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# Eating and Emotions: The Effect of Dark Chocolate and Apples on Mood Levels

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# Eating and Emotions:

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## The Effect of Dark Chocolate and Apples on Mood Levels

By

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An Honors Thesis Submitted in Partial Fulfillment of the  
Requirements for Graduation from the  
Western Oregon University Honors Program

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### Abstract

The current study looked at the short term and long term effects of consumption of dark chocolate versus apples on mood levels. There were 36 participants, 26 female and 10 male with a mean age of  $M = 20.25$  and  $SD = 2.65$  years. Using a 7-point Likert-type scale, participants were asked to rate a series of items that pertained to their current mood scaling from (1) meaning not at all to (7) meaning very strongly (Macht & Dettmer, 2006). For the first day, participants recorded their mood levels after consumption of either chocolate, apples, or water at four intervals: 1, 5, 30, and 60 minutes after eating. For the next two days, participants recorded their mood levels at 30 and 60 minutes only. Using a mixed factorial ANOVA, short term results were not statistically significant, indicating that palatability had no effect. Then, using a second mixed factorial ANOVA, long term results showed a significant result for time ( $F(1) = 5.713$ ,  $p < .05$ ,  $\eta^2 = .023$ ). This result shows that moods, regardless of food, decreased over time. There were no significant results for the time by group interaction for long term effects. These results indicate that dark chocolate and apples do not differentially affect mood level over time. However, data trends suggest that with more participants, a significant effect may be seen, but further research is needed.

## **The Effects of Dark Chocolate and Apples on Mood Levels**

Mood is a state of being that can include emotions such as happiness, sadness, frustration, anxiety, and more. Mood also differs along various dimensions, including strength (weak to strong), valence (negative to positive), and arousal (not aroused to aroused). Mood can vary in duration; some are short lived, ranging from minutes to hours, while others persist longer, ranging from a day to a few weeks. Regardless of duration, mood levels can affect how people perceive and experience the world around them. Additionally, mood can provide individuals with social cues on how they should respond to other people and their environment (Mood, 2008).

### **Mood and Food**

A significant and relatively easy way to alter mood levels is through food. Often, food choices are used to regulate and improve mood levels (Singh, 2014). This is understandable because when a person eats, the reward and gratification associated with food consumption activates dopamine receptors in the brain, stimulating reward and pleasure centers. Certain foods tend to be preferred or craved under various psychological conditions. For example, when an individual is feeling sad, they might crave something sweet (e.g., chocolate), because that will create a pleasurable feeling in the brain as well as stimulate the body because of

the copious amounts of sugar in the product. This will in turn make the person feel happier and energized. As a result, their mood level will increase.

This feeling can also be created through eating “comfort foods”. Comfort foods are foods that a person has associated with a certain feeling, such as safety, happiness, or love. Although comfort foods vary by person and culture, a common one is chocolate. Chocolate has been associated with pleasure and joy and is considered an aphrodisiac in many cultures (Scholey & Owen, 2013). There are technically three types of chocolate (white, milk, and dark), but for the purposes of this study only dark chocolate will be discussed. Dark chocolate differs from milk chocolate in several ways, but the most prominent are the cocoa content and health benefits. Traditionally, dark chocolate has a cocoa content of 63% or higher, whereas milk chocolate generally ranges between 38% and 42% cocoa content.

Cocoa polyphenols within dark chocolate have been shown to have many potential health benefits, such as reducing blood pressure, increasing cerebral blood flow, and improving neuropsychological functioning (Pase et al., 2013). Flavonoids are organic polyphenols found in dark chocolate and apples (Bell, Lamport, Butler, & Williams, 2015). Some of the various health benefits associated with flavonoids are reduced risk of cardiovascular disease, diabetes, and stroke. In addition to flavonoids, dark chocolate contains antioxidants,

primarily resveratrol, which can boost human immune system functioning (Acker et al., 2013).

## Effects of Dark Chocolate on the Brain

When observing the effects of food, it is essential to examine the neurotransmitters in the brain that carry different messages for hunger, fullness, and appetite and how those relate to the consumption of dark chocolate. Neurotransmitters are chemicals that transport information throughout the brain. Some of the neurotransmitters that play a role in mood levels and appetite control are serotonin and dopamine. Serotonin plays many roles in the body and is involved in sleep regulation, appetite, impulse control, and mood fluctuations (Parker, Parker, & Brotchie, 2006). When these neurotransmitters are balanced, there is a decrease in the chance of mood swings and hunger spikes. Low levels of serotonin in the brain have been known to be associated with both depression and anger. When the brain is in need of serotonin, individuals are drawn towards starchy carbohydrates, such as cake or bread. Consumption of these foods raises levels of tryptophan, which is an essential amino acid involved in the creation of protein. This in turn raises serotonin levels.

To further examine the effects of dark chocolate, studies have looked into the psychopharmacological effects of chocolate, specifically those related to the high levels of methylxanthines, caffeine, and theobromine found in this food.



Cocoa products have a surprisingly high concentration of theobromine, with dark chocolate having the most at 237-519 mg per 50 g portions (Smit, Gaffan, & Rogers, 2004). Smit and colleagues found that the cocoa content of a typical portion of dark chocolate produces significant psychopharmacological activity that can be attributed to the high content of theobromine. The high concentrations of theobromine and caffeine operate as a stimulant in the human body. Other psychopharmacological effects can be seen when examining endorphins and the opioid system. The opioid system plays an important role in the palatability of preferred foods and releases opioids, such as P-endorphins, that enhance the pleasure of eating (Parker, Parker, & Brotchie, 2006). This could in part explain why people experience a sense of pleasure when eating sweet foods, especially chocolate. Because chocolate is a natural opioid, it increases both endorphin and serotonin levels. Modern antidepressants, such as Selective Serotonin Reuptake Inhibitors (SSRI's) work to keep serotonin in the brain longer. The benefits from dark chocolate could potentially be a natural way to help alleviate the symptoms of depression, if eaten in moderation daily.

