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**Miara, Patricia A. *Nutrition Knowledge of Families with Children who have Attention Deficit Hyperactivity Disorder (ADHD) Compared to General Public Knowledge of ADHD and Nutrition***

**Abstract**

Attention Deficit Hyperactivity Disorder (ADHD) has become a growing concern. ADHD is multi-faceted and includes genetic, parental, social, developmental, nutritional and environmental concerns. ADHD is most commonly treated with medication and working with a psychologist or behavioral therapist. Many are concerned about medications and their side effects, so nutrition has been looked at in helping with treatment. This study examined information about nutrition and beliefs of food on symptoms. It also examined possible demographic differences in comparing knowledge of families and the general population.

Guardians who have children with ADHD in grades K-8 and general population filled out a questionnaire about knowledge and demographic information. They were found through snowball sampling and the University of Wisconsin-Stout.

There is limited knowledge on nutrition and ADHD and there is no demographic group that has more knowledge than another as analyzed through Chi-Square and frequencies.

Nutrition may help with symptoms of ADHD, but knowledge is limited, so the next step would be to find out what psychologist or behavioral therapists know on nutrition and ADHD.

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## Chapter I: Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is “characterized by persistent and excessive problems where the child is unable to focus and pay attention or conversely displays hyperactive and impulsive behavior” (Stordy & Nicholl, 2000, p. 4). ADHD has increased by 21.8% between 2003 and 2007 for children ages 4-17 years which means 5.4 million children are diagnosed with ADHD (Center for Disease Control and Prevention, 2010). When a child has ADHD some of the symptoms include inability to focus and control outbursts, not listening, not following directions, inability to sit quietly, trying dangerous activities and always “on the go” (Stevens, 2000). When these symptoms are not controlled the lasting effects may go into adulthood where they may never finish school, may have a hard time holding a job and may get into trouble (Bock & Stauth, 2007; Stordy & Nicholl; 2000, Stevens, 2000). Stordy and Nicholl (2000) pointed out that 25% of male prisoners had ADHD and many of them were never diagnosed until going to prison. With the increase in diagnosis in children it is more important than ever to find ways to help these children control their behavior, so they can become successful adults.

In determining the population for this study, data was looked at to see what age group has the most children diagnosed with ADHD and what age group with ADHD has been researched the most. According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, in order to be diagnosed with ADHD certain symptoms would have to exist prior to age 12 (American Psychiatric Association, 2013). The 2011 National Health Interview Survey breaks the percentage of children that have ADHD into age categories: 3-4 year olds (1.8%), 5-11 year olds (7.6%), and 12-17 (11.9%) (U.S. Department of Health & Human Services, 2012). According to the November 12, 2010 Morbidity and Mortality Weekly Report 5.5% children

ages 4-10, 8.6% children ages 11-14 and 9.3% children ages 15-17 have the current diagnosis of ADHD (Center of Disease Control and Prevention, 2010). Examination of the literature in the references shows that the majority of the research on ADHD is with children between four and fourteen years of age. Thus, this study focused on the guardians of children with ADHD in kindergarten through eighth grade.

This current study examined the nutrition knowledge of the guardians of children that have ADHD because children of this age are dependent on their families on what they eat and their medical care. In order to have an understanding of how much knowledge the guardians have, it is important to see how it compares to the knowledge of the general population with different careers or backgrounds.

Research that has been done on diet and ADHD includes looking at how food additives, refined sugars, food allergies, and fatty acid metabolism affect the child (Schnoll, Burshteyn, & Cea-Aravena, 2003). The Dietary Guidelines for Americans (2010) explains that the consumption of fruits, vegetables, whole grains, dairy products, and seafood are lower than recommended which is why there is a concern about children not getting enough potassium, fiber, calcium, vitamin D, iron, folate, and vitamin B12 (U.S. Department of Agriculture, 2011). When one does not get enough vitamins and minerals the body cannot protect, detoxify or restore itself which can contribute to health issues, such as ADHD (Bock & Stauth, 2007). That is why research has been looking at how nutrition intervention can help improve behavioral issues. Even though some research suggests the importance of diet in the etiology of ADHD, dietary treatment of this condition is not being used (Pelsser, Frankena, Buitelaar, & Rommelse, 2009; Patel & Curtis, 2007; Curtis & Patel, 2008; Stordy & Nicholl, 2000; Schnol et al., 2003).

## **Statement of the Problem**

Attention Deficit Hyperactivity Disorder (ADHD) has become a common problem in the youth of America today and medication is the most used method to help control symptoms. Since the 1980's there has been research looking at why ADHD has increased and one correlation that has been found is the increased consumption of fast food and processed foods and the decreased consumption of essential nutrients. This has led to research on diet and the impact it has on ADHD. Even though research has shown that a change in diet may affect the symptoms of ADHD in some children, it seems that there is a lack of nutrition education being offered to guardians of children diagnosed with ADHD (Pelsser et al., 2009; Patel & Curtis, 2007; Curtis & Patel, 2008; Stordy & Nicholl, 2000; Schnoll et al., 2003).

## **Purpose of the Study**

This study aimed to answer the following questions:

1. Do families who have children with ADHD receive information about how nutrition may impact symptoms?
2. What knowledge do families have of nutrition and ADHD symptoms?
3. Are there demographic differences between those that have knowledge of nutrition and ADHD in comparison to those that do not?
4. How does the nutrition knowledge of the guardians of children with ADHD compare to that of the general population?

## **Definition of Terms**

There are many terms in nutrition and about Attention Deficit Hyperactivity Disorder that may be confusing because they are not always used in the way they are supposed to be or they

are not totally understood. So, below is a list of terms that are found throughout the paper that are clarified for the convenience of the reader.

**ADHD.** Attention Deficit Hyperactivity Disorder: According to the American Psychological Association (n.d.) ADHD is “a behavioral condition that makes focusing on everyday requests and routines challenging.”

**ADHD symptoms.** Unable to focus or pay attention and are hyperactive or impulsive (Stordy & Nicholl, 2000).

**Alpha-linolenic acid.** An omega-3 essential fatty acid that has to come from food; it is found in vegetable oils (corn, sunflower, safflower, soybean, cottonseed), poultry fat, nuts and seeds (Pinna, Rolfes & Whitney, 2009).

**Antioxidants.** Chemicals found in food that help to prevent damage to the body by reducing oxidation reactions in the blood and cells.

**Atopic constitution.** When at least one parent and sibling have allergic complaints like asthma, eczema, hay fever or allergic rhinitis.

**DHA.** Docosahexaenoic acid: an essential omega-3, polyunsaturated fatty acid that is present in fish and may be synthesized from linolenic acid (but is limited) (Rolfes, Pinna & Whitney, 2009).

**DGLA.** Dihomo-gamma-linolenic acid: an omega-6, polyunsaturated fatty acid that is derived from linolenic acid (an essential fatty acid) (Wang, Lin & Gu, 2012).

**Double blind study.** When the person receiving treatment and the person giving the treatment do not know which treatment is being given.

**EDTA.** Ethylenediaminetetra acetic acid: a chemical used to bind calcium, iron, and sodium to help fortify or preserve food (WebMD, n.d.).

**EFA.** Essential fatty acid: fats that have to come from the diet because the body cannot make them. The two EFA's are linoleic acid & alpha-linolenic acid.

**Fatty acids.** They are the building blocks of fats; when fat breaks down in the body this are what they breakdown into (Kids Health from Nemours, n.d.). Fatty acids are comprised of carbon atoms that are connected into chains and have hydrogen atoms connected to each carbon. They can be short chain (less than six carbons), medium chain (6-10 carbons), or long chain (12-14 carbons). They can be saturated which means that the carbons are connected by a single link and hydrogen is connected at the maximum amount or they can be unsaturated which means that there is at least one link between carbons is doubled which means there is less hydrogen connected. There are two kinds of unsaturated fatty acids and that is monounsaturated or polyunsaturated. Monounsaturated is when there is one link that is doubled and polyunsaturated is when there are two or more doubled links (Pinna, Rolfes & Whitney, 2009).

**Food allergens.** Allergens are compounds that cause one to have an allergic reaction, such as rash, difficulty breathing, behavior changes, and swelling and cause an immune response

**Gastrointestinal (GI) symptoms.** Issues with the stomach or intestines such as diarrhea, constipation, vomiting, gas, and cramps.

**LCP.** Long-chain polyunsaturated fatty acids: they are a critical part of the brain and the omega-3 fatty acids are LCPs; without enough LCPs the brain cannot function properly

**Linoleic acid.** An omega-3 essential fatty acid that has to come from food; it is found in oils corn, sunflower, safflower, cottonseed, soybean), poultry fat, nuts and seeds and soybeans

**Natural foods.** Foods that have no additives like preservatives or artificial colors or flavors.

**Omega-3 fatty acids.** Also known as omega 3's: fats that are healthy and help reduce risk of heart disease and stroke; they are found in vegetable oils (canola, soybean, and flaxseed), walnuts, flaxseeds, and fatty fish (mackerel, salmon, sardines).

**Omega-6 fatty acids.** Also known as omega6's: fats that are important for linoleic acid and arachidonic acid; they are found in vegetable oils, poultry fat, nuts, seeds, meat, poultry, eggs.

**Omega-3 to Omega-6 ratio.** Recommended ratio is 1 to 4; Omega-3s are anti-inflammatory while omega-6s are pro-inflammatory, so this is the ratio (through research) that helps to balance out the two types of fatty acids (Gunnars, 2013).

**Organic foods.** Foods made from ingredients that are grown without any chemicals and meat products that come from animals that have not been fed any drugs or hormones

**Placebo.** When someone thinks they are receiving a certain treatment, but in reality they are receiving a non-functional treatment such as a sugar pill in place of the test drug, the subjects cannot tell if they have the treatment or the placebo.

**Processed foods.** For the purpose of this study this is foods that have additives such as preservatives, artificial colors or artificial flavorings.

**PubMed.** A data base of research articles that are related to the medical field

**Restrictive diet.** A diet in which certain foods are eliminated and not allowed to be eaten.

**Ritalin.** A drug that stimulates the brain to sort out all of the information that it is getting and it is used to treat symptoms of ADHD.

**Sensitivities.** When you react to a substance, such as rash, difficulty breathing, behavior changes, and swelling, but it does not cause an immune response like in allergies.

**Sugar substitute.** A food additive that is similar to sugar in use and taste, but has fewer calories per serving (Word IQ, n.d.).

**Whole foods.** Foods that have not been altered, such as fresh fruits and vegetables, plain meat, dried beans, milk in liquid form; also known as the basic foods.

## **Chapter II: Literature Review**

Attention Deficit Hyperactivity Disorder (ADHD) has become a common problem in the youth of America today and medication is the most used method to help control symptoms. Since the 1980's there has been research looking at why ADHD has increased and one correlation that has been found is the increased intake of fast food and processed foods and the decreased consumption of enough essential nutrients. This has led to ongoing research on diet and the impact it has on ADHD. Even though research has shown that a change in diet can affect the symptoms of ADHD in some children, it seems that there is a lack of nutrition education being offered to the guardians of ADHD children (Pelsser et al., 2009; Patel & Curtis, 2007; Curtis & Patel, 2008; Stordy & Nicholl, 2000; Schnoll et al., 2003).

### **Theory**

The theory model used for this research project is the Organizational Change Theory. According to the Public Health Agency (2009) the Organizational Change Theory looks at health issues and then, if proven to be a public health concern, a public policy or public program will be implemented to address the health concern. The Organizational Change Theory is broken into stages: the awareness stage, adoption stage, implementation of change, and institutionalization of change. This research project is going to look at whether or not nutrition education is being used to help guardians with children who have ADHD and to see what stage of the Organizational Change Theory nutrition education and ADHD are in. From there, improvements can be made in getting information out about nutrition and ADHD by going up the stages of the model.

### **Previous Research**

The diagnosis of ADHD has increased by 21.8% between 2003 and 2007, which means that in 2007 there were 5.4 million children (4-17 years old) diagnosed with ADHD (Center for

Disease Control and Prevention, 2010). Controlling ADHD is a complex matter because there are many factors involved, such as genetic, parental, social, developmental, nutritional, and environmental (Curtis & Patel, 2008).

ADHD has been treated mainly with medication, primarily Ritalin (American Psychological Association, n.d.). Ritalin is a stimulant that is used to increase the production of dopamine which helps to increase concentration and mood (McGoldrick, 2011; National Institute of Drug Abuse, 2009). In 2007 there were 2.7 million children between the ages of four and seventeen using medication (Center for Disease Control & Prevention, 2010). Bock and Stauth (2007) pointed out that American children consume 90% of the world's Ritalin supply. Ritalin is easy to use, improves behavior and school performance and is inexpensive which is why it is used (American Psychological Association, n.d.). Although Ritalin is effective in reducing symptoms for most ADHD children it has some serious problems for some children. Not only do these kids become dependent upon the medication, but it has caused acute liver failure in some individuals, which is why the United Kingdom banned its use in 1997 (Stordy & Nicholl, 2000). Ritalin does not work in 20-30% of children (Bock & Stauth, 2007; Stevens, 2000) and the side effects include headache, stomach ache, trouble sleeping, nausea, decreased appetite, nervousness, slowing of growth, seizures (mainly in patients with a history of seizures), eyesight changes or blurred vision, heart-related problems, and psychotic symptoms (hearing voices, believing things that are not true, are suspicious) or manic symptoms (U.S. Food and Drug Administration, n.d.).

In the 1970's Doctor Benjamin Feingold claimed that foods and food additives may increase ADHD and found that 30-50% of his patients had improvement in ADHD symptoms when artificial food coloring and flavoring were removed from the diet (Stordy & Nicholl,

2000). Feingold was a pediatrician, which led him to getting involved with allergies and then eventually to doing research with nutrition and behavior (Feingold, 1975). He started the San Francisco Kaiser Permanente Diet (K-P Diet) which eliminated natural salicylates and synthetic (artificial) colors or flavors from food and drugs (Feingold, 1975). When Feingold reviewed his research on the children that received the K-P Diet he concluded that about 75% will have a reduction in symptoms to the point that they no longer need medication (Feingold, 1975). Since then, research on diet and the impact it has on ADHD has focused on omega-3 fatty acids, vitamins, minerals, food allergens or sensitivities, food chemicals, sugar, and eating a healthy diet.

### **Omega-3 Fatty Acids**

Omega-3 fatty acids are most concentrated in the brain and retina and have important roles in brain and nerve function (Stevens, 2000). Stevens (2000) pointed out how researchers have been studying monkeys, rats and mice that were fed a diet very low in omega-3 fatty acids and found that the animals showed excessive thirst, frequent urination, visual disturbances, decreased learning abilities and abnormal behavior. Research that studied children with ADHD found that dietary omega-3 may help reduce ADHD symptoms in children, but concluded more research is needed (Stevens et al., 1995).

Lower amounts of DHA, DGLA, arachidonic acid and total serum phospholipid-EFA were found in children with ADHD in comparison to the control group in a study by Mitchell, Aman, Turbott and Manku (1987). Colter, Cutler and Meckling (2008) found that children with ADHD had lower DHA and omega 3 fatty acids in their blood and the ratio of omega 3's to omega 6's was also lower, but the level of LA, omega 6 and total saturated fatty acid levels were higher when compared to the control group. But, Colter, Cutler and Meckling (2008) did not

find that this was related to diet and concluded that it has to do with metabolic differences in the way that fatty acids are handled.

Germano et al. (2007) researched the effect of long chain omega-3 supplementation in children with ADHD and found that long chain omega-3's may be useful to reduce high values of AA / EPA ration and improve symptoms of ADHD. Gustafsson et al. (2010) also did research on long chain omega-3's and found that supplementation did not completely help ADHD symptoms, but should be used in conjunction with medication. Voigt et al. (2001) found that those with ADHD did have low levels of DHA in their blood and after four months of supplements of either a DHA supplement or a placebo the children taking the supplement did have increased levels of DHA in the blood, but there was no difference in ADHD symptoms. Raz, Carasso and Yehuda (2009) did not find improvements in ADHD symptoms when the child is taking an essential fatty acid supplement for seven weeks compared to a control group. Johnson, Ostlund, Fransson, Kadesjo and Gillberg (2009) did a study with an omega-3 and omega-6 fatty acid supplement and found that 9/34 (26%) children taking the supplement and 2/30 (7%) taking the placebo had a decrease in ADHD symptoms, but the researchers did not find this to be significant.

When it comes to omega-3 fatty acid supplementation some researchers found it helps and some found that it does not. The conclusion of most of the researchers concluded that there needs to be more research looking at various levels of supplementation along with different types of fatty acids used in the supplement. Fatty acids, especially the omega-3's from fish are essential for brain function, so it is important to get plenty of them. So, making sure the child is getting enough is an important factor in their development supplementation.

## **Vitamin B6 (Pyridoxine)**

Vitamin B6 is important in amino acid and fatty acid metabolism, especially with converting tryptophan to niacin and then to serotonin (Rolfes, Pinna and Whitney, 2009). Serotonin is a neurotransmitter that helps control appetite, sleep and sensory perception (Rolfes, Pinna, & Whitney, 2009). When there is a deficiency of vitamin B6, the key neurotransmitters diminish, which causes an accumulation of the compounds produced during tryptophan metabolism in the brain (Rolfes, Pinna, & Whitney, 2009). Symptoms of deficiency include depression, confusion, abnormal brain wave patterns and convulsions (Rolfes, Pinna, & Whitney, 2009). The recommended amount of vitamin B6 for children is 1-1.3 milligrams a day, depending on age and gender (U.S. Department of Agriculture, 2010). Vitamin B6 is found in meat, fish, poultry, potatoes, starchy vegetables, legumes, non-citrus fruits, fortified cereals, liver and soy products.

Coleman et al. (1979) realized the importance of serotonin in brain activity, so they researched serotonin levels along with looking at the most effective way of increasing serotonin levels. Coleman et al. (1979) investigated six children who had low levels of serotonin and then compared how well pyridoxine (vitamin B6), methylphenidate (ADHD medication) and placebos increased serotonin and how behavior of the children changed. Pyridoxine was investigated because of the role it plays in the production of serotonin, so low levels of pyridoxine means low levels of serotonin. Pyridoxine was given in the form of pyridoxine hydrochloride. The study lasted for 21 weeks with four different experimental conditions and three placebo periods which lasted for three weeks each. Serotonin levels were the highest and behavior was the best during the trial of the pyridoxine and during the placebo period following the pyridoxine administration. Methylphenidate had no impact on serotonin levels.

