

Knowledge About Organic Food Choices and Reported Eating Patterns of High School
Students

by
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Approval Page

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Abstract

Knowledge About Organic Food Choices and Reported Eating Patterns of High School Students, Jane Tobal, 2019: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: diet, knowledge, high school students, organic, GMO, glyphosate.

This research study was conducted to determine the factors that drive high school student's decisions about their diet choices. The analysis was conducted to determine what factor(s) had the greatest impact on that determination. Evidence was obtained that both knowledge and peer pressure may affect student decisions about making healthy food choices. The chosen diets under investigation were those of organically grown foods versus commercially grown foods. Organic foods do not contain GMO's or glyphosate.

The survey separated the students into three groups: Group 1, those who already adhered to an organic diet; Group 2, those who desired to eat organically; and Group 3, those who had no desire to eat organically.

The statistical analyses indicated that knowledge played a significant role in diet choices. The statistics showed a significant difference in knowledge regarding glyphosates and GMO's indicating that the organic group and those who desired to eat organically had significantly more knowledge about these substances than those who had no interest in an organic diet. Peer pressure was a significant issue among about 35% of the sample surveyed, but an omnibus test for dietary group differences failed to show conventional levels of statistical significance.

The analysis between students who were born inside and outside the USA showed that foreign born students tended to be less informed about GMO's and Glyphosates than those born in the USA. No significance was found from the groups when asked if they had knowledge about these substances from home.

The conclusions based on the results from this statistical analysis indicate that knowledge appears to be the single most significant factor associated with attitudes about healthy diet choices made among high school students. These findings were consistent with the Information Deficit Model which would assume that attitudes toward eating habits are intimately tied to the knowledge that students possess about healthy food choices.

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Chapter 1: Introduction

Knowledge About Organic Food Choices and Reported Eating Patterns of High School Students

The persistent problem that is being observed in classrooms today is the vast number of students that are on medication for behavioral issues, depression and/or learning disabilities. Nearly half of the student body in all my classes have special written documentation about how to accommodate these individuals. When students who are on medications or those with accommodations are questioned about their diet, specifically, if they have ever considered changing their diets to try to overcome their disabilities, the majority feel the idea of organic is just a marketing ploy, holds no scientific justification and will have no effect on their health. These same individuals also miss more school days than their organic peers (those students who choose a more organic diet) due to either physical illness or emotional issues. When students who are without accommodations and are well behaved are asked if they adhere to any special dietary plans, many claim to be eating organically. These students claim that they bring their lunch to school and stay away from the foods offered through the school cafeteria as well as in the vending machines, which do not offer any organic options for the students.

The problems that I am observing in my classrooms appears to be a nationwide dilemma. In the publication, *Primary Sources: America's Teachers on the Teaching Profession*, released by Scholastic and the Bill & Melinda Gates Foundation, it was reported that there has been an increased level of behavior problems seen across all grade levels: 68 percent of elementary teachers, 64 percent of middle school teachers, and 53 percent of high school teachers say the same (Scholastic and Bill & Melinda Gates

Foundation, 2012). These problems distract the entire class, behavior issues distract from learning and requires the teacher to reallocate academic instruction time to disciplinary issues which prevents students from achieving as much as they could. (Scholastic and Bill & Melinda Gates Foundation, 2012)

According to Dr. Mercola (Mercola, 2013) there has been a 22 percent rise in ADHD (Attention Deficit Hyperactivity Disorder) since 2003. That translates into one in ten children in the United States who are currently diagnosed with this disorder. ADHD symptoms include inattentiveness, hyperactivity, and impulsive behaviors. These children often struggle in school and have socialization difficulties. Glyphosate-contaminated food has recently been implicated in the dramatic rise of both ADHD and autism, the latter of which is clearly more difficult in terms of behavioral issues (Mercola, 2013).

Depression is also on the rise among school teens which has unfortunately seen an extreme spike in suicide rates. The present rate of suicide among teenage girls between the ages of 10 and 14 has experienced a threefold increase over the past 15 years (Bray, 2016). Research studies have compared the western diet that school children in the United States are exposed to with the Mediterranean and Japanese traditional diets. The results of the comparisons were that the children eating the Mediterranean and Japanese traditional diets had 25% to 35% fewer cases of depression. These same diets also provided more fruits and vegetables which ended up decreasing the obesity rates as well (Kosti, et al., 2013; Hopf, 2011). Another study done in Germany by Michael Macht (Macht, 2008) found similar results when doing clinical studies regarding food choices (those that ate more fruits and vegetables) and emotional health.