### Short Term Palatability Effects

While some studies have looked at possible psychopharmacological effects of chocolate on mood, other studies have examined how palatability effects can alter mood. In an experiment done by Macht and Dettmer (2006), it was

hypothesized that pleasure from eating chocolate would occur quickly after consumption, but hunger and psycho-pharmacological activation would occur much later. This means that the pleasure a person experiences after the consumption of chocolate was believed to be due to palatability and not because of chemical physiology or appetite. However, it was also suggested that the chemical properties play a bigger role in mood levels over the long term. It was found that over an extended period of time, feelings of guilt in normal healthy women occur after eating chocolate. Results such as these suggest that feelings of guilt are not due to palatability or psychopharmacological effects, but societal views about the potential risks and benefits of chocolate. Research has shown that despite the numerous health benefits that chocolate possesses, it is viewed as an unhealthy food (Macht & Dettmer, 2006). A possible reason for this could be the palatability of chocolate. Sweetness is often associated with sugar, which is in turn associated with unhealthy foods. While milk chocolate does contain added sugar and fats, dark chocolate lacks a considerable amount of sugar and fat that traditional milk chocolate has. However, because there are negative connotations about chocolate in general, the health benefits are either generally ignored or overlooked. Despite the negative views about chocolate, it is still a highly craved food and is consumed in massive quantities in the United States (Scholey & Owen, 2013).

While there has been a significant amount of research into the palatability and psychopharmacological properties of dark chocolate, there isn't as much research about how apples effect mood levels. Apples and chocolate share many similarities. They're both full of antioxidants, have numerous health benefits, and are carbohydrates. Apples are traditionally considered a healthier food, because they are a fruit and are relatively low in calories. Additionally, apples have high levels of tryptophan. When consumed, it increases serotonin levels in the brain, similar to the effects of dark chocolate.

### **Effect of Apples on the Brain and Body**

In addition to these effects, apples can also increase dopamine levels. Low levels of dopamine can produce frequent mood changes, difficulty focusing, fatigue, anxiety, and compulsive overeating (Mandal, 2015). Apples are considered to be a dopamine "superfood" and can help increase dopamine levels in several ways. Apples have a high concentration of quercetin, a powerful antioxidant that promotes brain growth and stimulates dopamine levels. This antioxidant is useful at preventing certain diseases (e.g., lung cancer and type II diabetes). However, quercetin is mainly in the peel of the fruit and not the flesh and it has the vitamin C equivalents of about 1500 mg (Boyer & Liu, 2004). So the apple must be eaten with the peel on it to obtain the maximum amount of health and mood level benefits. Additionally, apples have polyphenols, which is another

powerful antioxidant that protects dopamine cells from damage. Because of the potent antioxidant properties in apples, they can assist in alleviating some of the symptoms of low dopamine levels and build protection for existing dopamine cells. Similarly to chocolate, apples contain flavonoids that help to reduce the risk of cancer, asthma and pulmonary illnesses, and diabetes. Not only do apples have properties that can improve mood levels, but they have numerous health benefits.

One study examined the efficiency of apples, strawberries, and tomatoes in lowering oxidative stress in pigs, who share a considerable amount of traits and DNA with humans (Nelson, 2015). Overproduction of oxidants can cause an imbalance in the body which leads to oxidative stress (Pajk, Rezar, Levart, & Salobir, 2005). This in turn can lead to cellular damage in proteins, lipids, and DNA. The results of this study showed that a high intake of polyunsaturated fatty acids (PUFAs) can lead to a significant increase in peroxidation of body lipids, which is harmful to the body. However, by consuming a moderate amount of fruit, there was shown to be a reduction in oxidative stress. This study shows that not only can apples help to prevent against diseases, but they can also help reverse damage to the body. The body can undergo extreme amounts of stress which effect mood levels, sometimes without being consciously aware of it. By

eating apples regularly, bodily stress can be reduced, which then increases health and improves mood.

## Rational for Researching

The issue with examining how chocolate and apples affect mood levels is that the research is limited, especially in regards to examining the effects of consumption over the long term. Previous research has utilized within subject designs by having groups consume both chocolate and apples on the same day. A potential problem with using a within subjects design is that participants' mood levels can be affected by previous consumption of either dark chocolate or apples. Because of this, previous studies could potentially have misleading results that are attributable to their research designs. Therefore, the current study used a between subjects design to eliminate the possibility of potentially misleading results from previous consumption of other food.

## The Current Study

The current study lasted three days in total, testing participants once a day for three days. Those in the dark chocolate group consumed 2 oz., participants in the apple group consumed one medium sized apple, and those in the water group consumed one 8 oz. glass of water. After consumption, participants were asked to rate their mood at 1, 5, 30, and 60 minute intervals. On days two and

three, participants were only tested at 5, 30, and 60 minute intervals. Short term effects (Day 1) examined potential effects of palatability. It was hypothesized that palatability would increase positive affect in both the dark chocolate and apple groups. As for long term effects, it was hypothesized that those in the chocolate group would develop feelings of guilt, because of previous negative stigmatization and societal views on health, whereas the apple group would have a steady and continued increase in mood levels.