Brenner (1982) researched how different vitamins affected hyperactive children. He gave pyridoxine in 100mg doses three times a day to 100 children with ADHD. He found that no significant benefit of pyridoxine on behavior where 18% of the children improved, 16% got worse and 66% had no change in behavior.

Vitamin B6 is an important part of neurotransmitters and brain activity, so it is important to make sure the child is getting enough vitamin B6 for overall health. For children with ADHD, there is not much research on vitamin B6 and what there is shows that supplementation may help to improve symptoms in some children, but not many. So, just like children without ADHD, the child with ADHD needs to make sure that they are getting enough through foods.

### **Iron**

Iron is important in hemoglobin and myoglobin which accept, carry and release oxygen along with being an important part of enzymes (Rolfes, Pinna, & Whitney, 2009). In iron deficiency, behavior is affected with decreased work productivity and activity due to low energy metabolism and altered neurotransmitter synthesis (Rolfes, Pinna and Whitney, 2009). The recommended amount of iron for children is 8-15 milligrams per day, which is dependent upon age and gender (U.S. Department of Agriculture, 2010). Iron is found in red meats, fish, poultry, shellfish, eggs, legumes and dried fruits (Rolfes, Pinna, & Whitney, 2009).

Ritalin, the most common medication to treat ADHD, is a stimulant that increases the production of Dopamine which helps to increase concentration and mood (McGoldrick, 2011; National Institute of Drug Abuse, 2009). Since iron plays a role in neurotransmitter function, researchers studied the iron levels of children with ADHD and examined how iron supplementation affected ADHD symptoms.

Lahat et al. (2011) researched iron blood levels of children with ADHD to see if there is a correlation between iron levels and ADHD. They concluded that children with ADHD tend to have low iron levels, but also found that there was no significant difference in ADHD symptoms based on iron levels. Lahat et al. (2011) suggested that iron levels should be checked as a part of ADHD evaluations and that those with low iron levels receive the treatment needed to improve the level.

Konofal, Lecendreux, Arnulf and Mouren (2004) researched iron levels of children with ADHD and compared them to children without ADHD. Children with ADHD had lower levels of iron and that the children with the most severe deficiencies had the worst symptoms of ADHD (Konofal, Lecendreux, Arnulf and Moren, 2004). They concluded that blood iron levels should be tested in children with ADHD and that supplementation should be a part of treatment of ADHD if blood levels indicated a deficiency of iron.

Sever, Ashkenzi, Tyano and Weizman (1997) researched whether or not iron supplementation would improve symptoms of ADHD after 30 days of treatment. There was a significant increase in iron blood levels and in parent ratings of symptoms, but the teacher ratings on symptoms did not change (Sever, Ashkenzi, Tyano & Weizman, 1997). Since there was no placebo group and the teacher scores on the ADHD symptoms did not change, the researchers believe it is best to do more research before concluding that iron deficiency plays a role in ADHD (Sever, Ashkenzi, Tyano & Weizman, 1997).

Iron deficiency is a common factor with many children with ADHD and the results show mixed conclusions on whether or not correcting the deficiency will improve symptoms of ADHD. But, not correcting the iron deficiency can have serious implications on the children because of the importance of iron is in the blood and moving oxygen throughout the body and

helping with the synthesis of neurotransmitters. One thing most of the researchers believe is that testing iron levels should be a part of diagnosing ADHD and that correcting the deficiency if there is one is critical to the child's health, whether through diet or supplementation.

### **Magnesium**

Magnesium is important for bone health, energy metabolism, immune function and enzyme actions (Rolfes, Pinna, & Whitney, 2009). When one is deficient in magnesium, the central nervous system may be affected which may cause hallucinations and confusion (Rolfes, Pinna, & Whitney, 2009). The recommended amount of magnesium for children is 240-410 milligrams per day, depending on age and gender (U.S. Department of Agriculture, 2010). Magnesium is found in nuts, legumes, whole grains, dark green vegetables, seafood, chocolate and cocoa (Rolfes, Pinna, & Whitney, 2009).

ADHD is considered a brain disorder that affects the central nervous system (National Institute of Mental Health, 2012). Magnesium is an important part of the functions of the central nervous system which is why magnesium is being researched to determine if children with ADHD have a deficiency or whether or not supplementation can improve ADHD symptoms (Mousain-Bosc, Roche, Rapin, & Bali, 2004).

Mousain-Bosc, Roche, Rapin and Bali (2004) found that children with ADHD have low levels of magnesium in the intra- red blood cells. After supplementation of magnesium-vitamin B6, the levels of intracellular magnesium returned to normal and their abnormal behavior improved (Mousain-Bosc, Roche, Rapin, & Bali, 2004).

In another study, Mousain-Bosc et al. (2006) found that children with ADHD had lower levels of magnesium in in the intra-red blood cells in comparison to the control group. The children with ADHD then received a supplement of magnesium and vitamin B6 for at least two

months. Magnesium supplementation increased magnesium levels and improved symptoms of ADHD, but after stopping the magnesium-vitamin B6 supplement the levels of magnesium decreased and the symptoms returned in about two months (Mousain-Bosc et al., 2006).

Starobrat-Hermelin and Kozielec (1997) looked at how magnesium supplementation impacts ADHD by comparing children with ADHD and low blood magnesium who either received a supplement of magnesium with general treatment or received just general treatment and no magnesium. The results show that children who received the magnesium supplement for six months had had a lower drop in magnesium in their blood compared to the children who did not receive the supplement whose magnesium level dropped further (Starobrat-Hermelin & Kozielec, 1997). Those that had a rise in their blood magnesium levels also had improved symptoms of hyperactivity (Starobrat-Hermelin & Kozielec, 1997).

Some of the research done on magnesium and ADHD has had positive results in that magnesium supplementation seems to help not only to increase levels of magnesium in the blood plasma and intra-red blood cells, but also help to improve symptoms of ADHD. So, looking at magnesium levels of children diagnosed with ADHD is an important part of the assessment and making sure that the child is getting enough, whether from food or supplementation, is an important part of the child's health.

## **Zinc**

Zinc is an important part of many enzymes, making genetic material and proteins, immune reactions, transport of vitamin A, taste perception and wound healing (Rolfes, Pinna, & Whitney, 2009). Chronic deficiency of zinc may cause damage to the central nervous system and brain which may lead to poor motor development and cognitive performance (Rolfes, Pinna, & Whitney, 2009). The recommended amount of zinc for children is 8-11 milligrams per day,

depending on age and gender (U.S. Department of Agriculture, 2010). Zinc is found in red meats, shellfish, whole grains and some fortified cereals (Rolfes, Pinna, & Whitney, 2009).

Brain imaging of children with ADHD has found that the brain develops normally, but is delayed by about three years (National Institute of Mental Health, 2012). Many children with ADHD tend to be academically and socially behind their peers (Mousain-Bosc, Roche, Rapin, & Bali, 2004; Bilici et al., 2004). Since zinc is critical for brain development, especially the enzymes and a deficiency of zinc may cause motor development and cognitive performance delays, researchers started to study how zinc may be involved in ADHD.

Bekaroglu et al. (1996) looked at blood samples of free fatty acids and zinc of children with ADHD and compared those levels to children that did not have ADHD to see if there is a relationship between zinc and free fatty acids. The results showed that the children with ADHD had much lower levels of free fatty acids and zinc compared to the children without ADHD (Bekaroglu et al., 1996). Bekaroglu et al. (1996) concluded that zinc and free fatty acid levels are related, but they are not sure of the relationship, which is why more research needs to be done. Bekaroglu et al. (1996) believe that zinc supplementation may help with symptoms, but that this needs to be verified by research to see if zinc supplementation helps. Toren et al. (1996) researched zinc deficiency in children with ADHD compared to children without ADHD. The children with ADHD had significantly lower levels of zinc in their blood compared to the non-ADHD children. Toren et al (1996) believe that a change in diet to increase consumption of zinc or the use of zinc supplementation may be beneficial, but they believe it is important to do more research on find out the cause of the zinc deficiency.

Akhondzadeh, Mohammadi and Khademi (2004) researched whether or not supplementation of zinc sulfate would improve symptoms of ADHD. There were two groups

involved in which the one group received the supplement and the other group did not during a six week study (Akhondzadeh, Mohammadi, & Khademi, 2004). The children that received the zinc sulfate supplement had improved symptoms of ADHD when compared to the group that received the placebo (Akhondzadeh, Mohammadi, & Khademi, 2004). Akhondzadeh, Mohammadi and Khademi (2004) believe that zinc supplementation should be a part of the treatment, but they believe more research needs to be done to find the correct dose.

Bilici et al. (2004) studied the effects of zinc sulfate supplementation on ADHD symptoms by having two groups in which one received the supplement and the other group received a placebo for a twelve week study. The children who received the zinc sulfate supplement had improved symptoms of ADHD when compared to the group that received the placebo. Not all of the symptoms of ADHD improved or completely, which is why zinc supplementation should be used in conjunction with other treatments (Bilici et al., 2004).

Zinc is a critical mineral in brain function and children, whether or not they have ADHD, so it is important to make sure that they are getting enough. As for ADHD alone, the research shows that children supplemented with zinc sulfate did have improved symptoms of ADHD, but all of the researchers found that more research needs to be done to find the correct dose and whether or not there were other factors involved in the improvements. With the findings of how it does help for some to a point, but not completely, many of the researchers agree that zinc supplementation or changes in diet to increase zinc levels should be a part of “typical” treatments.

### **Food Allergens or Sensitivities**

The National Institute of Allergy & Infections Disease (2012) states that 1 in 20 children under five and 1 in 25 adults have at least one food allergy and that these numbers are increasing.

Food allergies occur when a person eats a food and then the body's immune system reacts by producing an antibody to proteins in that food (National Institute of Allergy & Infectious Disease, 2012). The antibodies that are produced attach to mast cells and basophils in the nose, throat, skin, lungs and/or gastrointestinal tract where they become inflamed (National, 2012). Once this attachment is made, every time the food is eaten histamine is produced and that is what causes the symptoms of food allergies to occur (National, 2012). Symptoms affect the skin, nose, mouth, throat, chest, heart, gastrointestinal tract and nervous system with itching, rashes, inability to breath, vomiting, diarrhea, abdominal pain and low blood pressure (National, 2012). The most common food allergies in children are eggs, milk, peanuts, tree nuts and wheat and most children will outgrow these allergies, except for peanut (National, 2012). Food sensitivities do not cause an immune response, but does cause symptoms such as flushing, sensations of warmth, headaches and chest discomfort (National, 2012). The most common food sensitivities are lactose, food additives such as MSGs and sulfites and gluten (National, 2012).

One of the most common forms of figuring out food allergies is through an elimination diet. The most common elimination diet is the oligoantigenic diet which was developed in England to treat children who were suffering from symptoms and diseases of food allergies, but the doctors could not figure out which food (Miller, 2013). The diet eliminates all food except: lamb, chicken, potatoes, rice, banana, apple, any brassica vegetable and water (Egger, Carter, Graham, Gumley & Soothill, 1985). Bock and Stauth (2007) also gave a list of foods that do not cause any type of allergy reaction and this would include rice, pears, lamb, kale, salmon, halibut, sole, trout, turkey, olives, olive oil, cabbage, tapioca, carrots, beets, cauliflower, squash, cranberries, apricots, broccoli, rabbit, and sweet potatoes.

Egger, Carter, Graham, Gumley and Soothill (1985) put 76 overactive children on an oligoantigenic diet (few foods diet) which consisted of lamb, chicken, potatoes, rice, banana, apple, any brassica vegetables, water, calcium and multivitamin and then reintroduced foods back into the diet to see how they reacted. The results show that 62 (82%) of the children improved in behavior and 21 (34%) of these achieved normal behavior scores (Egger et al., 1985). Egger et al. (1985) pointed out that the subjects were extremely overactive and that many of them had other psychosocial issues at home or in school and that more research needs to be done with a more generalized population of children that are hyperactive.

Pelsser, Frankena, Buitelaar and Rommelse (2010) did a study with 27 children in putting them on a limited food diet which included rice, turkey, lamb, vegetables, pears and water. The children were split into two groups, the elimination diet group or the control group (Pelsser et al., 2010). The elimination diet group had an average of 44 complaints and the control group at an average of 36 complaints at the beginning of the study and by the end of the study the complaints decreased by 77% with the diet group and by 17% with the control group (Pelsser et al., 2010). Pelsser et al. (2010) concluded that some foods may increase symptoms of ADHD, but more research is needed to see if there is a difference between children with ADHD and those without ADHD.

Carter et al. (1995) looked at 78 children with hyperactivity and looked at how the few foods diet would impact the behaviors of the children. The study was split into three phases: the few food diet, open reintroduction and then the double blind experimental phase (Carter et al., 1995). The few foods diet included lamb, turkey, rice, potato, banana, pear, root and green vegetables, bottled water, sunflower oil and milk free margarine (Carter et al., 1995). All 78 children completed the few foods diet in which 59 (76%) had improvement in behavior, two

(3%) became worse and 17 (22%) did not respond. The 59 children that did improve continued onto the second phase with the reintroduction of foods in which three (5%) remained well and did relapse, nine (15%) found it too demanding and dropped out of the study and the remaining 47 (80%) children did react to certain foods (Carter et al., 1995). The top three foods that the children reacted to are as follows: 70% (22 out of 32) reacted to additives, 64% (28 out of 37) reacted to chocolate and 64% (26 out of 45) reacted to cow's milk (Carter et al., 1995). There were 23 children that moved onto the third phase in which they were on a placebo diet or an incriminated foods diet for a week with a two week washout period, but only 19 children completed this (Carter et al., 1995). It was found that in the third phase the children had significantly improved behavior with the placebo diet if the placebo was given first and this could be due to the parents not realizing the severity of their child's usual symptoms prior to the an acceptable diet being identified (Carter et al., 1995). Carter et al. (1995) concluded that diet may impact symptoms of ADHD, but more research needs to be done to understand it better.

Some children with ADHD have allergies or sensitivities to food and when these foods are eliminated they have improvements in symptoms (references). The way to find out what foods affect the child is with the few foods diet and a gradual reintroduction of other foods to see which ones the child reacts to. This is expensive, time consuming and does cause social issues, which makes it difficult to do (Egger et al., 1985; Pelsser, et al, 2010; Carter et al., 1995). Feingold suggested finding which foods affect the child by keeping a journal of what the child eats and how they behave afterwards to see if there is a pattern to any foods (Feingold, 1975).

### **Food Chemicals**

Manufacturers use 14,000 laboratory-made additives in food to make it last longer, be more attractive and seem fresher (Sherpa, 2010). Some of these additives are safe and have no

side effects, but as they are used longer and in larger quantities, the impacts that they have on health is becoming known (Sherpa, 2010). The top 15 chemical additives used are: 1-methylcyclopropene, artificial colors, artificial flavoring, aspartame, astaxanthin, benzoic acid / sodium benzoate, BHA and BHT, canthaxanthin, emulsifiers, high fructose corn syrup, MSG, olestra, partially-hydrogenated oils, potassium bromate, and sodium nitrite and nitrate (Sherpa, 2010). With the side effects of many of these chemicals, some experts suggest purchasing food with up to five or six ingredients, with ingredients that you can pronounce and with natural additives (Sherpa, 2010).

Doctor Benjamin Feingold specialized in allergies and when he was working at the Kaiser-Permanente Medical Center in San Francisco, California in 1965, he had a woman come in with acute hives and all allergy tests came back negative (Feingold, 1975). So, he concluded that it was artificial food colors and flavors and he put her on an elimination diet of these (Feingold, 1975). About ten days later, this woman's psychiatrist called and wanted to know what he did to her because she was no longer aggressive, hostile and abusive (Feingold, 1975). Over time, this led to more research and he started the San Francisco Kaiser Permanente Diet (K-P Diet) which eliminated natural salicylates and synthetic (artificial) colors or flavors from food and drugs (Feingold, 1975). For those that Feingold put on the diet he saw about 50% completely recover in symptoms and get off of medication and a 75% partial recovery from symptoms, but off of medications (Feingold, 1975). Since, this time many researchers have looked at food chemicals and the impact that they have on children with ADHD.

Food chemicals such as benzoate, nitrates, monosodium glutamate (MSG), salicylates, sulfites, sorbic acid, dyes, parabens, benzoic acid, ethylenediaminetetra acetic acid (EDTA), aspartame, propyl gallate, alginate, bromates, yeast, butylated hydroxyanisole (BHA), butylated

hydroxytoluene (BHT), tert-butylhydroquinone (TBHQ), and artificial food colorings are have been found to possibly increase ADHD symptoms (Bock & Stauth, 2007; Buitellar, et al., 2010; Curtis & Patel, 2008).

Salicylates are found in almonds, apples, apricots, tomatoes, cucumbers, berries, cherries, currants, grapes / raisins, nectarines, oranges, peaches, and plums / prunes and may increase symptoms of ADHD in some children (Feingold, 1975).

Crook (1980) is a doctor who specializes in allergies and he started to investigate food chemicals as a reason for the children suffering from hyperactivity and emotional, behavioral and learning problems. He had the families eliminate food that they thought was causing the problem and then slowly introduce the child back to the food while keeping a record of what the child ate and the behavior or symptoms that would follow if any. Crook (1980) found that out of 136 children, 48 (35%) had increased hyperactivity when colors (especially red), additives and flavors was added back into the diet.

Rapp (1978) looked at how diet can affect hyperactivity by doing dye tests of red, green, yellow and blue McCormick's food coloring on 24 children. The dye control was colored to grape juice with grape juice being the placebo. Each child had 0.1mL of the dye put under the tongue for one minute prior to swallowing and the observation and recording of behavior was done after ten minutes. If hyperactivity occurred, the test was repeated at another time. The results showed that nine (38%) had a moderate increase in hyperactivity, five (21%) had a slight increase in hyperactivity and ten (42%) had no change in hyperactivity for the dyes. For the grape juice it was found that one (4%) had moderate changes, two (8%) had slight changes, and 20 (83%) had no changes in hyperactivity.

O'Shea and Porter (1981) looked at the red, yellow and blue dyes to see how the children's behavior changed. The children acted as their own controls in this study in that phenolated saline was used as the placebo. The study lasted for seven weeks in which it was split between two-three week periods with a week off between the two periods. The child during the week was given the allergy extract or the placebo. The tests were done sublingually and in different dilutions with 15 children. The results showed that 13 (87%) reacted to the red dye, 12 (80%) reacted to the yellow dye and 12 (80%) reacted to the blue dye. Reactions included hyperactivity, restlessness, crying, hostility, facial grimaces, lethargy, aggressiveness, defiance, boisterousness, irrationality and physical abusiveness.

