds with increasing rates of obesity, diabetes and liver cancer.
4. Mexico, South Africa and the UK implement the sugar tax, which taxes sodas, aiming to combat rising obesity rates. The tax shows promise as Mexico records a 7..6% drop in soda sales in the first year.
5. More companies are revealed to have paid scientists to downplay the effects of their products on health, such as Coca-Cola, which funded research that understates the role of sugary drinks in rising obesity rates. 6. The World Health Organisation starts recommending that sugar should only make up 10% or less of your daily energy intake, or around 50g of sugar per day.

What key information does your audience need to know related to your topic and outcome?

They need to know that the case study I will be doing involves not consuming refined sugars, processed and artificial sweeteners for a month. Refined sugars and sweeteners are more unhealthy than natural sugar. Refined sugars have been linked to weight gain, heart disease, energy crashes, and reduced cognitive function. While natural sugars are often found in foods with nutrients, antioxidants and minerals and offer a steady supply of energy. So for my case study, I will only be consuming natural sugar to record the positives/negatives on my health, like inflammatory markers, weight and energy levels, as well as withdrawal.

Who are the experts relevant to your topic?

Medical professionals who specialise in diet and sugar, like endocrinologists and dietitians, as well as GPs who work with patients who experience problems due to sugar. Other medical professionals working at institutions like the National Institute of Health and the World Health Organisation are also experts in the topic. Sometimes, even specialists like a rheumatologist would be involved if less sugar reduces inflammation, as well as other specialists

What have they accomplished? When did they do this? Why are they considered experts?

Experts in the field of sugar and diet education and treatment have accomplished a plethora of things, like treating ill patients, successfully finding new ways to advance clinical practice and research through studies and raising awareness around over-consuming refined sugar and sweeteners and sugar-related disease. These accomplishments have mostly happened over the last few decades as we grow in our knowledge of the dangers of sugar and are more able to treat it and research it. This is also because companies can’t get away with paying off scientists to downplay concerns. These professionals are considered experts because they have extensive medical training and practice and have vast knowledge about the topic.

What other people are relevant to your topic?

Scientists and researchers would also be considered experts and relevant as they study the effects and symptoms in a medically accurate way. They also have extensive knowledge of the topic and have been through extensive training and practice. They also see firsthand what sugar can do and are often the ones who publish studies and papers about what they’ve seen, put together with their knowledge of the field.

What skills are relevant to your outcome?

1. Problem solving: I need problem solving skills to overcome any obstacles I face in making my study, if something goes wrong in it then I need to be able to think “okay, something didn’t go to plan, how can I still make this a good study and how can I learn from this for the future.”
2. Critical thinking: I need critical thinking in order to be able to be rational and write an unbiased analysis of the factual evidence.
3. Honesty: Writing an honest study and not lying about results to shift the outcome in a more favourable direction.
4. Analytical thinking: dissecting and doing a thorough analysis of the data and complex problems to be able to understand and create a study to the best of my ability
5. Decision making: making decisions that only forward my study and push it to have a good outcome, assessing and making strategic choices that help my study to have interesting data, educate readers and clearly show a problem and a potential solution.

How will you create your best possible outcome?

By setting a clear outcome I want, setting goals and a timeline on my progress and writing, having a thought-out template and an idea of what I’m doing and how I’m going to achieve it. Then, gather credible sources for my literature study, start and complete my case study with notes and results and gather research for my results and hone and complete my study. To achieve this, I will stick to my timeline, hold myself accountable and keep to the highest standard of the criteria I have set for myself.

Where are you able to research tips and instructions for creating your best possible outcome?

I am able to find tips and instructions for creating a case study at trusted and credible academic and medical websites. Universities like Monash, New South Wales and Sheffield. As well as organisations such as the National Institute of Health and the Centre for Disease Control and Prevention.

Has anyone else undertaken a similar project before? If so, who and when?

Scientists, health enthusiasts and researchers have done case studies about not having refined sugar and sweeteners for a month, often on themselves and on others to observe, record and study symptoms, effects and benefits/negatives of refined sugar and not having refined sugar. Doctors also do this to advance clinical practice and research in certain fields. While non-medical professionals may do this to be in good health, or may be on a diet, or to see what the effects are on themselves. The study is done by not eating any refined sugar and processed and artificial sweeteners, which have the same effect on the brain, for a month. This has been done in a lot of places, often in a medical setting(doctors and scientists observing and doing a medical study) and a non-medical setting (non-medical professionals interested in this topic). These types of studies have become more and more common in recent decades as more research shows the effects of sugar and more people grow an understanding of the risks of over-consuming it.