## Method

**Participants:** This study included 33 undergraduate students at Western Oregon University and 3 non-student adults from the community. Participants were selected in two ways: by word of mouth on social media and by walk-ins at the library on campus. Data was collected from 36 individuals (26 female; 10 male) with a mean age of  $M = 20.25$  and  $SD = 2.65$  years. Participants were in numerous majors, with the highest being Psychology. Participants were told that the study was examining the effects of dark chocolate and apples on mood levels, and those who were either in psychology or gerontology classes received two extra credit slips in compensation for participation.

**Materials:** Participants were given a questionnaire that began with general background questions assessing age, gender, ethnicity, and major. In addition,

baseline mood was assessed before the experiment began. This was rated on a 10-point bipolar scale ranging from (0) meaning *extremely bad*, to (9), meaning *extremely good* (Macht & Dettmer, 2006). Following this was a section with a variety of emotions (anger, sadness, desire to eat, tension, tiredness, energetic, guilt, fear, joy, boredom, and loneliness) that were measured on a seven point Likert scale ranging from (1) meaning *not at all*, to (7) meaning *very strongly*. In the last part of the demographics survey, participants were asked to rate the overall taste of the product from (1) meaning *extremely bad*, to (7) meaning *extremely good* (see Appendix A). After consumption of either the dark chocolate, apple, or water, participants were then asked to fill out a four part questionnaire that consisted of the same 10-point bipolar scale that was on the demographics form. Participants were asked to fill out the ten point bipolar scale at one, five, thirty, and sixty minutes after consumption (see Appendix B). Then, for the following two days, participants were asked to consume the product again and rate their mood levels using the same scale at 30 and 60 minutes after consumption (see Appendix C).

**Procedure:** Before the study began, participants were given a consent form to examine and sign (see Appendix D). The consent form was then collected and placed in an envelope. After this, instructions on how complete the survey were provided. The questionnaires assessing general background facts and mood levels

were completed and placed into a separate envelope. Next, participants were given an eight ounce glass of water, half an apple, or two ounces of dark chocolate. Then, using a stop watch, students were then asked to complete a questionnaire at 1, 5, 30, and 60 minutes after consumption. These questionnaires included the same 10-point bipolar scale as the previous measures. Upon completion, the questionnaires were placed into another envelope marked "Day 1." A simplified version of this cycle was completed on the following two days with participants measuring their mood levels at 5, 30, and 60 minutes after consumption. Participants in the dark chocolate and apple groups were instructed not to consume any other chocolate or apples during the two days in order to keep the results as accurate as possible. In addition, students were asked not to eat anything one hour prior to data collection and until the final questionnaire was filled out. Participants were allowed to fill out these questionnaires at home and submit them via email for convenience. Privacy was ensured by not attaching names to any of the questionnaires, and confidentiality was maintained by placing the consent forms and the questionnaires in different envelopes. Participants were then given a debriefing form at the end of the experiment via email that explained the purposes and hypotheses of the study (see Appendix E). Participants were also informed that documents would be held



for three years upon completion of the study, and that they had the right to withdraw from the study while still receiving compensation.

## Results

To test the hypothesis of if palatability effects from apples, chocolate, and water resulted in increases or decreases in mood level, a mixed factorial ANOVA was performed using four levels (T1, T5, T30, and T60). This looked at mood level at four time points as well as the effects of time, food type, and time and food type interaction. Contrary to expectations, there were no significant results for the time  $F(1,31) = .001, p > .05, \eta^2 = .000$ , food type,  $F(2,31) = .821, p > .05, \eta^2 = .050$ , or time and food type interaction,  $F(2,31) = 1.678, p > .05, \eta^2 = .098$ . Using a second mixed factorial ANOVA for long term effects, there was a significant result for time  $F(1,30) = 5.713, p < .05, \eta^2 = .160$ . However, there were no significant results for food type  $F(2,30) = .895, p > .05, \eta^2 = .056$ , or for time and food type interaction  $F(2,30) = .034, p > .05, \eta^2 = .002$ .

## Discussion

This study examined the potential effects of dark chocolate and apples on mood levels, with a focus on the effects of palatability and psychopharmacological properties. Contrary to predictions, the effects of palatability on short term mood levels were not significant. In regards to long

term effects, neither palatability nor psychopharmacological properties had significant effects on mood levels. The only significant results showed that mood decreased in all groups regardless of what food was consumed. Participants in the apple group showed the slowest decline, followed by the dark chocolate group, and then water. Data trends suggest that if there had been more participants, a significant result could have been seen. However, because of low statistical power, data may have resulted in a type II error.

Results of the current study were not consistent with prior research. The study done by Macht and Dettmer (2006) showed that chocolate had both positive and negative effects on mood levels. Positive effects were due to palatability, rather than psychopharmacological properties, whereas negative effects were hypothesized to derive from negative food-related cognitions about societal views on chocolate. Additional research supports these findings, discussing how chocolate is a natural opioid and therefore when eaten it releases opioids (endorphins) in the brain and increases pleasure (Parker, Parker, & Brotchie, 2006; Acker et al., 2013). Because of this, chocolate should actually increase mood levels because of both palatability and psychopharmacological effects. However, these effects were not seen in the current study. As for apples, prior research is extremely limited in regards to how apples can affect mood. More research and information is known about the health benefits of apples and

how they increase serotonin and dopamine levels in the brain. Low dopamine and serotonin levels can cause mood fluctuations, fatigue, anxiety, and difficulty focusing (Mandal, 2015). Therefore, consuming apples in theory should increase mood levels.