Kaplan, McNicol, Conte, and Moghandam (1989) did an elimination diet of food dyes, food flavors, preservatives, MSG, chocolate and caffeine for 24 children and their family to see how the children's behavior changed. There were three parts to this study: the first part was the baseline diet and then the second and third parts were randomly assigned with the elimination diet and an equivalent diet of the child's typical diet. All milk and dairy products were eliminated in 15 of the children and four of the children had naturally occurring salicylates eliminated because the parents thought that these caused problems. The results showed that ten (42%) had a 50% improvement in their behavior, four (16%) had a 12% improvement in behavior and ten (42%) were unresponsive to the elimination diet. Since there were only 24 children in this study, it was not practical to run statistical significance, so the researchers believe the study needs to be done on a larger scale.

Carter, Urbanowicz, Mantilla, Graham and Taylor (1995) looked at how food colors and cola affect behavior of children with ADHD. There were 16 participants in a food color test in which three (18.75%) did not react, two (12.5%) had behavioral and physical symptoms, eight

(50%) had behavioral symptoms and three (18.75%) had physical symptoms. The researchers had 19 families that tried cola and 16 (84%) families reported problems with the cola.

Egger, Carter, Graham, Gumley, and Soothill (1985) did a study of the oligoantigenic diet and did introductions of foods and the reactions in 76 children. The study used the children as their own controls by having them on the oligoantigenic diet for four weeks. Those that had responded were placed in the second phase which was the reintroduction of different foods in which a different food was introduced one per week, but was given daily. The children that an acceptable diet was identified were placed in the placebo controlled trial. In this trial there were 34 children that were tested for colorants and preservatives and the results showed that 27 (79%) reacted to the colorants and preservatives.

Harley, Matthews, and Eichman (1978) did a study of synthetic food colors in nine children by having them follow an elimination diet and then for 21 days the children were given food items that contained the average daily intake of artificial colors. The researchers compared the hyperactive children to peers of theirs that are not hyperactive and found that there was no significance difference in behavior with the baseline diet, elimination diet and the challenge diet.

Bateman, et al. (2004) researched how food colorings and sodium benzoate affects behavior of children. The subjects that participated in the double-blind placebo controlled food challenge were 277 three year old children. The children were split into four groups that consisted of hyperactive and atopy (36), hyperactive and non-atopy (75), non-hyperactive and atopy (79) and non-hyperactive and non-atopy (87). The trial lasted for four week and consisted of weeks one and three of a diet with no artificial coloring and no sodium benzoate and weeks two and four consisted of 300mL of fruit juice with 20mg of food coloring and 45mg of sodium benzoate for the treatment group or just the juice for the placebo group. There was a slight

increase in behavioral problems as observed by parents, but not by clinic assessment when the children consumed food coloring and sodium benzoate.

Food chemicals are being used more than ever and much of the research has shown that some children with ADHD do become more hyperactive with the consumption of artificial food chemicals. With the many side effects that food chemicals may cause and the uncertainty of consuming them long term, it is best to avoid or limit the use of them. Going back to a diet of simple ingredients and good old fashioned cooking, is a good idea for the overall health of not only the child, but all family members.

### **Sugar and Sugar Substitutes**

Added sugar is sugar that is added to any food product and is not naturally in it. In the United States about 16% of children and adolescents (2-19 years of age) total kilocalories is from added sugar (Ervin, Kit, Carroll & Ogden, 2012; USDA, 2011). The recommendations for added sugar in preschoolers should not be more than 43 grams a day, for children ages 4-8 it should not be more than 33 grams per day and for children 8 years and above they should not have no more than 25-38 grams per day (Family Education Staff, n.d.). Sugar has been blamed for causing children to be hyperactive as parents witness children eating something sugary and then becoming hyper, which is why an association has been made between sugar and ADHD (Warner, 2004).

Milich and Pelham (1986) tested sucrose and aspartame by giving nine boys either one or the other for breakfast and then evaluating the boys for three and a half hour in which there were two - one hour recreation time and one - one hour classroom time with two 15 minute breaks. Each boy got the sucrose for two days and the aspartame for two days. The results found that there is no difference in behavior between sucrose and aspartame.

Wolraich, Milich, Stumbo and Schultz (1985) tested sucrose and aspartame in two studies in which each was for three days on 16 hyperactive boys, which were split into a control and a placebo group. Both studies included a sucrose-free diet, day one a baseline for behavior for both and day two and three a drink with sucrose for the control group and a drink with aspartame for the placebo group. The difference was in the first study the drink was given one hour after lunch and in the second study the drink was given in the morning after an overnight fast. The results showed that sucrose does not affect behavior.

Ferguson, Stoddart and Simeon (1986) did two studies to look at how sucrose and aspartame affects children. The first study was with eight children and the second study was with 18 children. In both studies all children got sucrose and aspartame, but on different days with at least 48 hours between. The results found that there is no relation between sucrose and behavior.

Behar, Rapoport, Adams, Berg and Cornblath (1984) did a study with 21 boys who were tested with glucose, saccharin (placebo) and sucrose with 48 hours in-between testing. The results found that after three hours there was a significant decrease in motor activity, but observer's behavior ratings and attention and memory measures showed no consistent or significant change following sugar challenges.

Prinz, Roberts and Hantman (1980) researched how diet affects behavior by comparing 28 children that are hyperactive with 26 children that are not along with a seven day dietary record and a one day observation in a playroom. The results found that the hyperactive children consumed significantly less total of food per gram than the control, but otherwise dietary scores were similar. When looking at correlations between the dietary factors and observed behaviors, there was a significant correlation between sugar products and hyperactive children. Even

though this relationship was found, the researchers talked about how this is a correlation and that it doesn't mean that there is not another factor involved.

Even though sugar consumption is higher than recommended and has been blamed for children becoming hyperactive, the research shows that sugar does not affect children's behavior. Added sugar may have other health effects on children and many times food consumed with sugar are also added with added fats and have little nutrition. So, it is important to not let children eat too much added sugar foods and eat more healthy foods.

### **Healthy Diet**

Specific foods or components are hard to completely eliminate and doing research is hard to do because double blind studies and creating a placebo is impossible and the restrictive diets are hard on the guardians and make going out to eat difficult (Buitellar, et al., 2010). Getting guardians to agree to restrictive diets is why many studies are for short trial periods and with small sample sizes (Buitelarr, et al., 2010; Burshteyn, et al., 2003; Curtil & Patel, 2007). Even the impact specific foods have on ADHD symptoms is not clear, there are some ways to help maintain health and possible help with ADHD. One way is to consume whole fruits and vegetables and limit juice because juice loses some of the nutrients when processed (Stevens, 2000). Stevens (2000) points out that eating a proper diet and getting plenty of nutrients by following the Food Guide Pyramid may help with reducing symptoms. Just as a note, the Food Guide Pyramid no longer exists and it has been replace by MyPlate, so MyPlate should be followed instead (My Plate, n.d.). Another important part of being healthy is making sure to get all of the essential vitamins and minerals by eating a balanced diet or by supplementing with a multi-vitamin and mineral supplement (Stevens, 2000). Nutrition and ADHD may be confusing, but eating healthy does have an impact on one's health.

### **Chapter III: Methodology**

Attention Deficit Hyperactivity Disorder (ADHD) has become a common problem in the youth of America today and medication is the most used method to help control symptoms. Since the 1980's there has been research looking at why ADHD has increased and one correlation that has been found is the increased consumption of fast food and processed foods and the decreased consumption of essential nutrients. This has led to research on diet and the impact it has on ADHD. Even though research has shown that a change in diet can affect the symptoms of ADHD it seems that there is a lack of nutrition education being offered (Buitelaar, Frankena, Pelsser, & Rommelse, 2009; Curtil & Patel, 2007; Curtis & Patel, 2008; Nicholl & Stordy, 2000; Schnol et al., 2003).

#### **Research Design**

The research design for this study is using a questionnaire methodology, in which both survey used for the study are in Appendix A. The objective of this study is to determine if families of children with ADHD have any knowledge about how nutrition may affect symptoms and if families have received nutrition information or have seen a dietitian about diet and ADHD Demographic differences between families that have knowledge in comparison to those that do not will also be examined. Finally, the knowledge of the guardians who have children with ADHD will be compared to the general population's knowledge along with the different careers that those from the general population are in.

#### **Population and Sample**

The subjects will be guardians of children, who are in Kindergarten through eighth grade, and have been diagnosed with ADHD. The sample is coming from a Snowball Sampling Method, in which I will send the survey out to those I know and they pass it on. The sample also

will come from a random sample of 50% of Graduate Students and Customized Instruction Students from UW-Stout for the questionnaire for those who have children with ADHD. For the questionnaire for the general population along with the one for those with children who have ADHD it will be sent out through Snowball Sampling and to all students in the Dietetics and Education programs and all faculty in the School of Education program at UW-Stout.

### **Instrumentation**

The questionnaire for those who have children with ADHD in grades Kindergarten through eight will consist of questions based on finding out if nutrition education opportunities have been available to them and to see what knowledge that they do have on nutrition affecting ADHD symptoms. Demographic information will also be collected to find out if there is a demographic difference between having knowledge and not having knowledge.

Demographic questions will include:

1. Age, education level, income level, household size, how many in household have ADHD, and the relationship to the child will be asked of the person filling out the survey.
2. How long has the child been diagnosed with ADHD and if there are any other medical conditions of the child that has ADHD.

Questions that will be asked to find out if guardians have received information about ADHD and nutrition include:

3. Have you ever received pamphlets about ADHD and nutrition?
4. Have you ever worked with a dietitian on ADHD and nutrition?
5. Have you ever heard or read about ADHD and nutrition?
6. Are there foods that you will not purchase or allow your child to eat because of the ADHD and if so please list.

7. Are there foods you will purchase or allow your child to eat because of the ADHD and if so please list.

To find out what knowledge guardians have:

8. There will be a list of different foods and whoever is filling out the survey will have to mark if they believe it will increase symptoms, decrease symptoms, have no impact or do not know.

The questionnaire for general public knowledge of ADHD and nutrition will consist of questions based on seeing if they have seen pamphlets, heard about or read about how nutrition affects ADHD symptoms. Demographic information will also be collected to find out if there is a demographic difference between having knowledge and not having knowledge.

Demographic questions will include:

1. Age, income level, education level, major or field of work, number in household, number of children in grades K-8, if they know any children with ADHD and how they know the child with ADHD and if that child has any other medical condition, including allergies.

Questions that will be asked to find out if they have seen or heard of information about ADHD and nutrition include:

2. Have you ever seen pamphlets about ADHD and nutrition?
3. Have you ever heard or read about ADHD and nutrition?

To find out what knowledge guardians have:

4. There will be a list of different foods and whoever is filling out the survey will have to mark if they believe it will increase symptoms, decrease symptoms, have no impact or do not know.

**Data Collection Procedures**

The questionnaires will be developed through UW-Stout's Qualtrics. To get the questionnaires out the links for them will be put into an email that is sent out to people I know and then they will send it out to people they know. The sample from UW-Stout came from Survey Clearinghouse, in which I received their email and I emailed the message with the links to them. If anyone chooses to do the questionnaire, they just have to go to the link fill out the survey and Qualtrics will store the results anonymously, since no personal information such as names or contact information will not be gathered.

**Data Analysis**

The information from the collection will be used to assess whether or not guardians of children with ADHD are receiving nutrition education and what knowledge guardians have of nutrition and ADHD. Other data that will be looked at is seeing if there is a difference between demographic information and nutrition knowledge. Analysis of how the guardian's knowledge will be compared to the general population and the demographic information from that group. The statistics used included descriptive statistics and chi square.

## **Chapter IV: Results**

Research has shown that a change in diet can affect the symptoms of ADHD, but it seems that there is a lack of nutrition education being offered (Buitelaar, Frankena, Pelsser, & Rommelse, 2009; Curtis & Patel, 2007; Curtis & Patel, 2008; Nicholl & Stordy, 2000; Schnol et al., 2003). To see whether or not nutrition education is a part of ADHD treatment two surveys were created to find out what knowledge guardians of children with ADHD and the general public has on nutrition and ADHD.

### **The Sample (or Subjects)**

The subjects for the survey in finding out what knowledge guardians of children with ADHD has was guardians of children in grades Kindergarten through eighth grade and had ADHD. Some of the subjects came through snowball sampling and some came from the University of Wisconsin-Stout through a random sample of 50% of the Customized Instruction students and 50% of graduate students. There were 22 surveys completed in which 15 (68.2%) were completed by a parent, 2 (9.1%) completed by another relative and five (22.7%) did not answer this question.

The subjects for the survey for the general public were recruited through snowball sampling, but many were from the University of Wisconsin-Stout. Stout recruiting occurred with all students in the Dietetics and Education Programs and the faculty in the School of Education. There were a total of 70 subjects that filled out this survey, in which 63.8% are undergraduates. To see breakdown of the majors see Table 1.

Table 1

*Majors of General Public*

	Education	Dietetics	Other*
Number of people	29	30	8
% of people	42.6	44.1	13.2

\* Other includes Management, Science and Technology and Arts, Humanities, and Social Sciences

The demographic data of the families with children with ADHD and the general public are listed in Tables 2 and 3. Table 2 looks at age and income level and Table 3 looks at education level and household size. Two major differences are that 27.3% of the families are less than 30 years of age while 76.8% of the general public is less than 30 years old and that 18.2% of the families had income less than \$25,000 compared to the 76.8% of the general public that had income less than \$25,000. There were not much of a difference in education level and number of people per household. Also, to note the number of people for household for the general public may not be accurate because the question did not state their family household, so some of the respondents may have given the number in their current household status which may be an apartment with many students.

Table 2

*Demographic Data of Families and General Public: Age and Income Level*

	Families		General Public	
	Frequency	%	Frequency	%
Age (years)	n=22		n=69	
<20	0	0	14	20.3
20-30	6	27.3	39	56.5
31-40	11	50.0	5	7.2
41-50	3	13.6	7	10.1
50+	2	9.1	4	5.8
Income Level (\$)	n=22		n=69	
<25,000	4	18.2	50	72.5
25,000-50,000	6	27.3	6	8.7
50,000-75,000	7	31.8	8	11.6
75,000-100,000	1	4.5	3	4.3
100,000+	4	18.2	2	2.9

Table 3

*Demographic Data of Families and General Public: Education Level and Household Size*

Education Level	Families		General Public	
	Frequency	%	Frequency	%
	n=22		n=69	
Undergraduate Student	*	*	44	63.8
Graduate Student	*	*	3	4.3
High School Diploma	1	4.5	3	4.3
Technical Degree	6	27.3	5	7.2
Bachelor's Degree	6	27.3	7	10.1
Post Bachelor's Degree	9	40.9	7	10.1
	n=22		n=69	
Household Size				
1 person / household	*	*	16	23.2
2 people / household	3	13.6	14	20.3
3 people / household	5	22.7	8	11.6
4 people / household	5	22.7	18	26.1
5 people / household	5	22.7	6	8.7
6 people / household	4	18.2	3	4.3
7 people / household	0	0	4	5.8

\* This means that the question was not asked.

### Variable 1: Nutrition Education and ADHD

On the survey for the families there were three questions related to finding out whether or not they have received nutrition information in relation to ADHD. These questions asked about receiving pamphlets, working with a dietitian or hearing or reading about nutrition and ADHD. The results are that 90.5% have not received a pamphlet, 100% have never worked with a dietitian and 59.1% have not heard or read about ADHD and Nutrition.

The survey for the general population had two questions that had to do with receiving pamphlets or hearing or reading about ADHD and nutrition. The results are that 63.2% have never received a pamphlet and 51.5% have read or heard about ADHD and nutrition.

Table 4 shows how frequencies on how the families and general population compares in receiving information on ADHD and nutrition. To get an understating of what this means a chi-square analysis was done comparing the families with the general population. The general population was split into three groups to get a better idea of how different majors compare to the families. The three groups are Education, Dietetics and other (Management, Science and Technology and Arts, Humanities, and Social Sciences).