The profound apathy among my students regarding their unhealthy dietary

patterns is disturbing so this research was designed to discover the root of that indifference. In the United States the only peer reviewed study that comes up regarding high school students and their dietary practices deals solely with what they eat and does not include any reference about the sources of the food or as to why it is occurring (Calderon, Jambazian, & Yu, 2004). There are numerous studies that have been done in China, the United Kingdom, Thailand, Turkey and Hong Kong to understand the relationship regarding attitude and diet. (Banjari , Mandić, & Milosavljević, 2015; Özfer Özcelik & Uçar, 2008; Huang & Sangkumchalianga, 2012; Hu, Shen, & Sun , 2015; Gibney, Hearty, Kearney, & McCarthy, 2006). In the study that took place in China, the researchers found that nearly the entire school population was eager to improve their diet. The study also indicated the students had a great desire to receive education about attaining the knowledge required to achieve that goal. There is a gap in the literature for this type of research study being conducted in the United States.

In the British study concerning attitudes or motivation towards eating healthily, the researchers found a paradoxical relationship between what was scientifically known about food and what perceptions about that science was (Gibney, Kearney, & McCarthy, 2006). This phenomena with the British study was in direct correlation with my personal observations. The prior studies mentioned above tend to concur that knowledge regarding organic food practices increases organic food consumption. These studies also tend to agree that knowledge is lacking among those individuals that are unconcerned about their diet. I have personally found that many of my students who feel that they are knowledgeable about the subject of organic foods, feel that there is really no difference between regular foodstuffs and organic foods. Some of my students have even informed

me that they were led to believe that GMO's have been proven to be equivalent to non-GMO foods and that they are perfectly healthy and safe to eat. These students explained that they are being taught this information as fact.

Further observations in my classroom have shown that those students who are indifferent about their diet tend to have more behavior problems and are absent more frequently than those who are concerned about their diets, as well as having difficulty concentrating in school. In 2013 the Sausalito Marin City School District created a pilot program to test the efficacy of an organic diet on 156 students. The pilot program served students that attended Bayside MLK Jr. Academy in Marin City, California. Upon the conclusion of the 2-year study, the program's researchers witnessed a great decrease in behavior issues, fewer absences and increased socialization among the participants (EcoWatch, 2015). There has been no statistical research done that follows this observational analysis to document the results of the intervention. It is a new practice so, perhaps those studies will appear in the near future.

Learning and memory are very important factors in determining a student's success in school. A study published in the October Journal of Neuroscience identified the source of the learning difficulties to the immune system (Bilbo & Schwarz, 2012). Bilbo showed that illnesses that trigger immune responses (all illnesses trigger an immune response) slow down a person's cognitive abilities. The correlation between food intake and cognitive abilities will be addressed in the literature review. Another study that tested IQ after mealtimes provided evidence that a poor diet in early childhood may be associated with small reductions in IQ in later childhood, conversely a healthy diet (more fruits and vegetables) appeared to be associated with small increases in IQ

(Emmett, Joinson, C, Ness, Northstne, & Paus, 2011).

A study published in the British Journal of Nutrition that explored the connection between nutritional knowledge and food choices found that participants with increased knowledge did make better food choices (Burdon, Kullen, O'Conner, & Spronk, 2014). The study researchers reviewed mass quantities of data from prior studies and found that while the majority of the studies conveyed a weak association it was still a positive relationship between nutritional knowledge and the food choices that were made. The only study that has been done in the United States was undertaken in 1974, long before G.M.O.s were introduced into the food supply (Schwartz, 1975). Furthermore, the study was administered only to high school graduates (Swartz, 1974).

The audience who will be affected by my study will include the students themselves, their parents, their teachers, the schools, and the community at large. The reason the community at large will benefit from this study is due to the enormous cost that the entire population now incurs due to uneducated children who enter the workforce. When a student's ability to be healthy, to socialize and to comprehend the lessons being taught is comprised, the education system fails, and they tend to drop out of school (Rumberger, 2013). The unemployment rate is highest among high school dropouts as compared to a high school graduates (Statista, 2018).

Researcher's Role

A short questionnaire survey was provided by the researcher, Appendix A, which addressed some of the most pervasive issues today that address student knowledge and attitude about a healthy diet. The survey was analyzed to determine the level of knowledge, misconceptions and concern about these factors that are assumed by high

school students. The survey was distributed amongst a wide variety of students so to comprise a segment from every type of student in the school. The use of a cross section of students provided a balanced survey of the entire student population for the study.

Purpose of the Study

The purpose of this Quantitative descriptive and correlational research study was employed to assess the degree of concern held by many American students regarding their dietary choices using a survey approach. The purpose for this design was to objectively analyze data collected to reveal the reason for the attitudes among high school students today regarding their diet. The questionnaire developed was employed to separate the student population into three distinct groups; those who already adhered to an organic type of diet, those who do not eat organically but would like to, and those who don't eat organically and have no interest in eating organically. The study was created to gain an understanding regarding any correlation between nutritional knowledge and reported healthy food choices among high school students. The focus of the study was to determine the variables of greatest significance that determine the diet choice differences between the three groups. One reason for this the focus was to gain a clear understanding for determining the reason for the lack of connection that third group has between science fact and belief and/or apathy.