What did they create/learn, and how did they go? What do you plan to do differently?

Medical Professionals and scientists have learned how sugar contributes to bad health and diseases like heart disease and obesity. They have learned how it causes high blood pressure, fatty liver disease, weight gain and inflammation, but also how it causes a crash in energy during the day. They learned that when eating less sugar, we have improved oral and heart health as well as weight loss, and keep our blood glucose levels within a healthy boundary and causing less energy crash. These scientists' studies didn't always go well, as back in the 20th centur,y scientists would get paid to not be completely honest about sugar, and if you were you wouldn't always be taken seriously, as companies and people who wouldn't benefit from the discovery would claim the research isn't true. Nowadays, scientists are taken more seriously in the field, and as concerns spread over sugar, more and more people are changing and listening, making scientists the agents of change and their studies are going much better. I plan to not only not eat sugar but also no sweeteners or ingredients that have the same effect as sugar which is something different that I'll be doing than some studies as depending on the goal sweeteners might be used in the study but my goal is to completely change my sugar intake to only natural sugar for a period of 4 weeks.

March 3rd: I started studying and researching how I would write the experimental case study. I found good sources, which helped me to understand how I was going to write my study. I researched for the whole week.

March 10th: I started gathering reliable studies and research to analyse and use for my experiment and study, specifically my background information.

February 10th - March 11th: This was the period during which Participant 2 and I went on the diet for 4 weeks. During this period, we logged any symptoms or changes that we could observe:

Week 1-2:

Participants 1 & 2: Feeling sick, dizzy, queasy and nauseous

Participant 1: Feeling more tired than normal and having mood changes often

Participants 1 & 2: experiencing Headaches and stomachaches

Weeks 3-4:

Participants 1 & 2: feeling more energised, focused and healthy during the day.

Participant 1: feeling less hungry

Participant 1: Taste changed, and things became sweeter

Participants 1 & 2: experienced no acid reflux, which they would normally

March 17th: The results for the participants' blood tests came back; these were taken at the start and end of the study (10/02/25 - 11/03/25), this was the period during which the participants (my mom and I) refrained from eating refined sugars as well as processed and artificial sweeteners. I analysed them and discussed them with a medical professional. We went over lurking variables, what experienced significant change, and we also went over participants' symptoms and changes, amongst other things.

March 24th - April 29th: I wrote my study and submitted my study. My study included an introduction, background information, method, results, discussion, conclusion and references. I printed and handed a hard copy to my teacher for grading.

The Final Product for Passion Project:

Introduction -

The craving for palatability has significantly influenced how we consume food and our relationship with it. The addition of spices to food can be traced back to an early period in human history, where it is suggested that hunter-gatherers discovered that wrapping their meat in leaves amplified the flavour of what they were eating. This discovery led to humans' later addition of spices and herbs to food. Sugar and sugarcane can be traced back thousands of years to when they were first found in Southeast Asia, then around 3500 years ago, they were spread to the Eastern Pacific and Indian Oceans by seafarers; eventually, refined sugar appeared in India 1000 years later. In the 1800s and 1900s, more types of sugars and sweeteners began to be produced, like high fructose corn syrup. From 1850 to 2000, sugar consumption in the world increased more than 100 times; this increase can be largely attributed to the changing European diet, which now consisted of tea, coffee, jam, candy, cocoa and processed foods. Today, an excessive amount of sugars and sweeteners are added to so many foods, especially processed foods. Yet we still consume these foods, neglecting the possible negative effects the over-consumption of sugar can have on our bodies. Previous studies have shown that over-consumption of sugar can lead to a plethora of health issues, including diseases like type 2 diabetes and cardiovascular disease. These diseases have become a health epidemic (for reference, around 1 in 10 people have diabetes), but in actuality, is sugar something that is causing health issues that are being overlooked?

