Eating and Emotions:

The Effect of Dark Chocolate and Apples on Mood Levels

By

Clarissa M. Toplar

An Honors Thesis Submitted in Partial Fulfillment of the

Requirements for Graduation from the

Western Oregon University Honors Program

Dr. Ethan A. McMahan

Thesis Advisor

Dr. Gavin Keulks

Honors Program Director

June 2017

Table of Contents

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.

References

Acker, D., Lendic, K. V., Valek, M., Subaric, D., Milicevic, B., Babic, J., & Nedic, I.

    (2013). Cocoa polyphenols: Can we consider cocoa and chocolate as

    potential functional food? *Journal of Chemistry.* doi:

    10.1155/2013/289392.

Bell, L., Lamport, D. J., Butler, L. T., Williams, C. M. (2015). A review of the

    cognitive effects observed in humans following acute supplementation

    with flavonoids, and their associated mechanisms of action. *Nutrients, 7,*

    10290-10306. doi: 10.3390/nu7125538.

Boyer, J., & Liu, R. H. (2004). Apple phytochemicals and their health benefits.

    Nutrition Journal, 3:5. http://www.nutritionj.com/content/3/1/5 .

Hayes, J. F., D'Anci, K. E., & Kanarek, R. B. (2011). Foods that are perceived as

    healthy or unhealthy differentially alter young women's state body image.

    Appetite, *57*(2), 384-387. doi:10.1016/j.appet.2011.05.323.

Kampov-Polevoy, A. B., Alterman, A., Khalitov, E., & Garbutt, J. C. (2005). Sweet

    preference predicts mood altering effect of and impaired control over

    eating sweet foods. *Eating Behaviors, 7(3),* 181-187.

    doi:10.1016/j.eatbeh.2005.09.005.

Leproult, R., Copinschi, G., Buxton, O., & Van Cauter, E. (1997). Sleep loss results

in an elevation of cortisol levels the next evening. *Sleep: Journal Of Sleep*

Research & Sleep Medicine, *20*(10), 865-870.

Lü, W., & Wang, Z. (2012). Emotional expressivity, emotion regulation, and mood

in college students: A cross-ethnic study. *Social Behavior and*

Personality, *40*(2), 319-330. doi:10.2224/sbp.2012.40.2.319.

Macht, M., & Dettmer, D. (2006). Everyday mood and emotions after eating a

chocolate bar or an apple. *Appetite*, *46*(3), 332-336.

doi:10.1016/j.appet.2006.01.014.

Macht, M., & Mueller, J. (2007). Immediate effects of chocolate on

experimentally induced mood states. *Appetite*, *49*(3), 667-674.

doi:10.1016/j.appet.2007.05.004.

Mandal, A. (2015). Dopamine functions. *Medical News: Life Sciences and*

Medicine. http://www.news-medical.net/health/Dopamine-

Functions.aspx .

Mood (2008) In International Encyclopedia of the Social Sciences. Retrieved from

http://www.encyclopedia.com/doc/1G2-3045301620.html.

Moreno-Dominguez, S., Rodríguez-Ruiz, S., Martín, M., & Warren, C. S. (2012).

Experimental effects of chocolate deprivation on cravings, mood, and

consumption in high and low chocolate-cravers. *Appetite*, *58*(1), 111-116.

doi:10.1016/j.appet.2011.09.013.

Nelson, B. (2015). Pigs and humans share more genetic similarities than

previously believed. *Mother Nature Network.*

http://www.mnn.com/earth-matters/animals/stories/pigs-and-humans-

more-closely-related-thought-according-genetic-analysis .

Pase, M. P., Scholey, A. B., Pipingas, A., Kras, M., Nolidin, K., Gibbs, A., Wesnes, K.,

& Stough, C. (2013). Cocoa polyphenols enhance positive mood states but

not cognitive performance: A randomized, placebo-controlled trial. *Journal

of Psychopharmacology 27(5),* 451-458. doi: 10.1177/0269881112473791.

Pajk, T., Rezar, V., Levart, A., & Salobir, J. (2005). Efficiency of apples,

strawberries, and tomatoes for reduction of oxidative stress in pigs as a

model for humans. *Nutrition (22)*, 376-384. doi:

10.1016/j.nut.2005.08.010.

Parker, G., Parker, I., & Brotchie, H. (2006). Mood state effects of chocolate.

Journal of Affective Disorders (92), 149-159. doi:

10.1016/j.jad.2006.02.007.

Satioquia-Tan, J. (2015). Americans eat how much chocolate? CNBC.

http://www.cnbc.com/2015/07/23/americans-eat-how-much-

chocolate.html .

Scholey, A., & Owen, L. (2013). Effects of chocolate on cognitive function and

mood: A systematic review. *Nutrition Reviews 71(10)*, 665-681. doi:

10.1111/nure.12065.

Singh, Minati. (2014). Mood, food, and obesity. *Frontiers in Psychology 5(925),* 1-

20. doi: 10.3389/fpsyg.2014.00925.

Smit, H. J., Gaffan, E. A., & Rogers, P. J. (2004). Methylxanthines are the psycho-

pharmacologically active constituents of chocolate. *Psychopharmacology*

176(3-4), 412-419. doi: 10.1007/s00213-004-1898-3.