Many factors could have influenced the results of the current study. For instance, because the subject group was exclusively college students, they might have been under different conditions than the rest of the population. Generally, college students are under varying levels of stress due to classes, exams, and other commitments. The study took place between midterms and finals at Western Oregon University, which could have impacted the stress levels of participants.

Secondly, the amount of sleep participants had throughout the course of the study could have affected their mood levels. Sleep deprivation has been seen to increase cortisol levels and lower performance (Leproult, Copinschi, Buxton, & Van Cauer, 1997). This suggests that if any of the participants were sleep deprived due to exams, their stress levels would increase and their cognitive functioning would decrease. Therefore, the amount of sleep participants received could have played a part in why significant results were not achieved.

Thirdly, because the study took place over three days, it was impossible to monitor what other food participants were consuming and at what times. At the

beginning of the study, participants were told not to eat one hour before and after consuming the dark chocolate or apple. Additionally, for the next two days, all were asked to refrain from eating more than the given amount and to not eat food from the other tested groups. Even though precautions were put in place, it is impossible to monitor what goes on outside of a testing lab, and therefore mood levels could have been affected by other food. Lastly, because there were only 34 participants, there wasn't enough statistical power to observe significant results.

Future research in this area should consider having participants keep a sleep log to monitor the amount of sleep participants are receiving each night. This could help control for the possibility of sleep deprivation effects on mood levels. Secondly, participants should keep a food log documenting what food they ate and how close it was to when they tested themselves. This could help control for the effects of outside food and isolate the effects of the dark chocolate or apple. Thirdly, the course of the study should be longer. The current study was only 3 days long. Greater effects might be seen by increasing the length of time participants are consuming the specific food type. This would give researchers a more in-depth view as to how mood fluctuates long term. Lastly, if working specifically with a college group, it would be beneficial to control for time. Because college students may experience a greater amount of stress towards the

end of the term, it could be advantageous to do testing at the beginning and end of the term. By doing this, the effect of stress on mood could be seen clearly and more accurate data would be available. Plus, it would be beneficial to see if the effects of dark chocolate and apples have a greater chance at producing significant mood level results when comparing two different times of the term.

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### Facts and Figures

**Table 1.1 Short Term Results for Time and Group Interaction**

#### Tests of Within-Subjects Contrasts

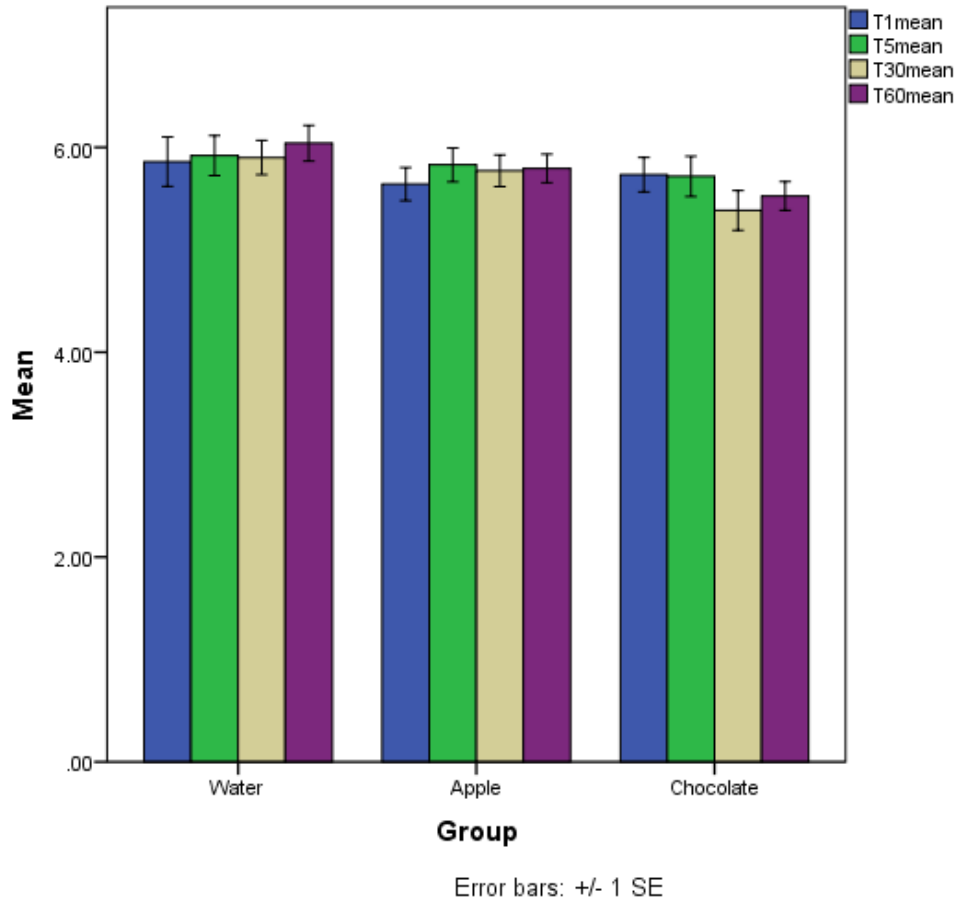
| Source       | Time      | Type III Sum of Squares | df | Mean Square | F     | Sig. | Partial Eta Squared |
|--------------|-----------|-------------------------|----|-------------|-------|------|---------------------|
| Time         | Linear    | .000                    | 1  | .000        | .001  | .976 | .000                |
|              | Quadratic | .004                    | 1  | .004        | .069  | .794 | .002                |
|              | Cubic     | .270                    | 1  | .270        | 2.682 | .112 | .080                |
| Time * Group | Linear    | .747                    | 2  | .374        | 1.678 | .203 | .098                |
|              | Quadratic | .196                    | 2  | .098        | 1.751 | .190 | .101                |
|              | Cubic     | .091                    | 2  | .045        | .452  | .640 | .028                |
| Error(Time)  | Linear    | 6.903                   | 31 | .223        |       |      |                     |
|              | Quadratic | 1.733                   | 31 | .056        |       |      |                     |
|              | Cubic     | 3.117                   | 31 | .101        |       |      |                     |