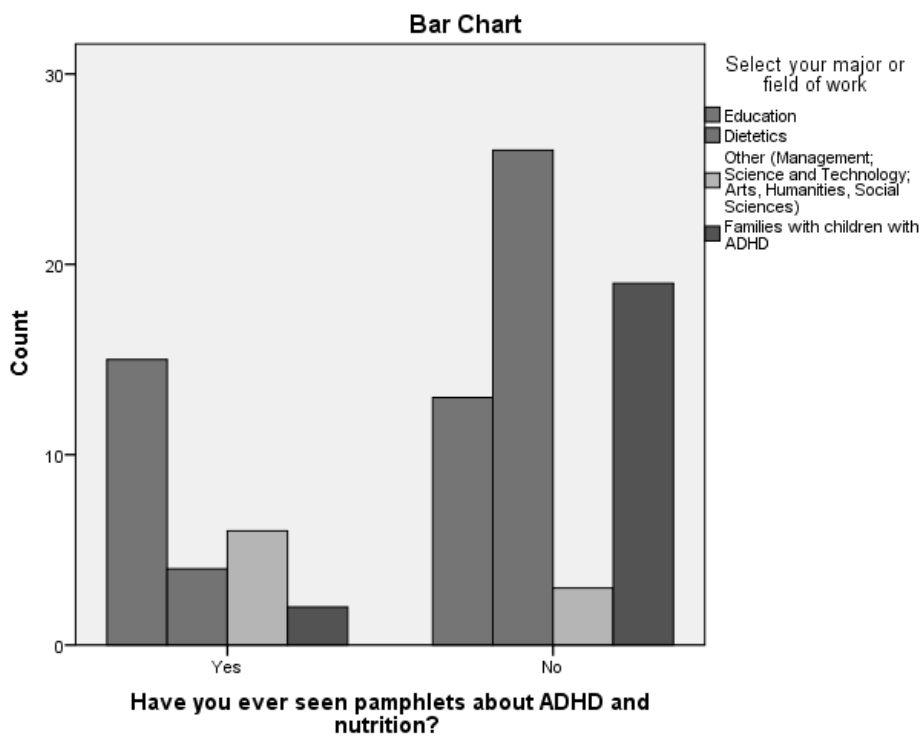
Table 4

*How Families and General Public Compare in Receiving Information on Nutrition and ADHD*

	Families		Public	
	Yes n(%)	No n(%)	Yes n(%)	No n(%)
Pamphlets	2(9.5)	19(90.5)	25(36.8)	43(63.2)
Hear or read	9(40.9)	13(59.1)	35(51.5)	33(48.5)
Dietitian	0(0)	21(100)	*	*

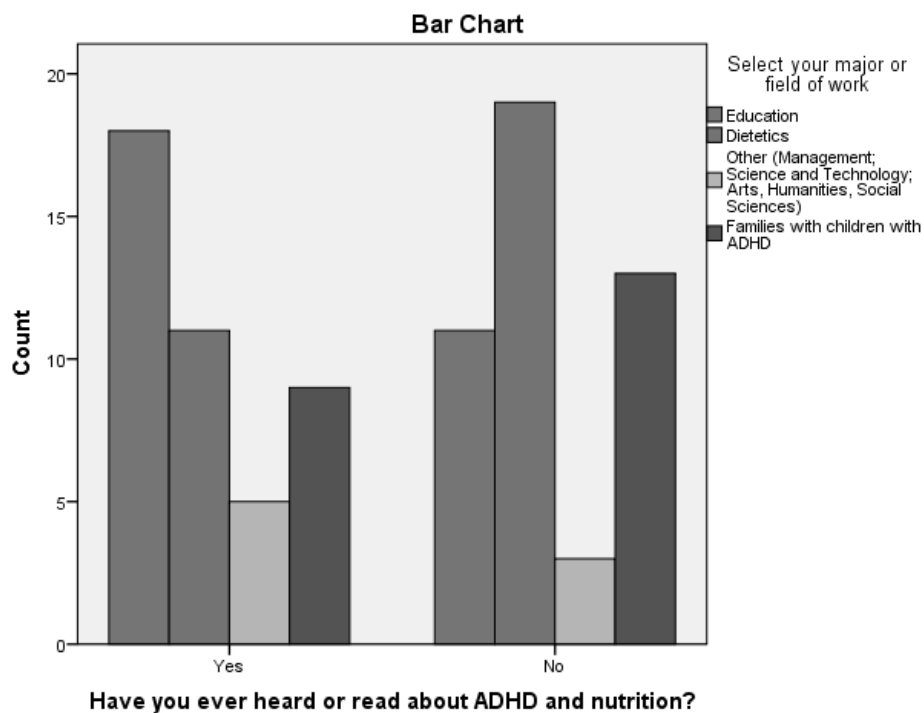
\* This means the question was not asked.

Figure 1 looks at the relationship with receiving pamphlets and the results show that there is a significant difference between receiving or not receiving pamphlets on ADHD and nutrition  $\chi^2(3, N=88) = 21.05, p < .001$ . Figure 1 also shows that those in the Education and Other group had more that reported yes they have received pamphlets while the Dietetics group and Families had more that stated no.



*Figure 1.* Have you ever seen pamphlets about ADHD and nutrition? This compares the differences between families with children with ADHD and the general public (education, dietetics and other) on whether or not they have seen pamphlets about ADHD and nutrition.

Figure 2 looks at how these groups differ with reading or hearing about ADHD and nutrition. The results found that there was no significant difference between hearing and reading about nutrition and ADHD and not hearing or reading about nutrition and ADHD  $\chi^2(3, N=89) = 4.96, p 0.18$ . Education and other majors had more that said yes than no, while dietetics and the families had more that said no than yes.



*Figure 2.* Have you ever heard or read about ADHD and nutrition? This compares the differences between families with children with ADHD and the general public (education, dietetics and other) on whether or not they have heard or read about ADHD and nutrition.

The families were asked if they ever worked with a dietitian and all families that answered this question (21 respondents) answered no. Using Chi-Square analysis to see if there were any significant differences between demographic data (age, income and education level) and receiving pamphlets and hearing or reading about nutrition and ADHD, the results found there was no significance difference.

When looking at Table 7 the numbers that are bolded are the ones that were the highest. Table 5 shows that for the most part people are not receiving pamphlets about nutrition and ADHD, except for the income level between \$25,000-\$50,000 where 58% have received pamphlets and those with a high school diploma were equal.

Table 5

*Comparison of Receiving Pamphlets on Nutrition and ADHD When Families and General Population are Combined\**

Demographic Data	Yes	%	No	%
< 20 years	3	21	<b>11</b>	<b>79</b>
21-30 years	15	35	<b>28</b>	<b>65</b>
31-40 years	4	25	<b>12</b>	<b>75</b>
41-50 years	3	30	<b>7</b>	<b>70</b>
51+ years	2	33	<b>4</b>	<b>67</b>
<\$25,000	14	27	<b>38</b>	<b>73</b>
\$25,000-\$50,000	<b>7</b>	<b>58</b>	5	42
\$50,000-\$75,000	3	20	<b>12</b>	<b>80</b>
\$75,000-\$100,000	1	25	<b>3</b>	<b>75</b>
\$100,000+	2	33	<b>4</b>	<b>67</b>
Undergraduate Student	13	30	<b>30</b>	<b>70</b>
Graduate Student	1	33	<b>2</b>	<b>67</b>
High School Diploma	2	50	2	50
Technical Degree	0	0	<b>10</b>	<b>100</b>
Bachelor's Degree	4	31	<b>9</b>	<b>69</b>
Post Bachelor's Degree	7	44	<b>9</b>	<b>56</b>

\* The bolded numbers are the one that had the highest prevalence for each demographic data.

When looking at Table 6 which looks at hearing or reading about nutrition the only thing that is interesting to point out is that the income level \$25,000-\$50,000 have heard or read about

nutrition and ADHD (83%) while those with income of \$100,000+ have not heard or read about nutrition and ADHD (83%).

Table 6

*Comparison of Hearing or Reading About Nutrition and ADHD When Families and General Population are Combined\**

Demographic Data	Yes	%	No	%
< 20 years	5	36	<b>9</b>	<b>65</b>
21-30 years	<b>25</b>	<b>56</b>	20	44
31-40 years	7	47	<b>8</b>	<b>53</b>
41-50 years	<b>6</b>	<b>60</b>	4	40
51+ years	1	17	<b>5</b>	<b>83</b>
<\$25,000	24	45	<b>29</b>	<b>55</b>
\$25,000-\$50,000	<b>10</b>	<b>83</b>	2	17
\$50,000-\$75,000	6	40	<b>9</b>	<b>60</b>
\$75,000-\$100,000	<b>3</b>	<b>75</b>	1	25
\$100,000+	1	17	<b>5</b>	<b>83</b>
Undergraduate Student	19	43	<b>25</b>	<b>57</b>
Graduate Student	<b>2</b>	<b>67</b>	1	33
High School Diploma	<b>3</b>	<b>75</b>	1	25
Technical Degree	4	<b>36</b>	<b>7</b>	<b>64</b>
Bachelor's Degree	<b>8</b>	<b>67</b>	4	33
Post Bachelor's Degree	8	50	8	50

\* The bolded numbers are the one that had the highest prevalence for each demographic data.

## **Variable 2: Beliefs about Foods and Their Effects on ADHD**

To analyze the 30 item food list, the foods were categorized into one of three groups based on what the general consensus is through research on how they impact ADHD symptoms (increase, decrease or no impact). Some foods may increase symptoms if one has an allergy or intolerance to that food so the foods were also placed into one of two categories (allergens or

non-allergens). The foods listed in the allergen group are some of the more common foods that may cause an increase in symptoms. See Table 7 for the categories and food items.

Table 7

*List of Categories and the Food Items in Them That Were Used to Analyze the Data*

Increase Symptoms	Decrease Symptoms	No Impact	Allergen Foods	Non-Allergen Foods
Caffeine American Cheese Ham Hot Dogs Chocolate Skittles MSG	Fish Sunflower Seeds Olive Oil Vitamin / Mineral Supplements Flaxseed Oil Almonds	Green Leafy Vegetables Beef Whole Grains Fruit Juice Coconut Beans Carrots Sugar Sugar Substitutes Milk Natural Cheese Shellfish Soy Milk Eggs Apples Tomatoes Citrus Fruits	Milk Natural Cheese Shellfish Soy Milk Eggs Almonds Apples Tomatoes Citrus Fruits Whole Grains Fish	Caffeine American Cheese Ham Hot Dogs Chocolate Skittles MSG Sunflower Seeds Olive Oil Vitamin / Mineral Supplement Flaxseed Oil Green Leafy Vegetables Beef Fruit Juice Coconut Sugar Sugar Substitutes

Table A in Appendix B shows the difference in beliefs with the 30 food item list and what their beliefs are with the food affecting ADHD symptoms. An interesting discovery is that the families are more willing to mark “do not know” in comparison to the general public. The “do not know” option was marked by 50% or more of the families for 21 of the 30 (70%) food items, while none of the food items had 50% or more for the “do not know” option. This made it difficult to assess if there was anything that was significant between the families and the general population.

### **Variable 3: Foods That May Increase ADHD Symptoms**

Research has shown that the foods that are listed in Table 9 under increase symptoms may increase symptoms more so than other foods. Skittle or American cheese may because of the artificial colors or flavors in them. MSG, hot dogs, ham and caffeine may because some may be sensitive to food chemicals. Chocolate is on this list because it has shown that it may increase symptoms but the reasoning on why is unknown. After running a Chi-Square analysis on the foods that may increase ADHD symptoms as listed in Table 9, caffeine with major or field of work  $\chi^2 (9, N=85) = 21.92, p=0.009$  and MSG with education level  $\chi^2 (15, N=84) = 30.65, p=0.010$  were the only ones that had significant difference.

Tables B-H in Appendix B are on the foods listed under increase symptoms from Table 9 and the breakdown of the demographic data (major or field of study, age, income and highest degree) and what the participants marked for that food (increase symptoms, decrease symptoms, no impact or do not know).

Caffeine is listed in Table B in Appendix B and the majority said increase symptoms with three exceptions. Those that make \$50,000-\$75,000 a year had five votes for increase, five votes for decrease and five votes for do not know, graduate students also had one vote for each of those same categories and those with a post bachelor's degree had five votes for increase, five for decrease and 4 for do not know.

Table C in Appendix B lists the demographic differences for American cheese and when the no impact and do not know groups are combined there is a small minority that have a belief that it will increase or decrease symptoms. One of the reasons for this may because American cheese is a dairy and those that are sensitive to dairy products may see an increase and American cheese is not all natural so there may be added artificial flavors or colors that may increase

symptoms. So, that is why there may be some that think will increase symptoms, but the majority of people think it has no impact or they do not know.

Table D in Appendix B lists the demographic differences for ham. This one was similar to American cheese in that most were choosing no impact or do not know. Ham is high in sulfates or nitrates which may increase ADHD symptoms, so that is why some would think it may increase symptoms, but most do not realize this or just do not know.

Table E in Appendix B lists the demographic differences for hot dogs. Hot dogs are similar to ham in that it may be high in sulfates or nitrates, but a lot more subjects were more willing to say they believe it may increase symptoms, but it was pretty close between those that said increase or no impact and do not know (when combined).

Table F in Appendix B lists the demographic differences for chocolate. For all but five of the demographic data, the majority at 50% or more stated they believe that chocolate will increase symptoms. For those who are 50+ years of age the majority said do not know (50%), those that make \$25,000-\$50,000 47% said increase, 7% said no impact and 47% do not know, those that make \$50,000-\$75,000 50% said do not know, those with a technical degree had 33% with increase, 22% with decrease, 11% no impact and 33% with do not know and those with a post bachelor's degree had 43% for increase, 14% for decrease and 43% for do not know.

Table G in Appendix B lists the demographic differences for skittles and for all demographic groups the majority said increase.

Table H in Appendix B lists the demographic differences for MSG and for all but six the majority at 50% or more believes that MSG will increase symptoms. The following had the majority at do not know: families (50%), \$25,000-\$50,000 (50%), \$75,000-\$100,000 (50%),

graduate students (67%) and those with a technical degree (56%). Those between the ages of 31-40 had 46% for increase, 8% for no impact and 46% for do not know.

#### **Variable 4: Foods That May Decrease ADHD Symptoms**

Research has shown that the foods listed in Table 9 under decrease symptoms may help with decreasing symptoms. Fish, sunflower seeds, olive oil, flaxseed oil and almonds may be helpful because of the omega 3s that are found in them. Vitamin and mineral supplements may be beneficial because of deficiencies of certain vitamin and minerals that are common in children with ADHD such as vitamin B6, iron, magnesium and zinc. A Chi-Square analysis revealed that significantly more individuals endorsed almonds as potentially decreasing symptoms compared to other food options compared to overall major or field of work  $\chi^2 (6, N=84) = 12.94, p=0.044$ .

Table I in Appendix B shows the demographic data for fish and most of the demographics were somewhat split between decrease, no impact and do not know. Those that make \$25,000-\$50,000 had a majority that said they believe fish may decrease symptoms (56%) and 50% of those with a high school diploma said fish may decrease symptoms.

Table J in Appendix B shows the demographic data for sunflower seeds most of the demographics have do not know as the majority of the votes, otherwise it is spread out between decrease and no impact.

Table K in Appendix B shows the demographic data for olive oil in which most of the demographics have do not know as the highest percent and then the rest is spread throughout the decrease or no impact and a couple of people put increase.

Table L in Appendix B shows the demographic data for mineral and vitamin supplements in which the majority of the votes were for decrease for ten of the demographic data (50%) or do not know for seven of the demographic data (35%) and the other three of the demographics

(15%) were spread evenly between decrease, no impact or do not know and a couple of people believe mineral and vitamin supplements may increase symptoms.

Table M in Appendix B shows the demographic data for flaxseed oil in which most do not know and the rest spread between decrease and no impact. A couple of people did believe that it may increase symptoms.

Table N in Appendix B shows the demographic data for almonds in which most do not know, while decrease of symptoms had many votes along with no impact and increase symptoms was not picked at all.

#### **Variable 5: Foods That May Have No Impact on ADHD Symptoms**

The rest of the food items in the survey (17 foods) have not been proven to have an impact on ADHD symptoms and these foods are listed in Table 9 under no impact. After running a Chi-Square analysis four foods were found to be significant when compared to education level and these are: leafy green vegetables  $\chi^2$  (15, N=85)=28.48, p=0.019, carrots  $\chi^2$  (15, N=85)=37.30, p=0.001, apples  $\chi^2$  (15, N=83)=31.06, p=0.009 and tomatoes  $\chi^2$  (15, N=83)=26.60, p=0.032. Two foods were significant when compared to major or field of study and these were: beef  $\chi^2$  (9, N=82) =18.53, p=0.030 and carrots  $\chi^2$  (9, N=94) =37.30, p=0.022.

All of the demographic data for these items are found in Tables O-EE in Appendix B. Here are the main results of this information:

- Table O has the information for green leafy vegetables and eleven (55%) of the demographics believe that green leafy vegetables may decrease symptoms.
- Table P has the information for beef and the beliefs on how this will impact ADHD is spread throughout with the exception of education majors or field of study in which

- 74% stated they do not know, those that make \$50,000-\$75,000 or have a technical degree, do not know was marked by 60% for both.
- Table Q has the information for whole grains and this was also spread evenly throughout with the exception of those who make \$75,000-\$100,000 in which 75% marked do not know and those that make \$50,000-\$75,000 or have a technical degree, 60% marked do not know for both.
  - Table R has the information for fruit juice and 16 (80%) of the demographics looked at had a rate of 50% or more for increase symptoms. Families, those that make \$25,000-\$50,000 and those with a technical degree had rates of 50% or more for do not know.
  - Table S has the information for coconut and 14 (70%) of the demographics had rates of 50% or more for do not know. The rest of the data was spread between decrease or no impact. Very few people marked increase symptoms.
  - Table T has the information for beans in which this was spread between decrease, no impact and do not know. Very few marked increase symptoms. The highest rates for do not know was those that make \$25,000-\$50,000 (64%) and those with a technical degree (67%).
  - Table U has the information for carrots in which the data was spread between decrease, no impact and do not know, with the exception of those who make \$25,000-\$50,000 and those with a technical degree where do not know was much higher with rates of 57% and 67% respectively.
  - Table V has the information for sugar in which every demographic data that was looked at had rates of 50% or more for increase symptoms.

- Table W has the information for sugar substitute in which 60% of the demographics had increase with the highest rates of 50% or more and 40% had rates of 50% or more marked do not know.
- Table X has the information for milk in which there was nothing that stuck out, the data was pretty even in which if no impact and do not know was combined that is where the majority marked.
- Table Y has the information for natural cheese in which 57% those that make \$50,000-\$75,000 and 70% with a technical degree marked do not know. Otherwise the rest are spread out.
- Table Z has the information for shellfish in which 75% of the demographics had rates of 50% or more marked do not know. For those with a high school diploma, 50% had marked no impact. Other than these, the rest was spread out.
- Table AA has the information for soy milk in which 50% of those with a high school diploma marked no impact and 12 (60%) of the demographics has marked do not know at rates of 50% or more.
- Table BB has the information for eggs in which 50% of those with a high school diploma marked decrease symptoms and 12(60%) of the demographics had marked do not know at rates of 50% or more.
- Table CC has the information for apples in which the data was spread out between decrease, no impact and do not know and very few marked increase. The rates that were at 50% or more for decrease was for those in dietetics, <20 years old and are undergraduate students. For no impact those that had 50% or more were found in those that make \$100,000+, are graduate students and have a high school diploma.

Other majors, the families of children with ADHD, those ages 31-40 years, those in the categories of income at \$25,000 and above and those with a technical degree or bachelor's degree had rates of 50% or more for do not know.

- Table DD has the information for tomatoes in which the majority for all demographics was no impact and do not know when combined. Very few marked increase and an average amount marked decrease.
- Table EE has the information for citrus fruits in which most were spread out between all categories with the exception of those with a technical degree a high majority (78%) marked do not know. As income increased the rates in the do not know column decreased. Those that are between 31-40 years of age had the highest rates of do not know (57%).

#### **Variable 6: A Note about Allergies**

When looking at Table 9 under the allergen column there are eleven foods listed. Fish or shellfish, milk or dairy products, eggs and some types of whole grains (mainly wheat) are some of the most common allergies. Almonds are also a common allergy, but they are also high in salicylates along with apples, tomatoes and citrus fruits. Some people may have allergies or intolerances to salicylates, but there has not been much research done on this to say whether or not it is true, so that is why these foods are places on the allergen foods.