Problem Statement

There is a need to better understand what factors are associated with the attitudes that high school students have regarding their food choices. It is unclear whether students' food choices are due to being either completely unaware of the long-term outcome of their dietary habits or perhaps due to a reluctance to change? The mind

does not always follow the facts (Varol, 2017). Varol goes on to assert that doubt is often unresolved even with facts, no matter how true they may be. It appears that when a person's beliefs are challenged there is a tendency for them to ignore or undervalue evidence that is contrary to those beliefs. Selective thinking takes over, leading to a systematic error of inductive reasoning. The purpose of this research was to explore the potential reasons for why high school students make healthy versus unhealthy food choices.

Definition of Terms

Glyphosate: Glyphosate is the primary active constituent of the commercial pesticide Roundup. The present results show that acute Roundup exposure at low doses (36 ppm, 0.036 g/L) for 30 min induces oxidative stress and activates multiple stress-response pathways leading to Sertoli cell death in prepubertal rat testis. The pesticide increased intracellular Ca^{2+} concentration by opening L-type voltage-dependent Ca^{2+} channels as well as endoplasmic reticulum IP3 and ryanodine receptors, leading to Ca^{2+} overload within the cells, which set off oxidative stress and necrotic cell death (PubChem Compound Database, 2018).

GMO's: Genetically modified organisms (GMOs) can be defined as organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination. The technology is often called "modern biotechnology" or "gene technology", sometimes also "recombinant DNA technology" or "genetic engineering". It allows selected individual genes to be transferred from one organism into another, also between nonrelated species. Foods produced from or using GM organisms are often referred to as

GM foods (WHO, 2014).

Immune response: The immune response is how your body recognizes and defends itself against bacteria, viruses, and substances that appear foreign and harmful. The immune system protects the body from possibly harmful substances by recognizing and responding to antigens. Antigens are substances (usually proteins) on the surface of cells, viruses, fungi, or bacteria. Nonliving substances such as toxins, chemicals, drugs, and foreign particles (such as a splinter) can also be antigens. The immune system recognizes and destroys, or tries to destroy, substances that contain antigens (MedlinePlus, 2018).

Oxidative stress: occurs when there's an imbalance between free radical activity and antioxidant activity. When functioning properly, free radicals can help fight off pathogens. Pathogens lead to infections. When there are more free radicals present than can be kept in balance by antioxidants, the free radicals can start doing damage to fatty tissue, DNA, and proteins in your body. Proteins, lipids, and DNA make up a large part of your body, so that damage can lead to a vast number of diseases over time. (healthline.com, 2018) Oxidative stress is a common feature in many diseases including diabetes complications, cardiovascular disease, neurodegenerative disease, cancer, renal disease and others (Kouretas, Tsatsakis, & Veskokoukis, 2011).

Diabetes mellitus: Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerves.

There are two principle forms of diabetes:

Type 1 diabetes (formerly known as insulin-dependent) in which the pancreas fails to produce the insulin which is essential for survival. This form develops most frequently in children and adolescents but is being increasingly noted later in life.

Type 2 diabetes (formerly named non-insulin-dependent) which results from the body's inability to respond properly to the action of insulin produced by the pancreas. Type 2 diabetes is much more common and accounts for around 90% of all diabetes cases worldwide. It occurs most frequently in adults but is being noted increasingly in adolescents as well (WHO, 2018).

Organic: The use of genetic engineering, or genetically modified organisms (GMOs), is prohibited in organic products. This means an organic farmer cannot plant GMO seeds, an organic cow can't eat GMO alfalfa or corn, and an organic soup producer can't use any GMO ingredients. To meet the USDA organic regulations, farmers and processors must show they are not using GMOs and that they are protecting their products from contact with prohibited substances from farm to table (USDA, 2018). The use of most synthetic pesticides and fertilizers, growth hormones, sewage sludge, irradiation, and genetic engineering (genetically modified organisms or GMOs) are prohibited (USDA, 2018). Current USDA NOP (National Organic Program) standards do not allow the use of the herbicide glyphosate on organic crops (Shilhavy, 2018).

Organophosphates: Organophosphates are insecticides, such as diazinon, chlorpyrifos, disulfoton, azinphos-methyl, and fonofos. They have been used widely in agriculture. The German military developed these substances as neurotoxins in World War II. They function as cholinesterase inhibitors, thereby affecting neuromuscular transmission

(Dyro, 2016).