**Table 1.2 Short Term Results for Food Type**

#### Tests of Between-Subjects Effects

| Source    | Type III Sum of Squares | df | Mean Square | F        | Sig. | Partial Eta Squared |
|-----------|-------------------------|----|-------------|----------|------|---------------------|
| Intercept | 3490.228                | 1  | 3490.228    | 3190.207 | .000 | .990                |
| Group     | 1.795                   | 2  | .898        | .821     | .450 | .050                |
| Error     | 33.915                  | 31 | 1.094       |          |      |                     |

**Graph 1.1 Short Term Results**



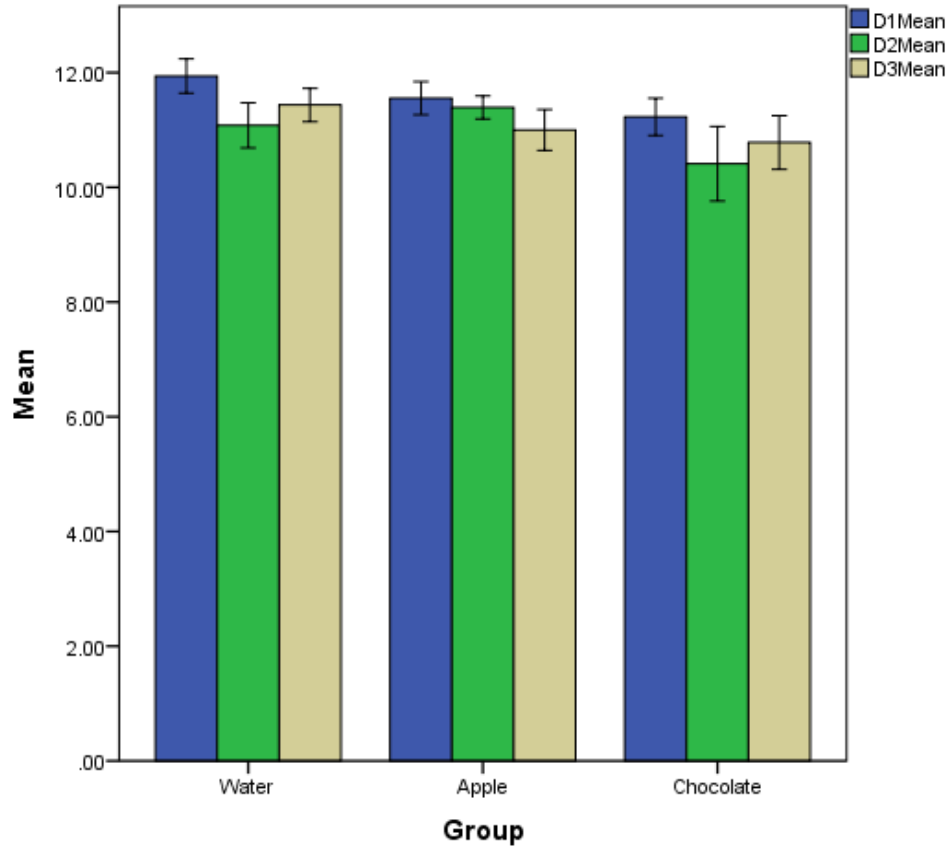
**Table 2.1 Long Term Results for Time and Group Interaction****Tests of Within-Subjects Contrasts**

| Source       | Time      | Type III<br>Sum of<br>Squares | df | Mean<br>Square | F     | Sig. | Partial Eta<br>Squared |
|--------------|-----------|-------------------------------|----|----------------|-------|------|------------------------|
| Time         | Linear    | 3.229                         | 1  | 3.229          | 5.713 | .023 | .160                   |
|              | Quadratic | 2.246                         | 1  | 2.246          | 2.905 | .099 | .088                   |
| Time * Group | Linear    | .039                          | 2  | .019           | .034  | .966 | .002                   |
|              | Quadratic | 2.825                         | 2  | 1.412          | 1.826 | .178 | .109                   |
| Error(Time)  | Linear    | 16.955                        | 30 | .565           |       |      |                        |
|              | Quadratic | 23.200                        | 30 | .773           |       |      |                        |

**Table 2.2 Long Term Results for Food Type****Tests of Between-Subjects Effects**

| Source    | Type III<br>Sum of<br>Squares | df | Mean<br>Square | F        | Sig. | Partial Eta<br>Squared |
|-----------|-------------------------------|----|----------------|----------|------|------------------------|
| Intercept | 9688.195                      | 1  | 9688.195       | 2496.938 | .000 | .988                   |
| Group     | 6.943                         | 2  | 3.472          | .895     | .419 | .056                   |
| Error     | 116.401                       | 30 | 3.880          |          |      |                        |

**Graph 2.1 Long Term Results**



Error bars: +/- 1 SE

**Appendix A**

Demographics Survey

Age:

Major:

Grade Level (circle one): Freshman   Sophomore   Junior   Senior

Gender: Male   Female   Other: \_\_\_\_\_

Current Mood Level: (0 = extremely bad; 9 = extremely good)

0      1      2      3      4      5      6      7      8      9

Please rate the following characteristics from 1-7, where (1) is not at all and (7) is very strongly.