These foods are listed in tables I (fish), N (almonds), Q (whole grains), X (milk), Y (natural cheese), Z (shellfish), AA (soy milk), BB (eggs), CC (apples), DD (tomatoes) and EE (citrus fruits). When looking at these tables in most of the demographics 10-50% rates were seen in the increase symptoms column for milk, natural cheese, shellfish, soy milk, eggs, citrus fruits

and grains. Very few participants marked increase symptoms for apples, tomatoes and fish. No one marked increase symptoms for almonds.

#### **Variable 7: Other Conditions of Child with ADHD**

There were ten out of 17 respondents (58.8%) stated that the child with ADHD has other medical conditions. Out of these there was one child with epilepsy and another child with a mood disorder and the rest were different allergies. There were two respondents that did not state what type of allergies, the rest included one child to fruit (apples, cherries and peaches) and box elder, another child to a couple of medications, the child with epilepsy is allergic to tree nuts, one child to bee stings, one child to amoxicillin and another child get hay fever.

There were six respondents out of 33 (18.2%) that stated the child with ADHD has other medical conditions. This includes one child has schizophrenia and the other five were allergy related. One child is allergic to medications in the penicillin family, azithromycin and latex, another child to dairy and gluten, one child to red dye, one child to dairy and peanuts and one child to amoxicillin and erythromycin.

#### **Variable 8: Foods Purchased or Not Purchased**

There were 15 respondents to the question that asked what foods that limit or do not purchase because they believe that it may increase ADHD symptoms, five (33%) of them state high sugary foods like candy, soda, and chocolate, one (6.7%) stated caffeine and one (6.7%) limits red dyes, while 1 (6.7%) notices red dyes causes the child to get hyper, but does not limit intake. There were seven respondents (46.7%) that stated no.

There were 14 respondents to the questions that asked what foods that they purchase because they believe it may decrease ADHD symptoms and two (14.3%) stated protein products, 2 (14.3%) stated fruits and vegetables and one (7.1%) stated they purchase high calorie healthy

food because the medication suppresses the child's appetite. There were nine respondents (64.3%) that stated no.

## Chapter V: Discussion and Summary

The purpose of this study was to answer the following questions:

1. Do families who have children with ADHD receive information about how nutrition may impact symptoms?
2. What knowledge do families have of nutrition and ADHD symptoms?
3. Are there demographic differences between those that have knowledge of nutrition and ADHD in comparison to those that do not?
4. How does the nutrition knowledge of the guardians of children with ADHD compare to that of the general population?

The study found that the families have received little to no information on nutrition and ADHD and neither has the public, with the exception of those in the education field and in other majors or fields of study. Those in education and the other majors had more knowledge based on hearing or reading about it and seeing pamphlets.

The only demographic differences found is that those with middle incomes, in education and those who have a technical degree are more quick to answer do not know.

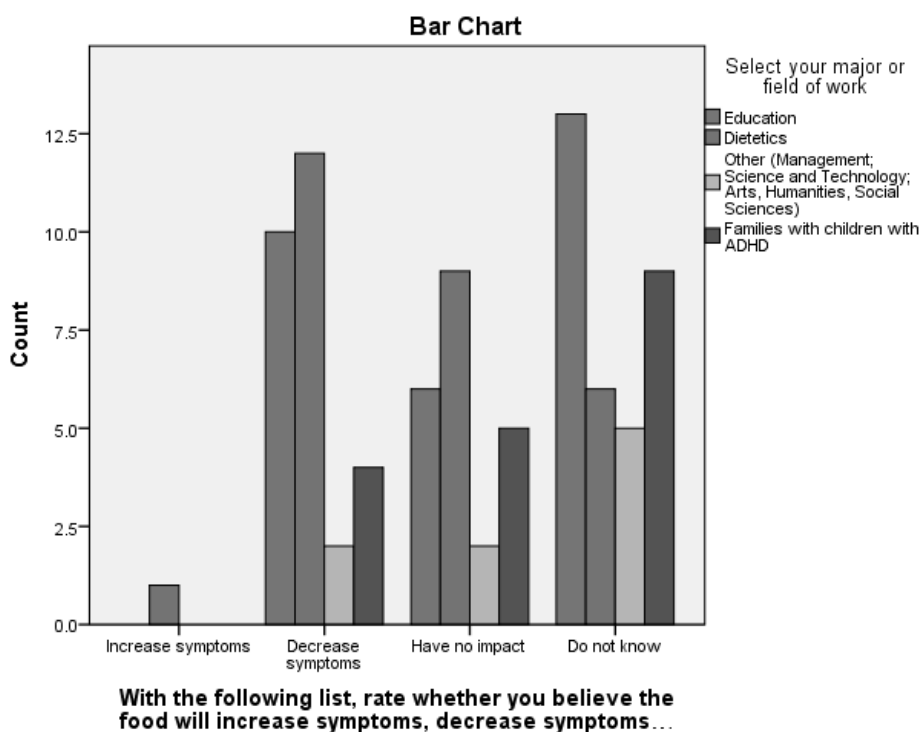
When it comes to what to the beliefs of the subjects on how certain foods will affect ADHD this is what was found: fruits and vegetables are believed to decrease symptoms, while high sugar foods increase symptoms. The allergen types of foods have mixed results on how they affect ADHD. Finally, the foods that are higher in omega 3s had some of the higher rates of do not know.

There was no clear idea on the belief of the families or the public or any demographic group having more knowledge. Therefore, there is an idea of what is healthy (fruits and

vegetables and fish) and not so healthy (sugar), but for the most part there is a lack of knowledge on the how foods fit into the diet and how they affect ADHD.

### Discussion (of the Findings)

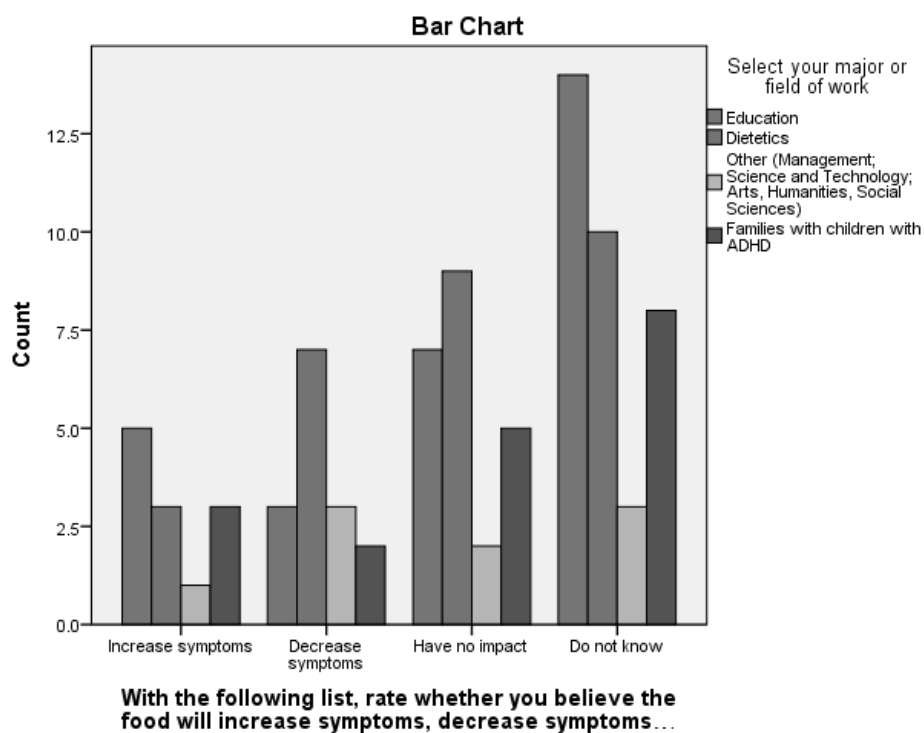
In the research there were mixed results on omega 3s and the impact it has on ADHD symptoms and this is what the results showed in the study. Fish is one of the most common forms of getting omega 3s and is highly recommended to eat 2-3 servings a week. Figure 3 shows the beliefs fish based on the different majors or fields, which shows that the mixed results.



*Figure 3.* Belief of how fish impacts ADHD symptoms based on major or field of work. This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact fish has on ADHD symptoms.

Vitamin B6 has a lack of research and how it impacts ADHD symptoms and this is found in meat products, non-citrus fruits, starchy vegetables and soy products. Since, this is in many foods, but meat products have higher amounts, beef is a good example to show the beliefs of

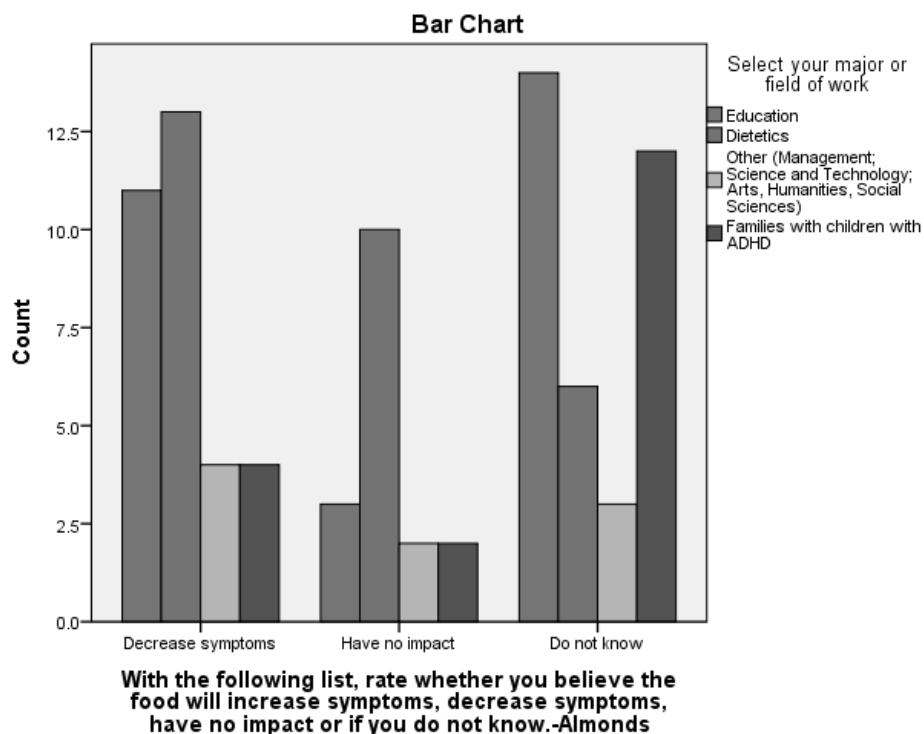
vitamin B6, which is shown in Figure 4, and it shows that most did not know or believe it has no impact.



*Figure 4.* Belief of how beef impacts ADHD symptoms based on major or field of work. This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact beef has on ADHD symptoms.

Research on iron has shown that children with ADHD tend to have low levels of iron, but there are mixed results on whether or not correcting the deficiency will improve ADHD symptoms. Iron is mainly found in meat, so looking at beef in Figure 4 can be used to assess knowledge of meat and ADHD symptoms.

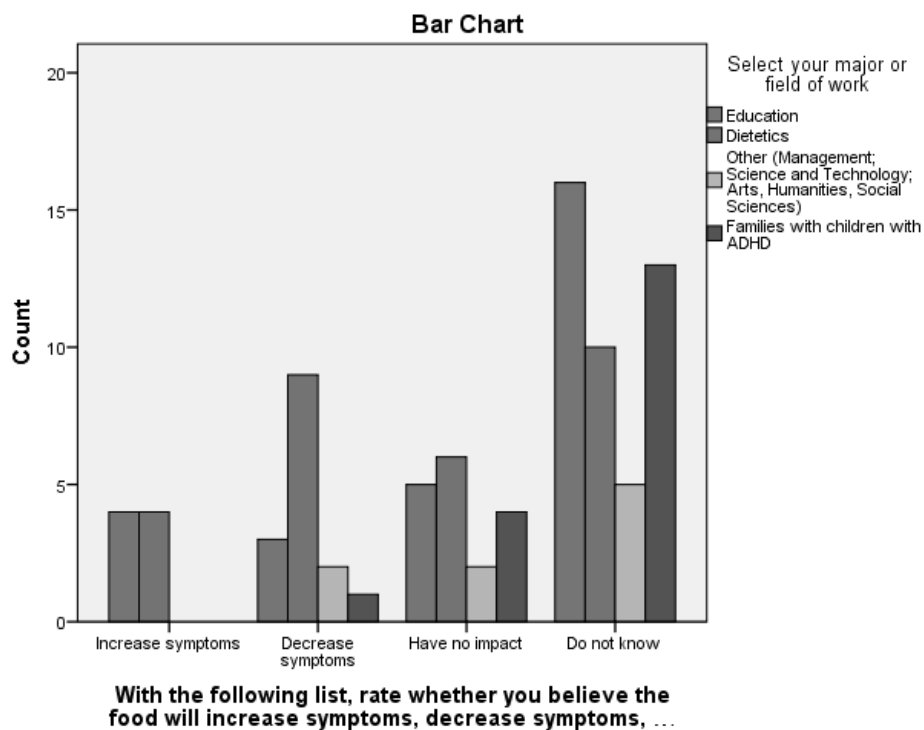
Magnesium may be beneficial, especially if the child has a magnesium deficiency. Magnesium is high in nuts, legumes, whole grains, dark green vegetables, seafood and chocolate. So, almonds is a good example of the beliefs of how magnesium may impact ADHD symptoms and Figure 5 shows the results of almonds in comparison to the different majors or field of work.



*Figure 5.* Belief of how almonds impacts ADHD symptoms based on major or field of work.

This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact almonds has on ADHD symptoms.

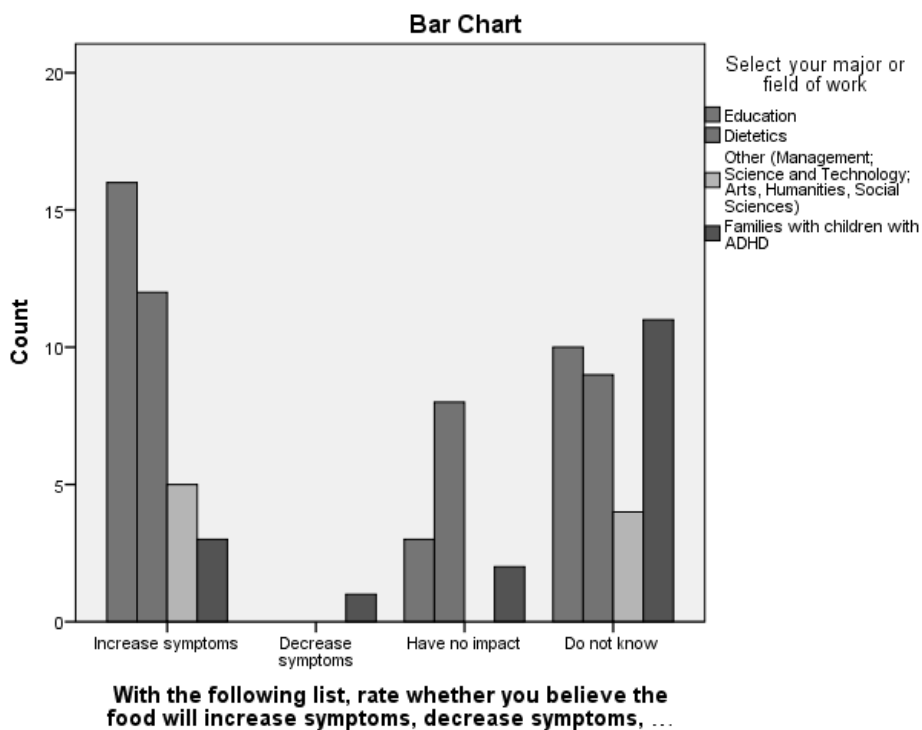
Zinc deficiency is common in children with ADHD as research has found along with when correcting the deficiency there may be a decrease in ADHD symptoms. Zinc is high in red meat, shellfish and whole grains. Figure 4 shows the belief of beef which shows mixed results and Figure 6 shows the beliefs of how shellfish affects ADHD symptoms, in which the majority do not know the impact on shellfish.



*Figure 6.* Belief of how shellfish impacts ADHD symptoms based on major or field of work.

This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact shellfish has on ADHD symptoms.

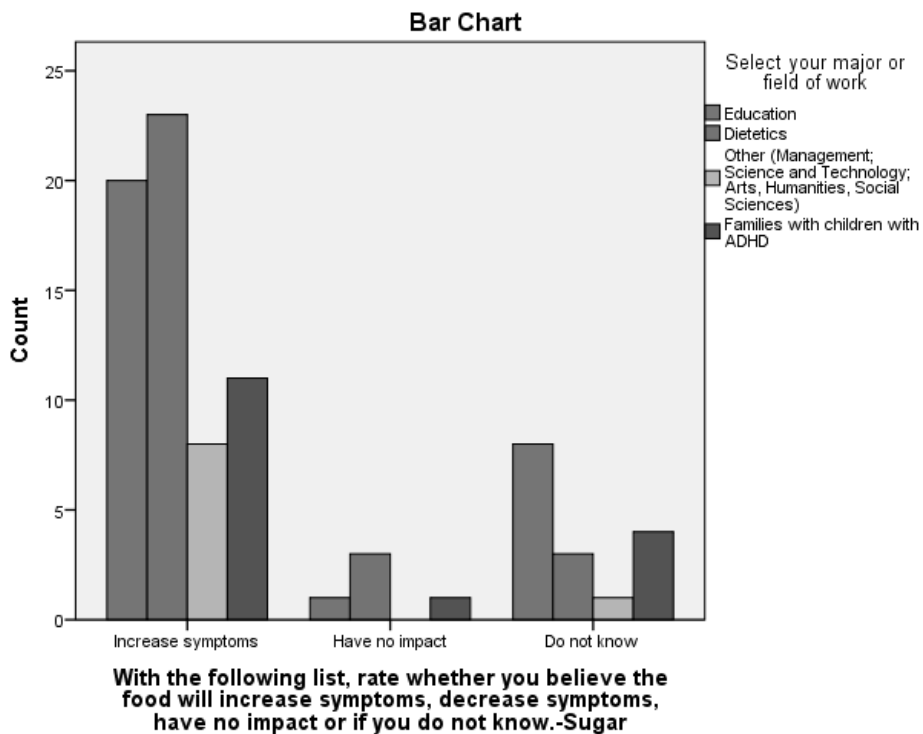
Research on food allergies or sensitivities and food chemicals may increase symptoms of ADHD, but it is difficult to assess these because of the strict diet that would need to be followed and the high amount of money to do testing. So, it is best to keep a journal of all foods and liquids consumed along with times and behavior and to look for patterns. As discussed earlier in the section about food allergies, these foods have mixed results, but for food chemicals such as artificial flavors or colors, hot dogs are a good example of this. Figure 7 shows the beliefs of how hot dogs affect ADHD symptoms and it shows that those who marked increase and those who marked do not know was fairly close in rate (43% for increase and 40% for do not know).