This study addresses the question of what negative and positive changes and effects the human body would go through given a period of abstaining from consuming all added sugars and sweeteners. The primary purpose of this study is to observe and analyse the significant changes and effects during abstaining from consuming added sugars and sweeteners for a period of four weeks in a 14-year-old male and a 46-year-old female; then also compare results from before and after. To achieve this, an experiment was conducted where 2 participants refrained from eating any added sugars and sweeteners, including foods containing these; blood samples were taken for testing at the start and end of the period, and results were discussed with a medical professional. Participants also noted symptoms during the period. It was hypothesised that the participants would first experience physical withdrawal with symptoms including but not limited to fatigue, mood changes, cravings, headaches, anxiety and nausea. It was also hypothesised that eventually participants would gain more focus, higher energy levels and be in better moods; as well as have improved cholesterol, blood pressure, inflammation, blood sugar and a lowered weight. This was hypothesised because of the results found in previous studies concerning the effects of sugar withdrawal. Understanding the results of this study can bring valuable insight into the psychological and physical effects when reducing refined sugar and sweetener intake; this can lead to an increased understanding of sugar addiction and its implications on health. This study can also bring forth a new perspective on our relationship with sugar and the need for sustainable dietary changes.

Background Information -

This is an analysis of previous studies that concern this study's inquiries, objectives, and hypothesis. They are relevant to the study by highlighting and guiding it using previous research and approaches to the problem at hand.

Natural sugar consumption instead of refined sugar can improve metabolism. Natural foods full of sugar, like honey, have been associated with limiting weight gain, improving dyslipidemia (abnormal levels of fat in the blood) and reducing glycemia (the concentration of glucose in the blood). Natural sugars and sweeteners also have molecules like minerals and polyphenols (compounds with anti-inflammatory and antioxidant properties), which could impede the effects of the high sugar content of the food. Foods like honey contain several substances linked to improving hypertension (the force of blood against artery walls is too high) and hyperglycemia (too much sugar in the blood), as well as antimicrobial properties (agents that kill microorganisms). Maple syrup contains polyphenols such as lignans, qeubecol, phytonutrients (compounds providing vitamins and minerals) and minerals.

A study done on Wistar male rats shows refined sugars and natural sweeteners lead to similar obesity, energy intake, weight gain and food efficiency. There were no differences in visceral (fat stored in the abdominal cavity, stores energy, protects organs and produces hormones) and subcutaneous adipose tissue (fat underneath the skin that insulates, provides cushioning and reserves energy). However, the weight of brown adipose tissue (a fat that burns calories to produce heat) was noticeably lower in natural sweetener-treated rats. Rats who ate molasses and brown rice daily were found to display improved fasting glycemia, and, compared to sucrose, fasting insulinemia and insulin resistance were improved by all-natural sweeteners. Most of the natural sugars reduced hepatic (relating to the liver) levels of pro-inflammatory cytokines compared to sucrose, and they also helped liver steatosis (abnormal level of fat in an organ or cell) and inflammation. Researchers propose that daily substituting refined sucrose with natural sweeteners would lower glycemic levels and insulinemic responses, improving metabolic health.

Phytochemicals in natural sweeteners impede carbohydrate digestion and absorption by hindering α-glucosidase, sodium-dependent glucose transporter 1 and sodium-dependent glucose transport in the intestine, by doing this it reduces glucose absorption. Other studies have found that maple syrup reduces plasma glucose levels and intestinal glucose absorption compared to sucrose in rats. It has been suggested that polyphenols, which natural sweeteners like maple syrup have, protect from fatty liver disease not caused by alcohol (NAFLD). Previous research has proven that cranberry extract, which is rich in polyphenols, helps fight against obesity and hepatic steatosis and can even reverse liver steatosis from the anti-obesity effect that it has. Chronic intake of natural sweeteners lessened liver inflammation compared to sucrose because natural sweeteners reduce IL-1βprotein, a driver of NAFLD. Mice low in IL-1β signalling or components turning it active are invulnerable to developing heavy-fat-diet-induced hepatic steatosis. It was shown that 17 genes related to immune response were increased in the liver, 6 connected with defence against infection, by MSX (a maple syrup extract). The extract has also been shown to help antibiotics protect from resistant bacteria in isolated cells.

Method -

Participants:

2 participants were recruited for this study: an adolescent male, 14 years old (53.1 kilograms) and an adult female, 46 years old (73.7 kilograms). The participants were chosen because one of them was I, and the other was a family member, and this was most effective for the small nature of the study. There was no criterion for participants besides the

requirement that they had to live in the same household as myself. Both participants gave consent to participate in the diet and to have blood drawn twice for testing. A medical professional was consulted to ensure the safety of the participants throughout the study, and discussions about any questions concerning changes were held when needed.