In my current state, I feel:

- |     |                  |                                       |
|-----|------------------|---------------------------------------|
| 1.  | Hungry           | 1.....2.....3.....4.....5.....6.....7 |
| 2.  | Nervous/Tense    | 1.....2.....3.....4.....5.....6.....7 |
| 3.  | Active/Energetic | 1.....2.....3.....4.....5.....6.....7 |
| 4.  | Guilty           | 1.....2.....3.....4.....5.....6.....7 |
| 5.  | Angry            | 1.....2.....3.....4.....5.....6.....7 |
| 6.  | Anxious          | 1.....2.....3.....4.....5.....6.....7 |
| 7.  | Sad/Depressed    | 1.....2.....3.....4.....5.....6.....7 |
| 8.  | Happy            | 1.....2.....3.....4.....5.....6.....7 |
| 9.  | Boredom          | 1.....2.....3.....4.....5.....6.....7 |
| 10. | Lonely           | 1.....2.....3.....4.....5.....6.....7 |

Lastly, please rate the overall taste of the product from 1-7, where (1) is extremely bad and (7) is extremely good:

1      2      3      4      5      6      7

## Appendix B

### Mood Survey (Day One)

ID Number: \_\_\_\_\_

#### **1 minute after consumption:**

Please rate the following characteristics from 1-7, where (1) is not at all and (7) is very strongly.

In my current state, I feel:

- |     |                  |                                       |
|-----|------------------|---------------------------------------|
| 1.  | Hungry           | 1.....2.....3.....4.....5.....6.....7 |
| 2.  | Nervous/Tense    | 1.....2.....3.....4.....5.....6.....7 |
| 3.  | Active/Energetic | 1.....2.....3.....4.....5.....6.....7 |
| 4.  | Guilty           | 1.....2.....3.....4.....5.....6.....7 |
| 5.  | Angry            | 1.....2.....3.....4.....5.....6.....7 |
| 6.  | Anxious          | 1.....2.....3.....4.....5.....6.....7 |
| 7.  | Sad/Depressed    | 1.....2.....3.....4.....5.....6.....7 |
| 8.  | Happy            | 1.....2.....3.....4.....5.....6.....7 |
| 9.  | Boredom          | 1.....2.....3.....4.....5.....6.....7 |
| 10. | Lonely           | 1.....2.....3.....4.....5.....6.....7 |

#### **5 minutes after consumption:**

- |    |                  |                                       |
|----|------------------|---------------------------------------|
| 1. | Hungry           | 1.....2.....3.....4.....5.....6.....7 |
| 2. | Nervous/Tense    | 1.....2.....3.....4.....5.....6.....7 |
| 3. | Active/Energetic | 1.....2.....3.....4.....5.....6.....7 |
| 4. | Guilty           | 1.....2.....3.....4.....5.....6.....7 |
| 5. | Angry            | 1.....2.....3.....4.....5.....6.....7 |
| 6. | Anxious          | 1.....2.....3.....4.....5.....6.....7 |
| 7. | Sad/Depressed    | 1.....2.....3.....4.....5.....6.....7 |

8. Happy 1.....2.....3.....4.....5.....6.....7
9. Boredom 1.....2.....3.....4.....5.....6.....7
10. Lonely 1.....2.....3.....4.....5.....6.....7

**30 minutes after consumption:**

1. Hungry 1.....2.....3.....4.....5.....6.....7
2. Nervous/Tense 1.....2.....3.....4.....5.....6.....7
3. Active/Energetic 1.....2.....3.....4.....5.....6.....7
4. Guilty 1.....2.....3.....4.....5.....6.....7
5. Angry 1.....2.....3.....4.....5.....6.....7
6. Anxious 1.....2.....3.....4.....5.....6.....7
7. Sad/Depressed 1.....2.....3.....4.....5.....6.....7
8. Happy 1.....2.....3.....4.....5.....6.....7
9. Boredom 1.....2.....3.....4.....5.....6.....7
10. Lonely 1.....2.....3.....4.....5.....6.....7

**60 minutes after consumption:**

In my current state, I feel:

1. Hungry 1.....2.....3.....4.....5.....6.....7
2. Nervous/Tense 1.....2.....3.....4.....5.....6.....7
3. Active/Energetic 1.....2.....3.....4.....5.....6.....7
4. Guilty 1.....2.....3.....4.....5.....6.....7
5. Angry 1.....2.....3.....4.....5.....6.....7
6. Anxious 1.....2.....3.....4.....5.....6.....7
7. Sad/Depressed 1.....2.....3.....4.....5.....6.....7
8. Happy 1.....2.....3.....4.....5.....6.....7
9. Boredom 1.....2.....3.....4.....5.....6.....7
10. Lonely 1.....2.....3.....4.....5.....6.....7



**Appendix C**

## Mood Survey (Day Two and Three)

ID Number: \_\_\_\_\_

Current Mood Level (Please complete before consumption):

0      1      2      3      4      5      6      7      8      9

**30 minutes after consumption:**

Please rate the following characteristics from 1-7, where (1) is not at all and (7) is very strongly.