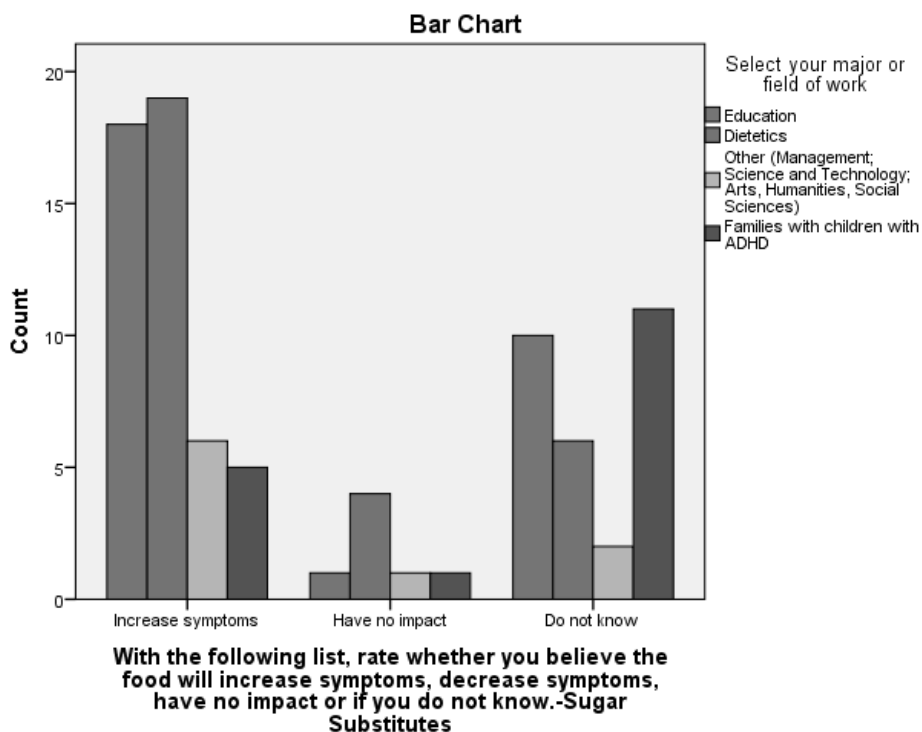
*Figure 7.* Belief of how hot dogs impacts ADHD symptoms based on major or field of work.

This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact hot dogs has on ADHD symptoms.

Sugar and sugar substitutes are interesting in that research has been consistent in that they do not impact ADHD symptoms, but the beliefs of families and the public is that it may increase symptoms. Figure 8 shows the belief of sugar and Figure 9 shows the belief of sugar substitutes and both figures show how the majority shows the belief of increase for both. Sugar substitutes do have slightly more in the do not know to decrease the amount that said increase, but it is still a majority for increase.



*Figure 8.* Belief of how sugar impacts ADHD symptoms based on major or field of work. This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact sugar has on ADHD symptoms.



*Figure 9.* Belief of how sugar substitute's impacts ADHD symptoms based on major or field of work. This graph shows the differences in how those in education, dietetics, other fields and families with children with ADHD differ in their beliefs on the impact sugar substitutes has on ADHD symptoms.

The families were asked about other medical conditions to see if there was another reason that they were seeing a dietitian that was not related to the ADHD. None of the families saw a dietitian, so this question was not needed for the purpose. But, it was useful in seeing that the most common problem was allergies (food and environmental). The public also was asked this question, but most did not know, but a few mentioned allergies.

The families were also asked about food they purchase or not purchase because of their belief on how that food impacts symptoms. The most common thing that the families did not purchase or tried to limit was products high in sugar and then red dye. Food that the families did

purchase to help with the symptoms was proteins, fruits and vegetables and then one family purchased high calorie healthy foods.

### **Limitations**

The main limitation of this study was that there was not a lot of difference in the demographics, especially in the general population and then the number of families was small (22 families) in comparison to the general population (70 individuals). Another limitation is because of the kind of data collected there was no easy way to figure out true significance. With the questionnaire for the families for the education level, there should have been the option of less than high school diploma because not everyone has at least that, so it would have been nice to see if any did fit into that category. Finally, with ADHD being complex and the way nutrition impacts symptoms has mixed results, it is difficult to conclude a food item that will specifically increase or decrease symptoms, which made it difficult to assess knowledge and then compare the data to a standard.

### **Conclusions**

The main conclusion is that ADHD is complex and what increases or decreases symptoms will vary from child to child. Nutrition may play a role in the lives of some children by decreasing symptoms and a healthy diet is important for overall health and wellbeing. For the most part though, nutrition and ADHD is not as known and many do not understand that some foods may impact ADHD symptoms and there is little information out there for easy access to the families or to the public. There are also no significant differences among demographics and what they do know.

**Recommendations**

The recommendations is that since nutrition may play a role in helping some children with ADHD, but the lack of knowledge by both families and the public occurs, more research is needed in how to incorporate nutrition into treatment. So, the next step would be to find out what psychologists know about nutrition and ADHD along with if they give any nutrition advice and what they give if they do. Also, more research is needed in all areas of nutrition to see what the best scope of practice would be in how nutrition relates to ADHD.

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## Appendix A: Surveys Used in the Study

### Questionnaire Used For Families

**Title:** Nutrition Knowledge of Families with Children who have Attention Deficit Hyperactivity Disorder (ADHD)

**Investigator:**  
Patricia Miara  
920-979-1128  
miarap6002@my.uwstout.edu

**Research Sponsor:**  
Maren Hegsted  
715-235-2545  
hegstedm@uwstout.edu

**Description:**

The objective of this study is to determine if families of children with ADHD have any knowledge about how nutrition may affect symptoms along with finding out if families have received nutrition information or have seen a dietitian. The study will also see if there are demographic differences between families that have nutrition knowledge in comparison to those that do not.

**Risks and Benefits:**

There are no risks involved in the participation of this study. Some personal demographic questions are included such as age, education level, income level, and personal questions about the child such as years diagnosed, school, and other medical conditions. However, all information will be kept confidential and you will not have to include any identifying information such as name, address, and phone number. The email that the survey will be sent to will not be seen by anyone but myself and once the survey is saved to a personal thumb drive the email will be deleted.

The benefits of this survey will show where improvements can be made in having nutrition education as a complementary treatment to "typical" treatment in improving symptoms of ADHD.

**Minors:**

The guardians of the children with ADHD are to fill out the questionnaire. Minors are not allowed to be involved in the survey.

**Time Commitment:**

The self-administered questionnaire will take about 15 minutes to fill out completely and email to the investigator.

**Confidentiality:**

Your name and contact information will not be included on the survey nor is it asked for. When the survey is emailed to the investigator they will save it to a personal thumb drive that is to be used strictly for the research project and then the email deleted immediately. The thumb drive will be kept secure and confidential and any data that is collected will be reported as group data and not personal data.

**Right to Withdraw:**

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the survey at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been turned into the investigator for withdrawal.

**IRB Exempt per Category 2:**

"This research has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46."

**Investigator:**

Patricia Miara  
  
miarap6002@my.uwstout.edu  
920-979-1128

**Advisor:**

Maren Hegsted  
205 Heritage Hall

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**IRB Administrator:**

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**Statement of Consent:**

By completing the following survey titled "Nutrition and Attention Deficit Hyperactivity Disorder (ADHD) Questionnaire" you agree to participate in the project entitled, "Nutrition Knowledge of Families with Children who have Attention Deficit Hyperactivity Disorder (ADHD)."

**Demographics of the person filling out the survey**

Select the category of your age.

- < 20 years
- 21-30 years
- 31-40 years
- 41-50 years
- 50+ years

Select your income level

- <\$25,000
- \$25,000-\$50,000
- \$50,000-\$75,000
- \$75,000-\$100,000
- \$100,000+

Select your education level.

- No Diploma
- High School Diploma
- Technical Degree
- Bachelor's Degree
- Post Bachelor's Degree

Select how many people are in your household.

- 2 people
- 3 people
- 4 people
- 5 people
- 6 people
- 7 people
- 8 or more people

Select how many in the household are diagnosed with ADHD.

- 1 person
- 2 people
- 3 people
- 4 people
- 5 or more people

Select what your relationship to the child with ADHD is.

- Parent
- Grandparent
- Other Relative
- Foster Family
- Other Guardians

Demographics of the child with ADHD

Select how many years they have been diagnosed with ADHD.

- < 1 year
- 1-2 years
- 3-4 years
- 5-6 years
- 7-8 years
- 9 or more years

Does the child with ADHD have any other medical condition, including allergies?

Have you ever received pamphlets about ADHD and nutrition?

- Yes
- No

Have you ever worked with a dietitian on ADHD and nutrition?

- Yes
- No

Have you ever heard or read about ADHD and nutrition?

- Yes
- No

Are there foods that you will not purchase or allow your child to eat because of the ADHD?  
If so please list.

Are there foods that you will purchase or allow your child to eat because of the ADHD?

If so please list.

With the following list, rate whether you believe the food will increase symptoms, decrease symptoms, have no impact or if you do not know.

	Increase symptoms	Decrease symptoms	No impact	Do not know	Click to write Scale point 5	Click to write Scale point 6
Fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green Leafy Vegetables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beef	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Cheese	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whole Grains	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunflower Seeds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Apples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Caffeine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shellfish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Olive Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Almonds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
American Cheese	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soy Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coconut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mineral & Vitamin Supplements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carrots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hot Dogs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flaxseed Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chocolate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eggs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sugar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yogurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tomatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skittles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Citrus fruits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit Juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sugar Substitutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for taking the time to fill out this questionnaire.

## Questionnaire Used for Public

**Title:** Nutrition Knowledge of Families with Children who have Attention Deficit Hyperactivity Disorder (ADHD) for General Public

**Investigator:**  
Patricia Miara  
920-979-1128  
miarap6002@my.uwstout.edu

**Research Sponsor:**  
Maren Hegsted  
715-235-2545  
hegstedm@uwstout.edu

**Description:**

The objective of this study is to determine if families who have children in grades K-8 have any knowledge about how nutrition may cause or prevent ADHD symptoms along with finding out if families have seen nutrition information or have seen a dietitian. The study will also see if there are demographic differences between families that have nutrition knowledge in comparison to those that do not and also look to see if there are differences between families that have children with ADHD and those who do not.

**Risks and Benefits:**

There are no risks involved in the participation of this study. Some personal demographic questions are included such as age, education level, income level, and personal questions about the child such as years diagnosed, school, and other medical conditions. However, all information will be kept confidential and you will not have to include any identifying information such as name, address, and phone number. The email that the survey will be sent to will not be seen by anyone but myself and once the survey is saved to a personal thumb drive the email will be deleted.

The benefits of this survey will show where improvements can be made in having nutrition education as a complementary treatment to "typical" treatment in improving symptoms of ADHD.

**Minors:**

The guardians of the children in K-8 are to fill out the questionnaire. Minors are not allowed to be involved in the survey.

**Time Commitment:**

The self-administered questionnaire will take about 15 minutes to fill out completely and email to the investigator.

**Confidentiality:**

Your name and contact information will not be included on the survey nor is it asked for. When the survey is emailed to the investigator they will save it to a personal thumb drive that is to be used strictly for the research project and then the email deleted immediately. The thumb drive will be kept secure and confidential and any data that is collected will be reported as group data and not personal data.

**Right to Withdraw:**

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the survey at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been turned into the investigator for withdrawal.

**IRB Approval:**

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the investigator or Advisor. If you

have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

**"This research has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46."**

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**Statement of Consent:**

By completing the following survey titled "Nutrition and Attention Deficit Hyperactivity Disorder (ADHD) Questionnaire" you agree to participate in the project entitled, "Nutrition Knowledge of Families with Children who have Attention Deficit Hyperactivity Disorder (ADHD)"

**Demographics of the person filling out the survey**

Select the category of your age.

- < 20 years
- 21-30 years
- 31-40 years
- 41-50 years
- 50+ years

Select your income level

- <\$25,000
- \$25,000-\$50,000
- \$50,000-\$75,000
- \$75,000-\$100,000
- \$100,000+

Select your education level.

- No Diploma
- High School Diploma
- Technical Degree
- Bachelor's Degree
- Post Bachelor's Degree

Select how many people are in your household.

- 2 people
- 3 people
- 4 people
- 5 people
- 6 people
- 7 people
- 8 or more people

Select how many in the household are diagnosed with ADHD.

- 1 person
- 2 people
- 3 people
- 4 people
- 5 or more people

Select what your relationship to the child with ADHD is.

- Parent
- Grandparent
- Other Relative
- Foster Family
- Other Guardians

**Demographics of the child with ADHD**

Select how many years they have been diagnosed with ADHD.

- < 1 year
- 1-2 years
- 3-4 years
- 5-6 years
- 7-8 years
- 9 or more years

Does the child with ADHD have any other medical condition, including allergies?

Have you ever received pamphlets about ADHD and nutrition?

- Yes
- No

Have you ever worked with a dietitian on ADHD and nutrition?

- Yes
- No

Have you ever heard or read about ADHD and nutrition?

- Yes
- No

Are there foods that you will not purchase or allow your child to eat because of the ADHD?  
If so please list.

Are there foods that you will purchase or allow your child to eat because of the ADHD?  
If so please list.

With the following list, rate whether you believe the food will increase symptoms, decrease symptoms, have no impact or if you do not know.

	Increase symptoms	Decrease symptoms	No impact	Do not know	Click to write Scale point 5	Click to write Scale point 6
Fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green Leafy Vegetables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beef	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Natural Cheese	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whole Grains	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sunflower Seeds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Apples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Caffeine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shellfish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Olive Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Almonds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
American Cheese	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soy Milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coconut	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mineral & Vitamin Supplements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carrots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hot Dogs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flaxseed Oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chocolate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eggs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sugar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yogurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tomatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skittles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Citrus fruits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit Juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSG	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sugar Substitutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for taking the time to fill out this questionnaire.