Study Design:

Participants went on an assigned diet prohibiting foods and beverages with any non-natural added sugars and sweeteners. Non-natural sugars and sweeteners were also not allowed to be consumed separately. This diet focuses on only allowing the consumption of natural sugars and sweeteners like that of milk, honey and fruit.

Procedure:

Baseline Assessment Measurements:

- Body weight (kg) using a digital scale
- Blood pressure (mmHg) using an automated sphygmomanometer by a doctor
- A phlebotomist took fasting blood samples to measure various components of the blood

Dietary Intervention:

- Participants met with a doctor before and during the study, discussing any symptoms and concerns about their diet and any changes they were experiencing.
- Participants were instructed to keep their usual exercise routines and not to change or add to their previous routine.
- Participants were instructed to write down any symptoms they had during the study; these symptoms were discussed with a doctor during check-ups.

End Assessment Measurements:

- At the end of the study, all baseline measurements were once again taken, including weight, blood pressure and blood samples.

Data Collection:

Anthropometric Measurements: Body weight was measured to the nearest 0.1 kg, and blood pressure was recorded in mmHg.

Biochemical Measurements: Blood samples were tested by a clinical laboratory for glucose, C-reactive protein, general chemistry, lipid studies, Haemoglobin A1c, haematology and urine.

Symptom Noting: Symptoms were noted by participants as they went along with the study; these symptoms would later be discussed with a doctor.

Data Analysis:

The baseline data was compared with the data collected at the end of the study for both participants. Weight, blood samples and blood pressure were compared from baseline to the end of the study, and the two participants' results were compared to observe any differences. The blood samples were discussed with a doctor, and any significant changes were made clear, as well as changes that the doctor thought might have been caused by

other factors, like illness. The participants' symptoms were also discussed with a doctor, who would explain why they might be happening and if they might have been caused by other factors.

Results -

C Reactive Protein (CRP) (inflammation) - Units: mg/L

	participant 1	participant 2
Start of study	8.7*	0.9
End of study	3.5	<0.7

Erythrocyte Sedimentation Rate (ESR) (Inflammation)- Units: mm/h

	participant 1	participant 2
Start of study	31*	9
End of study	19	9

Glucose - Units: mmol/L

	participant 1	participant 2
Start of study	5.3	5.2
End of study	4.8	4.7

Total Cholesterol - Units: mmol/L

	participant 1	participant 2
Start of study	4.3	5.6
End of study	4.1	5.2

HDL Cholesterol - Units: mmol/L

	participant 1	participant 2
Start of study	1.6	1.4
End of study	1.6	1.3

LDL Cholesterol - Units: mmol/L

	participant 1	participant 2

Start of study	2.2	3.7
End of study	2.1	3.4

Non-HDL Cholesterol - Units: mmol/L

	participant 1	participant 2
Start of study	2.7	4.2
End of study	2.5	3.9

Triglyceride - Units: mmol/L

	participant 1	participant 2
Start of study	1.0	1.0
End of study	0.9	1.1

Haemoglobin A1C - Units: mmol/mol

Parameters used to measure blood glucose levels

	participant 1	participant 2
Start of study	5.3	5.0
End of study	5.1	5.0

Aspartate Aminotransferase (AST) - Units: U/L

Parameters tested to check liver function

	participant 1	participant 2
Start of study	45*	16
End of study	17	20

Alanine Aminotransferase (ALT) - Units: U/L

Parameters tested to check liver function

	participant 1	participant 2
Start of study	46*	16
End of study	12	14

Platelets - Units: x10^9/L

	participant 1	participant 2
Start of study	255	261
End of study	242	247

White Cell Count (WCC) - Units: x10^9/L

	participant 1	(participant 2
Start of study	5.1	5.9
End of study	4.5	5.3

Neutrophils - Units: x10^9/L

	participant 1	participant 2
Start of study	4.0	3.8
End of study	2.7	3.3

Weight - Units: Kg

	participant 1	participant 2
Start of study	53.1	73.7
End of study	47.5	72.2

Blood Pressure - Units: mmHg

	participant 1	participant 2
Start of study	126/81	124/85
End of study	115/67	111/83

Participants' Symptoms

Week 1-2:

- Feeling sick, dizzy, queasy and nauseous
- Feeling more tired than normal and having mood changes often
- experiencing Headaches and stomachaches

Weeks 3-4:

- After the withdrawal, the participants started feeling more energised, focused and healthy during the day.