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

Error bars: +/- 1 SE
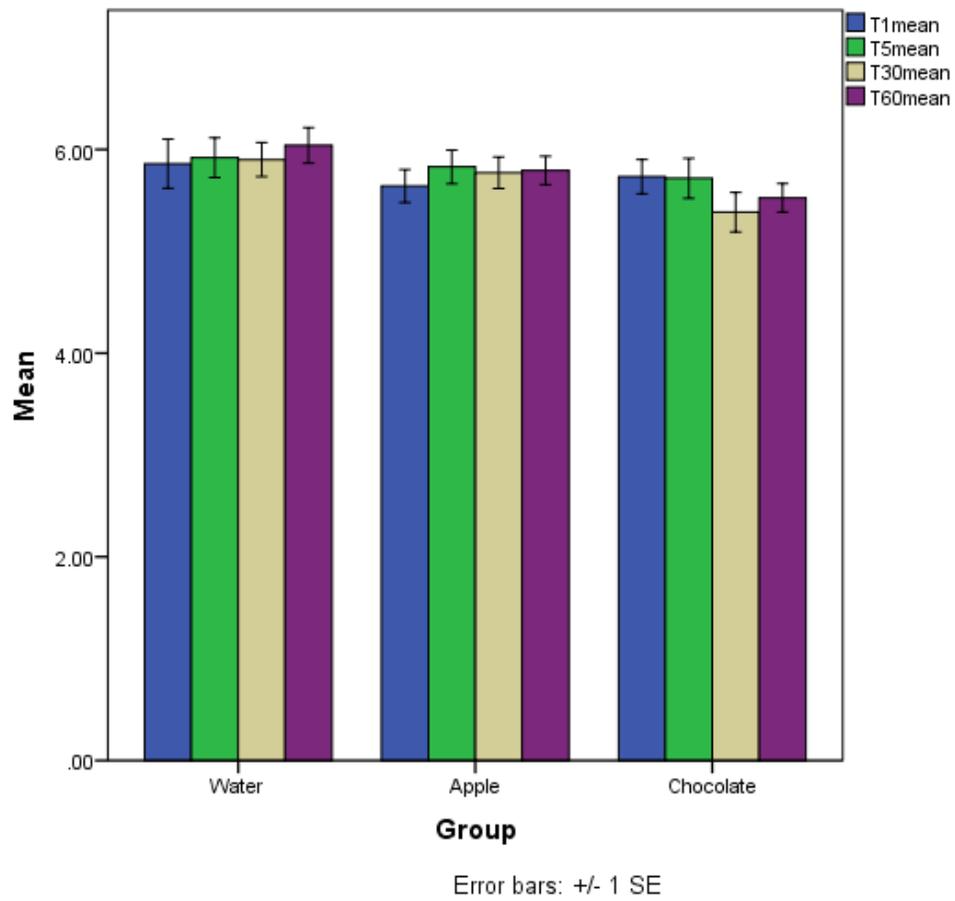
Table 2.1 Long Term Results for Time and Group Interaction

Tests of Within-Subjects Contrasts

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Linear	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 Sum of Squares	df	Mean Square	F	Sig.	Partial Eta 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
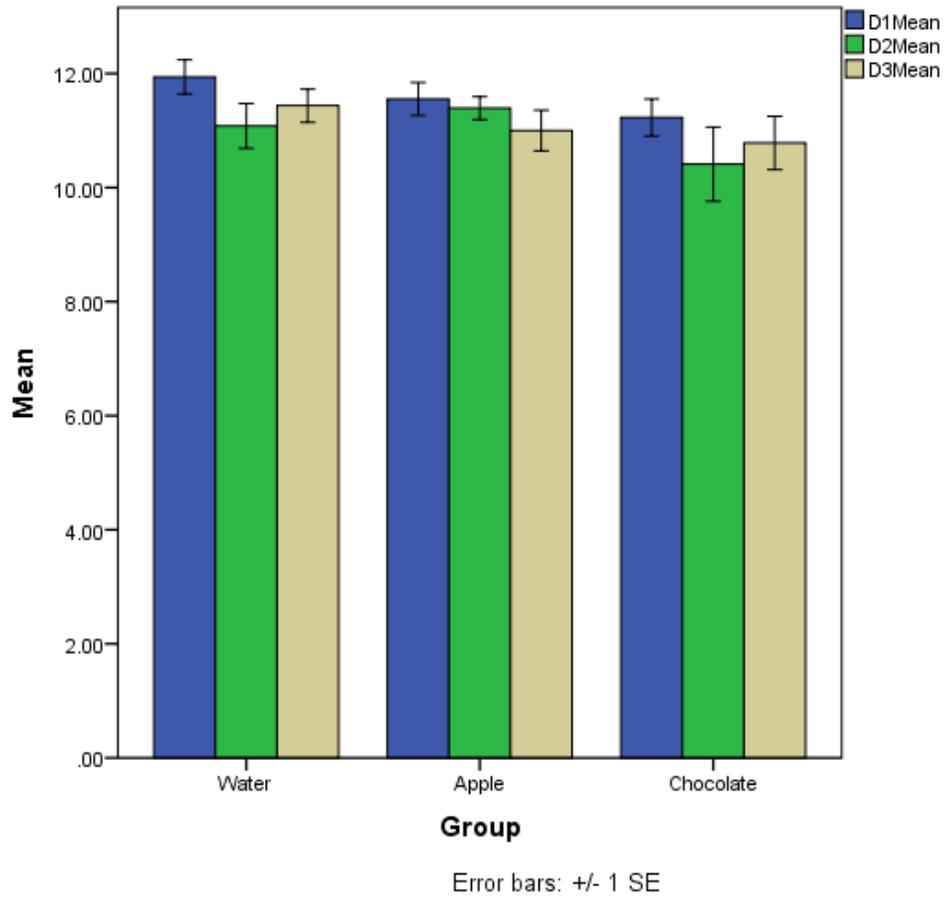
Appendix A

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
Email: ctoplar13@wou.edu
Faculty Advisor: Ethan McMahan
Phone: 503-838-8634
Email: 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 . 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-pharma logical, 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 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 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 30th, 3016*, 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

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.