In my current state, I feel:

- |     |                  |                                       |
|-----|------------------|---------------------------------------|
| 1.  | Hungry           | 1.....2.....3.....4.....5.....6.....7 |
| 2.  | Nervous/Tense    | 1.....2.....3.....4.....5.....6.....7 |
| 3.  | Active/Energetic | 1.....2.....3.....4.....5.....6.....7 |
| 4.  | Guilty           | 1.....2.....3.....4.....5.....6.....7 |
| 5.  | Angry            | 1.....2.....3.....4.....5.....6.....7 |
| 6.  | Anxious          | 1.....2.....3.....4.....5.....6.....7 |
| 7.  | Sad/Depressed    | 1.....2.....3.....4.....5.....6.....7 |
| 8.  | Happy            | 1.....2.....3.....4.....5.....6.....7 |
| 9.  | Boredom          | 1.....2.....3.....4.....5.....6.....7 |
| 10. | Lonely           | 1.....2.....3.....4.....5.....6.....7 |

**60 minutes after consumption:**

In my current state, I feel:

- |    |               |                                       |
|----|---------------|---------------------------------------|
| 1. | Hungry        | 1.....2.....3.....4.....5.....6.....7 |
| 2. | Nervous/Tense | 1.....2.....3.....4.....5.....6.....7 |

3. Active/Energetic 1.....2.....3.....4.....5.....6.....7
4. Guilty 1.....2.....3.....4.....5.....6.....7
5. Angry 1.....2.....3.....4.....5.....6.....7
6. Anxious 1.....2.....3.....4.....5.....6.....7
7. Sad/Depressed 1.....2.....3.....4.....5.....6.....7
8. Happy 1.....2.....3.....4.....5.....6.....7
9. Boredom 1.....2.....3.....4.....5.....6.....7
10. Lonely 1.....2.....3.....4.....5.....6.....7

**Appendix D****WESTERN OREGON UNIVERSITY  
Behavioral Sciences Division****Informed Consent for Research involving Human Subjects**

Title of Project:

**Effects of Dark Chocolate and Apples on Mood Levels**

Principal Investigator: Clarissa Toplar

Cell Phone: 541-829-8516

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Faculty Advisor: Ethan McMahan

Phone: 503-838-8634

Email: [mcmahane@wou.edu](mailto:mcmahane@wou.edu)

You are invited to participate in a research study conducted by Clarissa Toplar, undergraduate psychology major in pursuit of a Bachelor's of Science in Psychology.

**Purpose of the Study:** This project investigates the effects of dark chocolate and apples on mood levels, in addition to looking at overall health effects as well.

**Procedure of the Study:** This study includes both an online and in-person component. In short, you will have to complete a few forms in person, (an informed consent form, general demographics form, and mood level form). When these forms are filled out, you will be randomly selected to be in a dark chocolate, apple, or water group. From there, you will be asked to consume either two squares of dark chocolate, half an apple, or one glass of water. Next, at time intervals of 1, 5, 30, and 60 minutes after consumption, you will be asked to fill out additional mood level forms. After the initial day, you will be asked to repeat this cycle for two more days, filling out a similar mood survey and recording your mood levels at 30 and 60 minutes after consumption. All responses should be emailed to this address: [ctoplar13@wou.edu](mailto:ctoplar13@wou.edu) . At the end of the study, a debriefing form will be sent out via email explaining the purpose and hypothesis of the study. All your responses will be kept confidential and your name will not be associated with any of the data.

**Potential Risks and Discomforts:** This study poses only minimal risk, and participants will not be exposed to any risks that exceed that encountered during typical daily activities. Participants may feel slight increases in stress and/or tension as well as variations in mood levels. If these risks do occur, they are expected to decrease quickly after consumption.

**Potential Benefits to Participants:** Participants will benefit directly through the

provision of extra credit for participation. In addition to this, participants may feel increases in mood levels, reduced stress, tension, and tiredness, and reduced hunger.

**Potential Benefits to Society:** This study examines the effect of dark chocolate and apples on mood levels. Results of this study will contribute to prior research on how food effects mood levels and provide new information on long term exposure to dark chocolate and apples in regards to palatability, psycho-pharmalogical, and overall health benefits.

**Confidentiality:** The principal investigator will ensure that any information obtained in this study will in no way be connected to the participants. Participation in this study is confidential. After agreeing to participate, participants will be given a randomly generated participant identification code which will be used for the remainder of the study and in data organization. Participant information will be kept password protected and in a secure location.

**Participation and Withdrawal:** Participation is voluntary. The participant is free to discontinue participation at any point during this study without penalty. If the participant withdraws prior to completing the experimental protocol, all incomplete data will be deleted and dropped from analyses. Otherwise, data will be held for three years so that at any point a participant can withdraw their data if they so wish.

**Contact Information:** This study has been reviewed and approved by the Western Oregon University Institutional Review Board (IRB). If you like, you may print a copy of this page for your records. If you have any questions, concerns, or comments about this project, please contact Clarissa Toplar at [ctoplar13@wou.edu](mailto:ctoplar13@wou.edu) or (541)829-8516. If you have any questions about your rights as a research participant or any concerns about the project (which you may report anonymously), contact the Western Oregon University IRB chair at [irb@wou.edu](mailto:irb@wou.edu) or (503)838-9200.

**To be completed by participant:**

I have read and understand the information provided above and willingly agree to participate in this research study.

- Yes, I agree to participate.
- No, I do not want to participate.

If you agree to participate, please sign and date below.

Signature:

---

Date:

---

## Appendix E

### DEBRIEFING FORM

#### *The Effects of Dark Chocolate and Apples on Mood Levels*

Thank you for participating in our study. At this point we wanted to provide you with a little more detail regarding the focus of this study. As mentioned in the consent form, this study looked into the effects of dark chocolate and apples on mood levels both short term and long term. Prior research shows that both products can increase mood levels, reduce tiredness and hunger, and provide numerous health benefits. However, because chocolate is considered an “unhealthy” food because of negative connotations surrounding it, prior research has shown that it can produce feelings of guilt and lead to lower body image and self-esteem in people. The short term hypothesis of this study was that both dark chocolate and apples will increase mood, reduce tiredness, tension, and hunger. For long term hypothesis was that apple levels would remain constant while chocolate levels would vary and produce feelings of guilt and an increase in tension.