- Participants felt less hungry
- Participants' tastes changed, and things became sweeter
- Participants experienced no acid reflux, which they would normally

Discussion -

This experimental case study investigated the impact of a no-added-sugar or sweetener diet on participants over four weeks. The findings revealed a statistically significant decrease in weight, blood pressure, blood glucose levels, cholesterol, and inflammation. The findings also revealed a boost in energy, satiety, and mental awareness after the patients had experienced withdrawal. Withdrawal symptoms included fatigue, mood changes, cravings, anxiety, nausea, and dizziness. Additional effects, such as a reduction in acid reflux and increased sensitivity to sweet-tasting foods, were also noted during the period. Therefore, the results support all hypotheses, which were:
The participants will first experience physical withdrawal with symptoms including but not limited to fatigue, mood changes, cravings, headaches, anxiety and nausea.
After withdrawal, participants will gain more focus, higher energy levels, and be in better moods.
The final blood test results will show a significant improvement in cholesterol, inflammation, and blood sugar in the participants. The participants will also have lower blood pressure readings and lower weights.

Explanation

The observed effect could be attributed to the absence of added sugar's harmful effects. High sugar intake can slow down the breakdown of bad cholesterol, like VLDL, which can increase LDL cholesterol and cause the liver to make more LDL as well; this lowers good cholesterol, like HDL cholesterol. The higher levels of refined sugar intake can also cause blood glucose levels to spike and be elevated, as well as cause insulin resistance, which leads to glucose not being absorbed by cells and accumulating in the bloodstream. Additionally, the higher levels of sugar also cause oxidative stress on cells and destroy them, which increases inflammation. Not only that, but also excess sugar can trigger an immune response, increasing inflammation. The diet decreases all these effects by restricting any added sugar and sweetener intake. In turn, this increases insulin sensitivity, reducing blood sugar levels, decreases oxidative stress and increases gut health, reducing inflammation, and reducing LDL, which improves cholesterol levels.

The weight loss can be attributed to the reduction in foods high in calories. Most of the high-calorie foods we eat often contain high amounts of added sugar, for example, sweets, soda and processed foods, and so restricting foods with added sugar also reduces calorie intake. One of the ways the diet reduces blood pressure is by reducing inflammation, which has already been discussed. Another way the diet reduces blood pressure is by helping the body to produce nitric oxide more efficiently. Nitric oxide is critical for blood vessel function, and a reduction can lead to the narrowing of blood vessels (vasoconstriction). Added sugars can affect nitric oxide levels, which can cause higher blood pressure, and so cutting out added sugars helps restore nitric oxide levels, reducing blood pressure.

Gains in satiety, energy and mental awareness were also observed. Added sweeteners can disrupt the brain's energy and satiety signals, and they also change how the hypothalamus (the part of the brain that produces hormones that control hunger, thirst, body temperature and heart rate) sends signals to the parts of your brain like those involved in motivation and reward. The often high amounts of added sugar to foods, especially processed, can cause an energy spike and crash, which can increase the appetite. Gains in energy and mental

awareness can be attributed to a more stable blood sugar level that doesn't crash, and therefore doesn't cause tiredness, mood swings and reduced focus. Added sugars can cause spikes in blood sugar levels, which causes a crash, whilst natural sugars often raise sugar levels gradually and keep them more stable, which allows for better focus and being more energised.

The lessening of acid reflux could be a result of reducing sugar intake in general. Studies have found that reducing simple sugars can reduce GERD (gastroesophageal reflux disease) symptoms like acid reflux. The gained perceptiveness to sugar is most likely because the participants got used to the lower amounts of sugar and very sugary processed food. Taste bud cells have a lifespan of around 10 days, so during the study, it's likely that the new taste buds got used to the less sweet food, and so everything started to taste sweeter. Lastly, the diet also caused the participants to go through withdrawal before feeling better, this is because the body has to become used to the diet change, and this can cause headaches, fatigue, nausea and mood swings.