## Appendix B: Demographics of Participants and the Food Items on Questionnaire

Table A								
Comparison on how the families with children with ADHD and the public differ in their beliefs of how different foods affect ADHD symptoms.								
	Increase n(%)		Decrease n(%)		No Impact n(%)		Do Not Know n(%)	
	Families	Public	Families	Public	Families	Public	Families	Public
Fish	0(0)	1(1.5)	4(22.2)	25(37.3)	5(27.8)	17(25.4)	9(50)	24(35.8)
Milk	2(11.1)	14(20.9)	2(11.1)	12(17.9)	6(33.3)	19(28.4)	8(44.4)	22(32.8)
Green Leafy Vegetables	0(0)	1(1.5)	6(33.3)	38(56.7)	5(27.8)	10(14.9)	7(38.9)	18(26.9)
Beef	3(16.7)	9(13.2)	2(11.1)	13(19.1)	5(27.8)	19(27.9)	8(44.4)	27(39.7)
Natural Cheese	2(11.1)	9(13.2)	2(11.1)	18(26.5)	5(27.8)	14(20.6)	9(50)	27(39.7)
Whole Grains	0(0)	9(13.8)	4(22.2)	24(36.9)	5(27.8)	14(21.5)	9(50)	18(27.7)
Sunflower Seeds	0(0)	0(0)	3(16.7)	24(35.8)	4(22.2)	15(22.4)	11(61.1)	28(41.8)
Apples	0(0)	2(3)	3(17.6)	30(45.5)	5(29.4)	14(21.2)	9(52.9)	20(30.3)
Caffeine	7(38.9)	48(70.6)	5(27.8)	8(11.8)	0(0)	2(2.9)	6(33.3)	10(14.7)
Shellfish	0(0)	8(11.9)	1(5.6)	14(20.9)	4(22.2)	13(19.4)	13(72.2)	32(47.8)
Olive Oil	0(0)	2(2.9)	5(27.8)	22(32.4)	3(16.7)	14(20.6)	10(55.6)	30(44.1)
Almonds	0(0)	0(0)	4(22.2)	28(41.8)	2(11.1)	15(22.4)	12(66.7)	24(35.8)
American Cheese	2(11.1)	20(29.4)	1(5.6)	4(5.9)	5(27.8)	17(25)	10(55.6)	27(39.7)
Ham	2(11.1)	13(19.1)	1(5.6)	6(8.8)	3(16.7)	19(27.9)	12(66.7)	30(44.1)
Soy Milk	1(5.6)	6(8.8)	1(5.6)	16(23.5)	2(11.1)	20(29.4)	14(77.8)	26(38.2)
Coconut	0(0)	2(2.9)	3(17.6)	20(29.4)	2(11.8)	16(23.5)	12(70.6)	30(44.1)
Mineral & Vitamin Supplements	1(5.6)	2(3)	4(22.2)	34(50.7)	4(22.2)	6(9)	9(50)	25(37.3)
Beans	0(0)	1(1.5)	3(17.6)	28(41.8)	6(35.3)	14(20.9)	8(47.1)	24(35.8)
Carrots	0(0)	1(1.5)	2(11.8)	33(48.5)	7(41.2)	14(20.6)	8(47.1)	20(29.4)
Hot Dogs	3(17.6)	34(50)	1(5.9)	0(0)	2(11.8)	11(16.2)	11(64.7)	23(33.8)
Flaxseed Oil	0(0)	2(2.9)	5(29.4)	27(39.7)	2(11.8)	12(17.6)	10(58.8)	27(39.7)
Chocolate	9(52.9)	43(63.2)	2(11.8)	5(7.4)	1(5.9)	4(5.9)	5(29.4)	16(23.5)
Eggs	1(5.9)	6(9)	4(23.5)	25(37.3)	3(17.6)	10(14.9)	9(52.9)	26(38.8)
Sugar	11(68.8)	52(76.5)	0(0)	0(0)	1(6.3)	4(5.9)	4(25)	12(17.6)
Tomatoes	0(0)	3(4.5)	2(11.8)	26(39.4)	4(23.5)	13(19.7)	11(64.7)	24(36.4)
Skittles	12(70.6)	52(77.6)	0(0)	1(1.5)	0(0)	3(4.5)	5(29.4)	11(16.4)
Citrus Fruits	2(11.8)	15(22.1)	2(11.8)	16(23.5)	3(17.6)	14(20.6)	10(58.8)	23(33.8)
Fruit Juice	6(35.3)	40(58.8)	1(5.9)	6(8.8)	1(5.9)	7(10.3)	9(52.9)	15(22.1)
MSG	6(37.5)	42(61.8)	0(0)	1(1.5)	2(12.5)	3(4.4)	8(50)	22(32.4)
Sugar Substitutes	5(29.4)	44(64.7)	0(0)	0(0)	1(5.9)	6(8.8)	11(64.7)	18(26.5)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	15(52)	7(24)	0(0)	7(24)
Dietetics	24(83)	0(0)	2(7)	3(10)
Other	8(89)	1(11)	0(0)	0(0)
Families	7(39)	5(28)	0(0)	6(33)
<20 years	14(100)	0(0)	0(0)	0(0)
21-30 years	26(62)	5(12)	2(5)	9(21)
31-40 years	6(43)	5(36)	0(0)	3(21)
41-50 years	5(50)	3(30)	0(0)	2(20)
50+ years	4(67)	0(0)	0(0)	2(33)
<\$25,000	38(75)	6(12)	2(4)	5(10)
\$25,000-\$50,000	5(50)	2(20)	0(0)	3(30)
\$50,000-\$75,000	5(33)	5(33)	0(0)	5(33)
\$75,000-\$100,000	3(75)	0(0)	0(0)	1(25)
\$100,000+	4(67)	0(0)	0(0)	2(33)
Undergraduate Student	34(79)	2(5)	2(5)	5(12)
Graduate Student	1(33)	1(33)	0(0)	1(33)
High School Diploma	4(100)	0(0)	0(0)	0(0)
Technical Degree	4(40)	3(30)	0(0)	3(30)
Bachelor's Degree	7(58)	2(17)	0(0)	3(25)
Post Bachelor's Degree	5(36)	5(36)	0(0)	4(29)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	8(28)	1(3)	5(17)	15(52)
Dietetics	9(31)	2(7)	10(34)	8(28)
Other	2(22)	1(11)	2(22)	4(44)
Families	2(11)	1(6)	5(28)	10(56)
<20 years	3(21)	2(14)	5(36)	4(29)
21-30 years	12(29)	1(2)	11(26)	18(43)
31-40 years	3(21)	0(0)	3(21)	8(57)
41-50 years	2(20)	1(10)	2(20)	5(50)
50+ years	2(33)	1(17)	1(17)	2(33)
<\$25,000	14(27)	3(6)	16(31)	18(35)
\$25,000-\$50,000	3(30)	0(0)	1(10)	6(60)
\$50,000-\$75,000	3(20)	1(7)	1(7)	10(67)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	1(17)	1(17)	3(50)	1(17)
Undergraduate Student	14(33)	2(5)	11(26)	16(37)
Graduate Student	1(33)	0(0)	1(33)	1(33)
High School Diploma	1(25)	0(0)	3(75)	0(0)
Technical Degree	1(10)	2(20)	0(0)	7(70)
Bachelor's Degree	3(25)	0(0)	3(25)	6(50)
Post Bachelor's Degree	2(14)	1(7)	4(29)	7(50)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	5(17)	2(7)	7(24)	15(51)
Dietetics	6(21)	3(10)	9(31)	11(38)
Other	2(22)	1(11)	2(22)	4(44)
Families	2(11)	1(6)	3(17)	12(67)
<20 years	1(7)	3(21)	3(21)	7(50)
21-30 years	9(21)	2(5)	12(29)	19(45)
31-40 years	2(9)	9(39)	4(17)	8(35)
41-50 years	2(20)	1(10)	3(30)	4(40)
50+ years	1(17)	1(17)	0(0)	4(67)
<\$25,000	10(20)	5(10)	16(31)	20(39)
\$25,000-\$50,000	2(20)	0(0)	1(10)	7(70)
\$50,000-\$75,000	1(7)	1(7)	2(13)	11(73)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	1(17)	1(17)	2(33)	2(33)
Undergraduate Student	11(26)	3(7)	11(26)	18(42)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	1(25)	2(50)	1(25)
Technical Degree	0(0)	2(20)	1(10)	7(70)
Bachelor's Degree	2(17)	0(0)	5(42)	5(42)
Post Bachelor's Degree	2(14)	1(7)	2(14)	9(64)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	16(55)	0(0)	3(10)	10(34)
Dietetics	12(41)	0(0)	8(28)	9(31)
Other	5(56)	0(0)	0(0)	4(44)
Families	3(18)	1(6)	2(12)	11(65)
<20 years	7(50)	0(0)	2(15)	5(21)
21-30 years	18(44)	0(0)	9(22)	14(34)
31-40 years	5(36)	0(0)	1(7)	8(57)
41-50 years	4(40)	1(10)	1(10)	4(40)
50+ years	3(50)	0(0)	0(0)	3(50)
<\$25,000	22(43)	1(2)	11(22)	17(33)
\$25,000-\$50,000	4(40)	0(0)	0(0)	6(60)
\$50,000-\$75,000	7(50)	0(0)	0(0)	7(70)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	3(50)	0(0)	1(17)	2(33)
Undergraduate Student	21(49)	0(0)	8(19)	14(33)
Graduate Student	1(33)	0(0)	1(33)	1(33)
High School Diploma	2(50)	0(0)	1(25)	1(25)
Technical Degree	2(22)	1(11)	0(0)	6(67)
Bachelor's Degree	5(42)	0(0)	2(17)	5(42)
Post Bachelor's Degree	6(43)	0(0)	1(7)	7(50)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	15(52)	4(14)	0(0)	10(34)
Dietetics	20(69)	0(0)	4(14)	5(17)
Other	7(78)	1(11)	0(0)	1(11)
Families	9(53)	2(12)	1(6)	5(29)
<20 years	13(93)	0(0)	1(7)	0(0)
21-30 years	24(59)	1(2)	3(7)	13(32)
31-40 years	8(57)	2(14)	1(7)	3(21)
41-50 years	5(50)	3(30)	0(0)	2(20)
50+ years	2(33)	1(17)	0(0)	3(50)
<\$25,000	34(67)	4(8)	4(8)	9(18)
\$25,000-\$50,000	7(47)	0(0)	1(7)	7(47)
\$50,000-\$75,000	6(43)	1(7)	0(0)	7(50)
\$75,000-\$100,000	2(50)	1(25)	0(0)	1(25)
\$100,000+	3(50)	1(17)	0(0)	2(33)
Undergraduate Student	29(67)	1(2)	3(7)	10(23)
Graduate Student	2(67)	0(0)	0(0)	1(33)
High School Diploma	4(100)	0(0)	0(0)	0(0)
Technical Degree	3(33)	2(22)	1(11)	3(33)
Bachelor's Degree	8(67)	2(17)	1(8)	1(8)
Post Bachelor's Degree	6(43)	2(14)	0(0)	6(43)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	20(71)	0(0)	1(4)	7(25)
Dietetics	23(79)	0(0)	2(7)	4(14)
Other	8(89)	1(11)	0(0)	0(0)
Families	12(71)	0(0)	0(0)	5(30)
<20 years	14(100)	0(0)	0(0)	0(0)
21-30 years	27(68)	0(0)	3(8)	10(25)
31-40 years	11(79)	1(7)	0(0)	2(14)
41-50 years	8(80)	0(0)	0(0)	2(20)
50+ years	4(67)	0(0)	0(0)	2(33)
<\$25,000	39(78)	1(2)	3(6)	7(14)
\$25,000-\$50,000	7(70)	0(0)	0(0)	3(30)
\$50,000-\$75,000	10(71)	0(0)	0(0)	4(29)
\$75,000-\$100,000	3(75)	0(0)	0(0)	1(25)
\$100,000+	5(83)	0(0)	0(0)	1(17)
Undergraduate Student	33(79)	0(0)	3(7)	6(14)
Graduate Student	2(67)	0(0)	0(0)	1(33)
High School Diploma	3(75)	0(0)	0(0)	1(25)
Technical Degree	6(67)	1(11)	0(0)	2(22)
Bachelor's Degree	11(92)	0(0)	0(0)	1(8)
Post Bachelor's Degree	9(64)	0(0)	0(0)	5(36)

Demographic Data	Increase	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	16(55)	0(0)	2(7)	11(38)
Dietetics	18(62)	1(3)	1(3)	9(31)
Other	7(78)	0(0)	0(0)	2(22)
Families	6(38)	0(0)	2(13)	8(50)
<20 years	9(64)	1(7)	0(0)	4(29)
21-30 years	24(59)	0(0)	4(10)	13(32)
31-40 years	6(46)	0(0)	1(8)	6(46)
41-50 years	5(50)	0(0)	0(0)	5(50)
50+ years	4(67)	0(0)	0(0)	2(33)
<\$25,000	31(60)	1(2)	3(6)	16(31)
\$25,000-\$50,000	4(40)	0(0)	1(10)	5(50)
\$50,000-\$75,000	8(62)	0(0)	0(0)	5(38)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	4(67)	0(0)	0(0)	2(33)
Undergraduate Student	28(65)	0(0)	2(5)	13(30)
Graduate Student	1(33)	0(0)	0(0)	2(67)
High School Diploma	2(50)	1(25)	1(25)	0(0)
Technical Degree	4(44)	0(0)	0(0)	5(56)
Bachelor's Degree	6(55)	0(0)	0(0)	5(45)
Post Bachelor's Degree	7(54)	0(0)	2(15)	5(38)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	10(34)	6(21)	13(45)
Dietetics	1(4)	12(43)	9(32)	6(21)
Other	0(0)	2(22)	2(22)	5(56)
Families	0(0)	4(22)	5(28)	9(50)
<20 years	1(8)	5(38)	3(23)	4(31)
21-30 years	0(0)	14(33)	12(29)	16(38)
31-40 years	0(0)	4(29)	4(29)	6(43)
41-50 years	0(0)	4(40)	1(10)	5(50)
50+ years	0(0)	2(33)	2(33)	2(33)
<\$25,000	1(2)	16(32)	15(30)	18(36)
\$25,000-\$50,000	0(0)	5(56)	1(11)	3(33)
\$50,000-\$75,000	0(0)	6(40)	1(7)	8(53)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	1(17)	3(50)	2(33)
Undergraduate Student	1(2)	16(38)	12(29)	13(31)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	0(0)	2(50)	1(25)	1(25)
Technical Degree	0(0)	3(30)	0(0)	7(70)
Bachelor's Degree	0(0)	3(25)	3(25)	6(50)
Post Bachelor's Degree	0(0)	4(29)	5(36)	5(36)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	5(11)	12(27)	28(62)
Dietetics	0(0)	10(34)	9(31)	10(34)
Other	0(0)	3(33)	1(11)	5(56)
Families	0(0)	3(17)	4(22)	11(61)
<20 years	0(0)	6(43)	3(21)	5(36)
21-30 years	0(0)	13(32)	12(29)	16(39)
31-40 years	0(0)	3(21)	2(14)	9(64)
41-50 years	0(0)	3(30)	2(20)	5(50)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	0(0)	17(34)	15(30)	18(36)
\$25,000-\$50,000	0(0)	4(40)	1(10)	5(50)
\$50,000-\$75,000	0(0)	3(20)	1(7)	11(73)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	0(0)	14(33)	12(29)	16(38)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	2(50)	1(25)	1(25)
Technical Degree	0(0)	3(30)	1(10)	6(60)
Bachelor's Degree	0(0)	3(25)	2(17)	7(58)
Post Bachelor's Degree	0(0)	5(36)	2(14)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	10(34)	4(14)	15(51)
Dietetics	2(7)	10(34)	8(28)	9(31)
Other	0(0)	2(22)	2(22)	5(56)
Families	0(0)	5(28)	3(17)	10(56)
<20 years	2(14)	4(29)	3(21)	5(36)
21-30 years	0(0)	14(33)	11(26)	17(40)
31-40 years	0(0)	5(36)	2(14)	7(50)
41-50 years	0(0)	2(20)	1(10)	7(70)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	2(4)	17(33)	13(25)	19(37)
\$25,000-\$50,000	0(0)	3(30)	2(20)	5(50)
\$50,000-\$75,000	0(0)	4(27)	0(0)	11(73)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	2(5)	14(33)	11(26)	16(37)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	1(25)	1(25)	2(50)
Technical Degree	0(0)	5(50)	0(0)	5(50)
Bachelor's Degree	0(0)	3(25)	2(17)	7(58)
Post Bachelor's Degree	0(0)	4(29)	2(14)	8(57)

<u>Demographic Data</u>	<u>Increase n(%)</u>	<u>Decrease n(%)</u>	<u>No Impact n(%)</u>	<u>Do Not Know n(%)</u>
Education	0(0)	14(48)	1(3)	14(48)
Dietetics	2(7)	14(50)	5(18)	7(25)
Other	0(0)	6(67)	0(0)	3(33)
Families	1(6)	4(22)	4(22)	9(50)
<20 years	1(7)	9(64)	1(7)	3(21)
21-30 years	1(2)	18(44)	5(12)	17(41)
31-40 years	1(7)	5(36)	3(21)	5(36)
41-50 years	0(0)	3(30)	0	7(70)
50+ years	0(0)	3(50)	1(17)	2(33)
<\$25,000	2(4)	26(52)	6(12)	16(32)
\$25,000-\$50,000	1(10)	5(50)	1(10)	3(30)
\$50,000-\$75,000	0(0)	4(27)	1(7)	10(67)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	2(5)	21(50)	5(12)	14(33)
Graduate Student	0(0)	2(67)	0(0)	1(33)
High School Diploma	0(0)	2(50)	1(25)	1(25)
Technical Degree	0(0)	3(30)	0(0)	7(70)
Bachelor's Degree	0(0)	7(58)	1(8)	4(33)
Post Bachelor's Degree	1(7)	3(21)	3(21)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	1(3)	10(34)	3(10)	15(52)
Dietetics	1(3)	11(38)	9(31)	8(28)
Other	0(0)	5(56)	0(0)	4(44)
Families	0(0)	5(29)	2(12)	10(59)
<20 years	1(7)	6(43)	3(21)	4(29)
21-30 years	1(2)	16(39)	9(22)	15(37)
31-40 years	0(0)	5(36)	1(7)	8(57)
41-50 years	0(0)	3(30)	1(10)	6(60)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	2(4)	18(35)	12(24)	19(37)
\$25,000-\$50,000	0(0)	5(50)	0(0)	5(50)
\$50,000-\$75,000	0(0)	6(43)	0(0)	8(57)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	1(2)	17(40)	9(21)	15(36)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	2(50)	1(25)	1(25)
Technical Degree	0(0)	4(44)	0(0)	(56)
Bachelor's Degree	0(0)	4(33)	2(17)	6(50)
Post Bachelor's Degree	0(0)	5(36)	1(7)	8(57)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	11(39)	3(11)	14(50)
Dietetics	0(0)	13(45)	10(34)	6(21)
Other	0(0)	4(44)	2(22)	3(33)
Families	0(0)	4(22)	2(11)	12(67)
<20 years	0(0)	8(57)	3(21)	3(21)
21-30 years	0(0)	16(38)	11(26)	15 (36)
31-40 years	0(0)	3(23)	2(15)	8(62)
41-50 years	0(0)	3(30)	1(10)	6(60)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	0(0)	22(43)	14(27)	15(29)
\$25,000-\$50,000	0(0)	3(30)	1(10)	6(60)
\$50,000-\$75,000	0(0)	4(29)	0(0)	10(71)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(17)
Undergraduate Student	0(0)	16(38)	13(31)	13(31)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	2(50)	0(0)	2(50)
Technical Degree	0(0)	4(40)	0(0)	6(60)
Bachelor's Degree	0(0)	5(42)	2(17)	5(42)
Post Bachelor's Degree	0(0)	4(31)	1(8)	8(62)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	15(54)	2(7)	11(39)
Dietetics	1(3)	18(62)	6(21)	4(14)
Other	0(0)	4(44)	2(22)	3(33)
Families	0(0)	6(33)	5(28)	7(39)
<20 years	1(7)	11(79)	1(7)	1(7)
21-30 years	0(0)	20(48)	9(21)	13(31)
31-40 years	0(0)	6(46)	2(15)	5(38)
41-50 years	0(0)	4(40)	2(20)	4(40)
50+ years	0(0)	3(50)	1(17)	2(33)
<\$25,000	1(2)	29(57)	10(20)	11(22)
\$25,000-\$50,000	0(0)	5(50)	1(10)	4(40)
\$50,000-\$75,000	0(0)	7(50)	0(0)	7(50)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	3(50)	1(17)
Undergraduate Student	0(0)	25(58)	8(19)	10(23)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	1(25)	2(50)	1(25)	0(0)
Technical Degree	0(0)	5(50)	0(0)	5(50)
Bachelor's Degree	0(0)	6(50)	3(25)	3(25)
Post Bachelor's Degree	0(0)	5(38)	2(15)	6(46)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	5(26)	3(16)	7(37)	14(74)
Dietetics	3(10)	7(24)	9(31)	10(34)
Other	1(11)	3(33)	2(22)	3(33)
Families	3(17)	2(11)	5(28)	8(44)
<20 years	1(7)	5(36)	3(21)	5(36)
21-30 years	6(14)	6(14)	13(31)	17(40)
31-40 years	2(14)	2(14)	4(29)	6(43)
41-50 years	2(20)	1(10)	3(30)	4(40)
50+ years	1(17)	1(17)	1(17)	3(50)
<\$25,000	8(13)	10(16)	15(25)	18(30)
\$25,000-\$50,000	1(10)	2(20)	3(30)	4(40)
\$50,000-\$75,000	1(7)	3(20)	2(13)	9(60)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	1(17)	0(0)	3(50)	2(33)
Undergraduate Student	7(16)	6(14)	12(28)	18(42)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	0(0)	2(50)	2(50)	0(0)
Technical Degree	1(10)	3(30)	0(0)	6(60)
Bachelor's Degree	1(8)	3(25)	5(42)	3(25)
Post Bachelor's Degree	3(21)	0(0)	4(29)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	2(7)	9(32)	5(18)	12(43)
Dietetics	6(22)	10(37)	9(33)	2(7)
Other	1(11)	4(44)	0(0)	4(44)
Families	0(0)	4(22)	5(28)	9(50)
<20 years	3(23)	6(46)	3(7)	1(8)
21-30 years	4(10)	13(33)	11(28)	12(30)
31-40 years	1(7)	3(21)	2(14)	8(57)
41-50 years	0(0)	4(40)	2(20)	4(40)
50+ years	1(17)	2(33)	1(17)	2(33)
<\$25,000	6(13)	18(38)	14(29)	10(21)
\$25,000-\$50,000	1(10)	4(40)	1(10)	4(40)
\$50,000-\$75,000	2(13)	4(27)	0(0)	9(60)
\$75,000-\$100,000	0(0)	0(0)	1(25)	3(75)
\$100,000+	0(0)	2(33)	3(50)	1(17)
Undergraduate Student	7(18)	14(35)	11(28)	8(20)
Graduate Student	1(33)	0(0)	1(33)	1(33)
High School Diploma	0(0)	3(75)	1(25)	0(0)
Technical Degree	0(0)	4(40)	0(0)	6(60)
Bachelor's Degree	0(0)	2(17)	4(33)	6(50)
Post Bachelor's Degree	1(7)	5(36)	2(14)	6(43)

<u>Demographic Data</u>	<u>Increase n(%)</u>	<u>Decrease n(%)</u>	<u>No Impact n(%)</u>	<u>Do Not Know n(%)</u>
Education	16(53)	2(7)	3(10)	9(30)
Dietetics	19(66)	2(7)	4(14)	4(14)
Other	5(56)	2(22)	0(0)	2(22)
Families	6(35)	1(6)	1(6)	9(53)
<20 years	9(64)	3(21)	2(14)	0(0)
21-30 years	21(51)	2(3)	6(15)	12(29)
31-40 years	7(50)	1(7)	0(0)	6(43)
41-50 years	6(60)	0(0)	0(0)	4(40)
50+ years	3(50)	1(17)	0(0)	2(33)
<\$25,000	29(57)	4(8)	8(16)	10(20)
\$25,000-\$50,000	4(40)	1(10)	0(0)	5(50)
\$50,000-\$75,000	7(50)	1(7)	0(0)	6(43)
\$75,000-\$100,000	3(75)	0(0)	0(0)	1(25)
\$100,000+	3(50)	1(17)	0(0)	2(33)
Undergraduate Student	26(60)	4(9)	5(12)	8(19)
Graduate Student	1(33)	0	1(33)	1(33)
High School Diploma	2(50)	1(25)	1(25)	0(0)
Technical Degree	3(33)	1(11)	0(0)	5(56)
Bachelor's Degree	6(50)	0(0)	1(8)	5(42)
Post Bachelor's Degree	8(57)	1(7)	0(0)	5(36)

Table S

Demographic differences on beliefs on how coconut impacts ADHD symptoms.