For the current study, we asked you to consume a food product and rate your mood level at 1, 5, 30, and 60 minutes after consumption. The mood questionnaire was taken from a similar prior study using the same materials. Although we expect to find differences in mood levels for both chocolate and apples, we predict that there will be some similarities as well.

Thank you again for participating in our study. Please refrain from discussing this study with other individuals who might participate until *March 30<sup>th</sup>, 2016*, as doing so might compromise our data collection.

I will be giving a poster presentation of the results of this study at Academic Excellence Showcase at the end of Winter Term (time and location will be provided in the showcase program). You are welcome to come to the poster session to see how the study turned out. If you have additional questions about the study, please feel free to contact:

*Clarissa Toplar*

[Ctoplar13@wou.edu](mailto:Ctoplar13@wou.edu)

### **Larger Context/Significance**

Food and the act of consuming food is a significant and essential part of all cultures. From an evolutionary standpoint, food is essential to maintain and sustain life, while providing the body with essential vitamins, minerals, and nutrients. However, overtime it has transformed to much more than meeting bodily needs. This can be seen largely from media (e.g. cooking channels, movies, talk shows, documentaries, ads) and social gatherings (e.g. parties, meeting with friends, dating). Because eating is such an essential part of living, it should be studied intensely. That being said, many aspects and foods have been studied, especially when discussing physical effects food can have on the body. The connection between diet and Diabetes II, which is a disease where the body can't produce or respond to insulin correctly, has been well documented and demonstrates how food can negatively or positively impact the body. While the connection between food and body has been studied greatly, the connection between food and mood still has room for improvement. Special attention should be placed on foods commonly eaten in many cultures. Fruits and sweets can be found in all cultures, varying in amounts and tastes. However, chocolate has a long history originating in Mexico with the Olmecs in 1200 BC (Scholey & Owen, 2013). Since then, it has appeared in cultures all over the world, with consumption being highest in Europe and the United States. In fact, American eat over \$18 million worth of chocolate each year (Satioquia-Tan, 2015). Even though

large quantities of chocolate are consumed each year, there is limited research on its effect on how it can effect mood levels. Similarly, apples are one of the most common and important fruits in developed nations. However, even less information is known on the effects of apples on mood levels.

Unfortunately, the results of my study looking into how dark chocolate and apples effect mood levels had insignificant results. However, data trends suggest that with more participants there would have been significant effects showing that while mood decreased in all groups, it decreased the slowest in the apple group, followed by the dark chocolate group. More participants and further research is needed to make a definitive claim as to how and how much these foods affect mood levels. With more participants, I hypothesize there would be significant results showing that chocolate and especially apples when consumed continuously can help not only stabilize mood levels, but eventually increase them as well. If found true, it could provide a cost effective and natural way to increase mood without having to take medication. This would be especially helpful to college students, like all the participants in my study, who lack funds to take medications, such as anti-depressants and anti-anxiety, as well as those in impoverished areas.

### **Personal Interest and Relevance**

When I first became interested in studying psychology, I knew I wanted to study mood disorders. Mood disorders include: Major Depressive Disorder, Bipolar I & II, Persistent Depressive Disorder, Cyclothymia, and Seasonal Affective Disorder. While I was growing up, I watched my mother struggling to overcome depression and felt horrible that I couldn't help her in any way. It wasn't until I was diagnosed with depression myself at 16 that I realized she wasn't the only one struggling. I had never known there was a name for the symptoms associated to the way I or my mother was feeling. Once I knew, I wanted to dedicate my time and energy to finding a way to help others who were struggling with the same issues. It wasn't until a couple of years ago when I decided to major in psychology that I knew how to do it. So, I wanted this study to revolve around understanding and changing mood in a significant way that would be available to everyone.

Additionally, I wanted to find a way to provide a cheaper alternative to medication and therapy that families and students who are struggling in poverty can easily access. I grew up in extreme poverty and was even homeless for a year when I was younger. My family didn't have health care for the majority of my upbringing, so it was near impossible to receive any type of therapy or medication. Because of this, it's important to me to be able to find ways to help



those who struggle with mental health issues, especially mood disorders. Everyone should have access to health care and counseling, but currently that isn't a realistic possibility. It was my hope that my study would show significant results and provide a mild alternative that could relieve some of the symptoms of stress and anxiety. All my participants were college students either attending Western Oregon University or a close by one. College students are traditionally known for being under intense amounts of stress and anxiety. Thankfully at Western, there are many programs in place, including free unlimited counseling that can help students deal with stress and anxiety. However, not all universities are like this. Not only this, but students already pay staggering amounts of money each year in tuition, rent, food, textbooks, and supplies. After all of these expenses, there is little money to do much of anything, including going to therapy or paying for medication. That's why it's so important to find cheaper ways of relieving the symptoms of stress and anxiety so that everyone, regardless of funds, health care, or availability, can have ways to help themselves.

While my study didn't have significant results, it did motivate me to pursue a career in which I could study mood more closely. That's why after I receive my Bachelor's degree I'm pursuing a Masters in Psychological Research Methods at the University of Exeter. I will be focusing on something related to mood disorders and stress disorders, such as Post Traumatic Stress Disorder

(PTSD) for my future dissertation. While I don't think I will be continuing my study of chocolate and apples, I will continue researching and understanding mood and how it can be influenced and altered through our environment and non-traditional methods.