Implications

The positive impact of the diet suggests its potential to be a valuable tool for medical professionals and people struggling with cholesterol, weight, blood pressure, inflammation, low energy levels and blood sugar levels. Doctors seeking to help patients could recommend a diet like this, which could benefit those struggling by potentially identifying a root cause, reducing patient reliance on medication, boosting their quality of life, and reducing stress on patients as they feel more in control of their health. The findings highlight the importance of food choices, specifically how dietary choices directly impact complex physiological processes and the importance of addressing dietary choices as a concern for major health issues.

Limitations

Whilst this research is promising, several limitations should be considered. The small sample size of this study limits the generalisation of the results to other contexts. Furthermore, the researcher's participation in the study could have inadvertently influenced the outcomes observed. Moreover, the study only lasted four weeks; further investigation is required to determine its effectiveness over a prolonged period.

Further Research

Further research could investigate the long-term effects of a no-added-sugar and sweetener diet on health and chronic health conditions, as well as the effect of the diet on mental well-being. A larger number of participants is needed to increase the generalisation of this study's findings. New research could also explore what degree of sugar restriction in the diet is optimal to not only increase and promote health but also lessen withdrawal from sugar for those for whom the diet might be too intense.

Summary

In conclusion, this experimental case study offers compelling evidence for the positive impact of a no-added-sugar and sweetener diet on physical and mental health when applied. While acknowledging the limitations of a case study, the findings offer valuable insight into the potential of this diet to increase mental and physical health. Further research is warranted to explore the effects of this diet over a longer period, in a broader context and to determine what extent of sugar restriction that is optimal.

Conclusion -

This experimental case study aimed to evaluate the effectiveness of a no-added-sugar and artificial and processed sweetener diet in reducing cholesterol, inflammation, weight, blood sugar levels and blood pressure. As well as its effectiveness in boosting energy levels and mental awareness.

The findings revealed a statistically significant decrease in cholesterol, inflammation, blood sugar levels and blood pressure, as well as a decrease in weight and an increase in energy and mental awareness. Suggesting a positive impact of the added sugar-restricted diet. These findings contribute to the body of evidence that continually supports the use of diets that cut out excessive sugar intake in increasing mental and physical health. While these findings are promising, the limitations of this study, such as its small sample size and researchers' direct involvement, warrant caution in generalising these results to broader populations. New research could aim to explore the effectiveness of the diet with a diverse population and/or on a wide array of health issues. Future research could also explore its effectiveness on chronic conditions and even on mental health and well-being. More research is warranted on what degree of sugar restriction should be applied and to what demographics when on the diet. In conclusion, this case study provides encouraging evidence for the effectiveness of a no-added-sugar and artificial and processed sweetener diet on cholesterol, blood pressure, inflammation, weight, blood sugar levels, energy and mental awareness levels. highlighting its potential to be an effective method for increasing physical and mental health.

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End

28th April - 6th May: I wrote the reflection on writing my project and submitted it.

The Reflection:

What did you create and how did you go? Was it easier or more difficult than you anticipated? Why was this? Were some parts more or less fun than others?

I created an experimental case study where I did not eat added sugar or sweetener for 4 weeks. I recorded symptoms I had and had blood samples taken, as well as weight and blood pressure. I also discussed with a medical professional to ensure safety and get some guidance on how to go about my study. After all of this, I put everything into a scientific study, including an introduction, method, background information, results, discussion and conclusion. I think I did well, and I'm glad my study had no complications and it had a scientifically significant outcome that I was able to easily discuss. It was harder but also easier than I anticipated. It had a lot of parts that I didn't know I would need, which overwhelmed me, but then, as I wrote, it wasn't too hard, but still had some challenging parts. I do think some parts were more fun than others. I really liked doing things like my introduction, method, conclusion and some parts of my discussion and looked forward to it, but then things like the background information, results and explanation part of my discussion were more tedious. Ironically, I liked doing my references.

Achievement

I achieved above what I expected. I didn't think I would get it done on time and I thought I would just procrastinate, but I did work on it when I was behind and took initiative to hand it in early and I worked on it whenever I could and worked to make it an exemplary standard even if it took more time. I also thought my case study wouldn't be proper and to an excellent standard, but I'm very happy with how it turned out, I think it's very clear, scientifically accurate and has great cohesion, and I put a lot of work into making sure it was to the best of my abilities. I used a wide range of studies and research for this study, which I also didn't expect to be able to do, and I'm really happy with all the in-depth research. Overall, I think I put a lot of hard work and time into this and gave all my effort, and I couldn't be happier with the result.