<u>Demographic Data</u>	<u>Increase n(%)</u>	<u>Decrease n(%)</u>	<u>No Impact n(%)</u>	<u>Do Not Know n(%)</u>
Education	0(0)	8(28)	5(17)	16(55)
Dietetics	2(7)	8(28)	10(34)	9(31)
Other	0(0)	3(33)	1(11)	5(56)
Families	0(0)	3(18)	2(12)	12(71)
<20 years	1(7)	5(36)	4(29)	4(29)
21-30 years	1(2)	11(27)	10(24)	19(46)
31-40 years	0(0)	3(21)	2(14)	9(64)
41-50 years	0(0)	2(20)	2(20)	6(60)
50+ years	0(0)	2(33)	0	4(67)
<\$25,000	2(4)	13(25)	15(29)	21(41)
\$25,000-\$50,000	0(0)	3(30)	0(0)	7(70)
\$50,000-\$75,000	0(0)	4(29)	1(7)	9(64)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	0(0)	15(35)	11(26)	17(40)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	1(25)	1(25)	1(25)	1(25)
Technical Degree	1(11)	2(22)	0(0)	6(67)
Bachelor's Degree	0(0)	2(17)	3(25)	7(58)
Post Bachelor's Degree	0(0)	3(21)	2(14)	9(64)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	11(39)	3(11)	14(50)
Dietetics	1(3)	13(45)	9(31)	6(21)
Other	0(0)	3(33)	2(22)	4(44)
Families	0(0)	3(18)	6(35)	8(47)
<20 years	0(0)	6(43)	5(36)	3(21)
21-30 years	1(1)	14(47)	9(30)	16(53)
31-40 years	0(0)	4(29)	3(21)	7(50)
41-50 years	0(0)	4(40)	2(20)	4(40)
50+ years	0(0)	3(50)	1(17)	2(33)
<\$25,000	1(2)	19(38)	15(30)	15(30)
\$25,000-\$50,000	0(0)	4(40)	1(10)	5(50)
\$50,000-\$75,000	0(0)	5(36)	0	9(64)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	3(50)	1(17)
Undergraduate Student	0(0)	18(42)	11(26)	14(33)
Graduate Student	0(0)	1(50)	0(0)	1(50)
High School Diploma	0(0)	2(50)	2(50)	0(0)
Technical Degree	1(11)	2(22)	0(0)	6(67)
Bachelor's Degree	0(0)	3(25)	5(42)	4(33)
Post Bachelor's Degree	0(0)	5(36)	2(14)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	15(52)	3(10)	11(38)
Dietetics	1(3)	16(55)	8(28)	4(14)
Other	0(0)	2(22)	2(22)	5(56)
Families	0(0)	2(12)	7(41)	8(47)
<20 years	1(7)	8(57)	3(21)	2(14)
21-30 years	0(0)	17(41)	11(27)	13(32)
31-40 years	0(0)	5(36)	2(14)	7(50)
41-50 years	0(0)	2(20)	4(40)	4(40)
50+ years	0(0)	3(50)	1(17)	2(33)
<\$25,000	1(2)	24(47)	14(27)	12(24)
\$25,000-\$50,000	0(0)	3(30)	2(20)	5(50)
\$50,000-\$75,000	0(0)	5(36)	1(7)	8(57)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	3(50)	1(17)
Undergraduate Student	0(0)	23(53)	10(23)	10(23)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	1(25)	0(0)	3(75)	0(0)
Technical Degree	0(0)	2(22)	1(11)	6(67)
Bachelor's Degree	0(0)	3(25)	4(33)	5(42)
Post Bachelor's Degree	0(0)	6(43)	2(14)	6(43)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	20(69)	0(0)	1(3)	8(28)
Dietetics	23(79)	0(0)	3(10)	3(10)
Other	8(88)	0(0)	0(0)	1(11)
Families	11(69)	0(0)	1(6)	4(25)
<20 years	13(93)	0(0)	1(7)	0(0)
21-30 years	29(71)	0(0)	3(7)	9(22)
31-40 years	8(62)	0(0)	1(8)	4(31)
41-50 years	9(90)	0(0)	0(0)	1(10)
50+ years	4(67)	0(0)	0(0)	2(33)
<\$25,000	40(78)	0(0)	4(8)	7(14)
\$25,000-\$50,000	6(67)	0(0)	1(11)	2(22)
\$50,000-\$75,000	9(64)	0(0)	0(0)	5(36)
\$75,000-\$100,000	3(75)	0(0)	0(0)	1(25)
\$100,000+	5(83)	0(0)	0(0)	1(17)
Undergraduate Student	33(77)	0(0)	4(9)	6(14)
Graduate Student	2(67)	0(0)	0(0)	1(33)
High School Diploma	4(100)	0(0)	0(0)	0(0)
Technical Degree	5(63)	0(0)	0(0)	3(38)
Bachelor's Degree	10(83)	0(0)	1(8)	1(8)
Post Bachelor's Degree	9(64)	0(0)	0(0)	5(36)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	18(62)	0(0)	1(3)	10(34)
Dietetics	19(66)	0(0)	4(14)	6(21)
Other	6(67)	0(0)	1(11)	2(22)
Families	5(29)	0(0)	1(6)	11(65)
<20 years	10(71)	0(0)	2(14)	2(14)
21-30 years	26(63)	0(0)	3(7)	12(29)
31-40 years	5(36)	0(0)	1(7)	8(57)
41-50 years	4(40)	0(0)	1(10)	5(50)
50+ years	4(67)	0(0)	0(0)	2(33)
<\$25,000	32(63)	0(0)	6(12)	13(25)
\$25,000-\$50,000	4(20)	0(0)	6(30)	10(50)
\$50,000-\$75,000	9(64)	0(0)	0(0)	5(36)
\$75,000-\$100,000	1(25)	0(0)	0(0)	3(75)
\$100,000+	3(50)	0(0)	1(17)	2(33)
Undergraduate Student	29(67)	0(0)	5(12)	9(21)
Graduate Student	1(33)	0(0)	0(0)	2(67)
High School Diploma	3(75)	0(0)	0(0)	1(25)
Technical Degree	4(44)	0(0)	0(0)	5(56)
Bachelor's Degree	4(33)	0(0)	2(17)	6(50)
Post Bachelor's Degree	8(57)	0(0)	0(0)	6(43)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	6(21)	4(14)	7(24)	12(41)
Dietetics	4(14)	7(25)	11(39)	6(21)
Other	3(33)	1(11)	1(11)	4(44)
Families	2(11)	2(11)	6(33)	8(44)
<20 years	3(21)	5(36)	4(29)	2(14)
21-30 years	4(10)	6(15)	14(34)	17(41)
31-40 years	3(21)	2(14)	3(21)	6(43)
41-50 years	4(40)	1(10)	2(20)	3(30)
50+ years	2(33)	0(0)	2(33)	2(33)
<\$25,000	7(14)	11(22)	18(36)	14(28)
\$25,000-\$50,000	3(30)	2(20)	1(10)	4(40)
\$50,000-\$75,000	2(13)	1(7)	3(20)	9(60)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	3(50)	0(0)	2(33)	1(17)
Undergraduate Student	8(19)	9(21)	12(29)	13(31)
Graduate Student	0(0)	0(0)	2(67)	1(33)
High School Diploma	1(25)	1(25)	2(50)	0(0)
Technical Degree	0(0)	2(20)	2(20)	6(60)
Bachelor's Degree	4(33)	2(17)	2(17)	4(33)
Post Bachelor's Degree	3(21)	0(0)	5(36)	6(43)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	3(10)	6(21)	7(24)	13(45)
Dietetics	3(10)	10(34)	7(24)	9(31)
Other	2(22)	2(22)	0(0)	5(56)
Families	2(11)	2(11)	5(28)	9(50)
<20 years	1(7)	8(57)	1(7)	4(29)
21-30 years	4(10)	7(17)	13(31)	18(43)
31-40 years	3(21)	2(14)	2(14)	7(50)
41-50 years	2(20)	1(10)	2(20)	5(50)
50+ years	1(17)	2(33)	1(17)	2(33)
<\$25,000	4(8)	15(29)	13(25)	19(37)
\$25,000-\$50,000	3(30)	2(20)	1(10)	4(40)
\$50,000-\$75,000	2(13)	2(13)	1(7)	10(67)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	1(17)	1(17)	3(50)	1(17)
Undergraduate Student	6(14)	11(26)	10(23)	16(37)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	1(25)	2(50)	1(25)	0(0)
Technical Degree	0(0)	3(30)	0(0)	7(70)
Bachelor's Degree	2(17)	2(17)	3(25)	5(42)
Post Bachelor's Degree	2(14)	1(7)	4(29)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	4(14)	3(11)	5(18)	16(57)
Dietetics	4(14)	9(31)	6(21)	10(34)
Other	0(0)	2(22)	2(22)	5(56)
Families	0(0)	1(6)	4(22)	13(72)
<20 years	2(14)	6(43)	2(14)	4(29)
21-30 years	5(12)	5(12)	10(24)	21(51)
31-40 years	0(0)	2(14)	4(29)	8(57)
41-50 years	1(10)	0(0)	1(10)	8(80)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	7(14)	10(20)	12(24)	21(42)
\$25,000-\$50,000	0(0)	1(10)	2(20)	7(70)
\$50,000-\$75,000	0(0)	2(13)	1(7)	12(80)
\$75,000-\$100,000	1(25)	0(0)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	7(17)	9(21)	7(17)	19(45)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	0(0)	1(25)	2(50)	1(25)
Technical Degree	0(0)	2(20)	0(0)	8(80)
Bachelor's Degree	1(8)	1(8)	3(25)	7(58)
Post Bachelor's Degree	0(0)	2(14)	4(29)	8(57)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	2(7)	7(24)	6(21)	14(48)
Dietetics	3(10)	6(21)	12(41)	8(28)
Other	1(11)	3(33)	1(11)	4(44)
Families	1(6)	1(6)	2(11)	14(78)
<20 years	1(7)	4(29)	6(43)	3(21)
21-30 years	5(12)	8(19)	10(24)	19(45)
31-40 years	1(7)	2(14)	3(21)	8(57)
41-50 years	0(0)	1(10)	3(30)	6(60)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	4(8)	12(24)	17(33)	18(35)
\$25,000-\$50,000	3(30)	0(0)	1(10)	6(60)
\$50,000-\$75,000	0(0)	2(13)	2(13)	11(73)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	4(9)	12(28)	12(28)	15(35)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	1(25)	0(0)	2(50)	1(25)
Technical Degree	0(0)	1(10)	1(10)	8(80)
Bachelor's Degree	0(0)	2(17)	4(33)	6(50)
Post Bachelor's Degree	2(14)	2(14)	2(14)	8(57)

Demographic differences on beliefs on how eggs impacts ADHD symptoms.				
Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	1(3)	10(34)	4(14)	14(48)
Dietetics	2(7)	13(46)	6(21)	7(25)
Other	3(33)	1(11)	0(0)	5(56)
Families	1(6)	4(24)	3(18)	9(53)
<20 years	2(15)	8(62)	0(0)	3(23)
21-30 years	4(10)	12(29)	10(24)	15(37)
31-40 years	1(7)	3(21)	2(14)	8(57)
41-50 years	0(0)	4(40)	1(10)	5(50)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	4(8)	20(40)	10(20)	16(32)
\$25,000-\$50,000	3(30)	2(20)	0(0)	5(50)
\$50,000-\$75,000	0(0)	5(36)	1(7)	8(57)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	1(17)	1(17)	4(67)
Undergraduate Student	4(10)	17(40)	7(17)	14(33)
Graduate Student	0(0)	1(33)	1(33)	1(33)
High School Diploma	1(25)	2(50)	1(25)	0(0)
Technical Degree	0(0)	3(33)	0(0)	6(67)
Bachelor's Degree	0(0)	4(33)	2(17)	6(50)
Post Bachelor's Degree	2(14)	2(14)	2(14)	8(57)

Demographic differences on beliefs on how apples impacts ADHD symptoms.				
Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	13(46)	5(18)	10(36)
Dietetics	2(7)	15(54)	6(21)	5(18)
Other	0(0)	2(22)	2(22)	5(56)
Families	0(0)	3(18)	5(29)	9(53)
<20 years	2(14)	8(57)	2(14)	2(14)
21-30 years	0(0)	16(40)	9(23)	15(38)
31-40 years	0(0)	3(23)	3(23)	7(54)
41-50 years	0(0)	4(40)	3(30)	3(30)
50+ years	0(0)	2(33)	2(33)	2(33)
<\$25,000	2(4)	24(49)	10(20)	13(27)
\$25,000-\$50,000	0(0)	2(22)	2(22)	5(56)
\$50,000-\$75,000	0(0)	4(27)	3(20)	8(53)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	3(50)	1(17)
Undergraduate Student	1(2)	22(52)	8(19)	11(26)
Graduate Student	0(0)	0(0)	2(67)	1(33)
High School Diploma	1(25)	0(0)	3(75)	0(0)
Technical Degree	0(0)	3(33)	0(0)	6(67)
Bachelor's Degree	0(0)	2(18)	3(27)	6(55)
Post Bachelor's Degree	0(0)	6(43)	3(21)	5(36)

Table DD				
Demographic differences on beliefs on how tomatoes impacts ADHD symptoms.				
Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	0(0)	12(43)	4(14)	12(43)
Dietetics	2(7)	12(43)	7(25)	7(25)
Other	1(11)	2(22)	1(11)	5(56)
Families	0(0)	2(12)	4(24)	11(65)
<20 years	2(15)	6(46)	3(23)	2(15)
21-30 years	1(3)	14(35)	9(23)	16(40)
31-40 years	0(0)	4(29)	2(14)	8(57)
41-50 years	0(0)	2(20)	3(30)	5(50)
50+ years	0(0)	2(33)	0(0)	4(67)
<\$25,000	2(4)	19(39)	13(27)	15(31)
\$25,000-\$50,000	1(10)	3(30)	0(0)	6(60)
\$50,000-\$75,000	0(0)	3(21)	2(14)	9(64)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	0(0)	2(33)	1(17)	3(50)
Undergraduate Student	2(5)	18(44)	9(22)	12(29)
Graduate Student	0(0)	0(0)	1(33)	2(67)
High School Diploma	1(25)	0(0)	3(75)	0(0)
Technical Degree	0(0)	1(11)	1(11)	7(78)
Bachelor's Degree	0(0)	4(33)	1(8)	7(58)
Post Bachelor's Degree	0(0)	5(36)	2(14)	7(50)

Demographic Data	Increase n(%)	Decrease n(%)	No Impact n(%)	Do Not Know n(%)
Education	3 (10)	7(24)	6(21)	13(45)
Dietetics	11(38)	6(21)	7(24)	5(17)
Other	1(11)	3(33)	0(0)	5(56)
Families	2(12)	2(12)	3(18)	9(59)
<20 years	7(50)	5(36)	1(7)	1(7)
21-30 years	7(17)	6(15)	11(27)	17(41)
31-40 years	1(7)	3(21)	2(14)	8(57)
41-50 years	1(10)	2(20)	2(20)	5(50)
50+ years	1(17)	2(33)	1(17)	2(33)
<\$25,000	13(25)	10(20)	12(24)	16(31)
\$25,000-\$50,000	2(20)	2(20)	0(0)	6(60)
\$50,000-\$75,000	0(0)	3(21)	3(21)	8(57)
\$75,000-\$100,000	0(0)	1(25)	1(25)	2(50)
\$100,000+	2(33)	2(33)	1(17)	1(17)
Undergraduate Student	13(30)	9(21)	8(19)	13(30)
Graduate Student	0(0)	0(0)	2(67)	1(33)
High School Diploma	1(25)	1(25)	2(50)	0(0)
Technical Degree	0(0)	1(11)	1(11)	7(78)
Bachelor's Degree	2(17)	2(17)	2(17)	6(50)
Post Bachelor's Degree	1(7)	5(36)	2(14)	6(43)