If you were to do the same project again, what would you do differently? Why would you make these changes?

One change I would make is to add more research to my background information, as I couldn't find many related studies. I didn't think it would be necessary to add more, but it does give the reader a bigger overview of what, why, how, who and where and a greater overview of the topic and research question. Another change I would make is to add food intake diaries for the week before and the first week into the diet, which I was originally going to do. However, I ended up not doing it, which I would have because it gives the readers a clear perspective on the clear difference between sugar intakes before and after, and that could show how much of a difference needs to be made to have significance. Lastly, I would focus more on withdrawal in my discussion writing, which I didn't do very well. I would do this because it would give more insight into the possible side effects of the diet and the risks it could have. However, I did have information about withdrawal, so I do give a warning, but more could be warranted.

What did you learn? How can you use this new knowledge and these skills in the future?

One of the things I learnt while doing this study was the importance of nutrition and healthy eating, and how it can affect us without us even realising. This is very useful to know because I will be able to plan my future meals and nutrition to be enjoyable but also healthy with less added sugars and more nutrients, which will help my body stay healthy. Several studies have found that if you are educated on nutrition, then it's easier to make healthier choices. I learnt about cholesterol, inflammation and glucose in the body, which is going to help me when it comes to picking my nutrition. Another skill I learnt was how to write a study. This will help me in the future when analysing data, writing other studies, gathering information, and so much more, whether for school or college or a job. All of these skills are important to my education and to my overall abilities and knowledge, especially if I want a job like being a research scientist.

What did you enjoy most about the Passion Project? Why?

The thing that I enjoyed most about the passion project was seeing my creative vision and all my hard work come together, and seeing the finished project. I loved making my passion project, and I liked the idea I had, but I never thought I'd be able to make it. So after putting all my hard work into it, a lot of research and a lot of time and then finally being able to print it and hand it in early, it felt really good and I felt proud of myself and excited about it, so finishing it was probably my favourite. I also really enjoyed writing the actual study. I enjoyed things like the method and the discussion, and just seeing it all come together slowly. I like science writing, so writing thousands of words on it, although at times boring, was very exciting. I also really liked presenting it to the passion project professional and showing it to the teachers because I felt like they were engaged with the project and really appreciated it, which felt good.

9th June - 24th June: I modified my study and experiment for Oliphant. Adding graphs, necessary missing information and making sure to follow the checklist and rules. I then handed it to my science teachers to check.

OSA RISK ASSESSMENT FORM

for all entries in (✓) ☐ Models & Inventions and ☑ Scientific Inquiry

This must be included with your report, log book or entry. One form per entry.

STUDENT(S) NAME: Kean Landman ID: 0522-004

SCHOOL: Portside Christian College

Activity: Give a brief outline of what you are planning to do.

I am planning on going on a diet void of any refined sugars and processed and artificial sweeteners in order to see if it will have significant health improvements or if the diet will not have any improvements and maybe even have negative effects that outweigh any of the positives.

Are there possible risks? Consider the following:

- Chemical risks: Are you using chemicals? If so, check with your teacher that any chemicals to be used are on the approved list for schools. Check the safety requirements for their use, such as eye protection and eyewash facilities, availability of running water, use of gloves, a well-ventilated area or fume cupboard.
- Thermal risks: Are you heating things? Could you be burnt?
- Biological risks: Are you working with micro-organisms such as mould and bacteria?
- Sharps risks: Are you cutting things, and is there a risk of injury from sharp objects?
- Electrical risks: Are you using mains (240 volt) electricity? How will you make sure that this is safe? Could you use a battery instead?
- Radiation risks: Does your entry use potentially harmful radiation such as UV or lasers?
- Other hazards.

Also, if you are using other people as subjects in an investigation you must get them to sign a note consenting to be part of your experiment.

Risks	How I will control/manage the risk
Health Risks -	To control this, I will consult with a medical professional about any risk and dangers with the diet before the 4 weeks of the diet. During the diet symptoms and changes will also be discussed with a medical professional to ensure there's no risk to the health's of the participants.

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Kean Landman

SIGNATURE(S):  ☑ By ticking this box, I/we state that my/our project adheres to the listed criteria for this Category.

TEACHER'S NAME: Sarah Turland SIGNATURE:  DATE: 27/06/2025