Organophosphates are efficiently absorbed by inhalation and ingestion. They poison primarily through phosphorylation of the acetylcholinesterase enzyme (AChE) at nerve endings. The enzyme is critical to normal control of nerve impulse transmission from nerve fibers to smooth and skeletal muscle cells, secretory cells and autonomic ganglia, and within the central nervous system (Reigart & Roberts, 2018). Once a critical proportion of the tissue enzyme mass is inactivated by phosphorylation, symptoms and signs of cholinergic poisoning become manifest. Symptoms are: headache, hypersecretion, muscle twitching, nausea, diarrhea, vomiting, tachycardia/bradycardia, bronchospasm/ bronchorrhea, respiratory depression, seizures (esp. pediatric), and a loss of consciousness. (Reigart & Roberts, 2018)

Chapter 2: Literature Review

My area of research involved understanding the lack of motivation to eat a healthy diet among many high school children in the public schools. There has been a significantly growing rate of medicated students in the public schools (Brenner, 2018; Thompson, 2018) which may be linked to choices they are making about their diet (Abrahamson, Leu, Swanson, & Wallet, 2014). Diet is emerging as a possible driving force for exacerbating symptoms of ADHD (Barnard, Pellow and Solomon, 2011). This points to one reason why a students' food choices are is so important. In my classrooms, I have found that healthy students are often more aware of the dangers of many of today's popular foods and try to avoid them. The students that are medicated with a variety of conditions articulate assuredly that there is no difference between organically grown food stuffs and commercially grown products that are more economical and widely consumed.

Theoretical Framework

The theoretical framework structure of this research study is the theory referred to as the information deficit model. This theory is also referenced as the science literacy/knowledge deficit model. This model attributes indifference about scientific knowledge to a lack of information about the issue being addressed. Cacciatore, Madden and Simis (2016) state further that this model suggests that a focus on improving effective communication of science may help to improve the understanding of information received from experts to those who are not experts.

Consistent with information deficit model, the theoretical framework for this quantitative research study was designed to investigate any correlations between a student's knowledge about GMO's, glyphosates, and milk as it relates to possible impacts

concerning their food choices. The information deficit model would predict that attitudes toward healthy eating habits is intimately tied to the knowledge the students possess. Quantitative research uses deductive reasoning to uncover the reasons for an effect. There is a gap in prior research studies for this type of inquiry. There are two studies that have been conducted, one in Canada and one in Britain, that were conducted to understand the public's perception of what constitutes a healthy diet (Paquette, 2015; Gibney, Kearney, & McCarthy, 2006). Both research teams determined that there was a definite difference between the reality of a healthy diet and the perceptions of a healthy diet among the populations referenced. Neither of these studies addressed whether knowledge made a difference in food choices among their populations and neither one addressed the issues of GMO's, glyphosate or milk. The design of my study was small in scope, so it easily located correlations between knowledge and food choices of the items in question among the student populations.

The study conducted in Canada by M. Paquette (Paquette, 2005) focused on discovering what a healthy diet meant to the public at large in Canada. The author wanted a clearer understanding of what factors influenced the eating patterns of the citizens. She felt that the perceptions people had about what constituted a healthy diet would be considered to be one of the many factors that influences people's dietary habits. Paquette was determined to uncover where the perceptions regarding healthy food originated and how those perceptions affected the dietary choices that were made. She wanted to uncover the perceptions of the population under observation because she found there was a difference between the reality of a healthy diet and the perceptions the population had regarding a healthy diet. (Paquette, 2005)

A large study was conducted in Iran (Fakhri, et al., 2014) among elementary and junior high school students to determine if nutritional knowledge made a difference in the food choices of those students. The purpose of their research was twofold, to evaluate nutritional knowledge and the dietary habits of primary and junior high school students in a specific province and to uncover any differences that gender may have with those habits. The research results indicated that the even though there were differences among the groups regarding nutritional knowledge, that those students who had greater knowledge did not practice better eating habits. (Fakhri, et al., 2014)

The American public school system provides balanced meals for their student population; however, the foods sources are not considered. The foods that are offered for breakfast are not organic, which means they include GMO's and glyphosates. Both of these substances have been banned in numerous countries across the globe (Genetic Literacy Project, 2018) (Organic Consumers Association, 2018). Furthermore, the independent research studies that I have found revealed a growing body of evidence that demonstrated the link between cognitive, behavioral and emotional well-being with the diet options that are presently made available to the students in public schools.

The literature review begins with evidence that explains why it is important to look for independent research. Independent research is that research that has been undertaken by individuals or groups who have no link to the food industry financially. An article by Pietrowski (Pietrowski, 2017) in Waking Times refers to a quote by a Lancet editor who claims that possibly as much as half of the scientific literature today may be false due to corruption. That corruption is due to industry-funded nutrition studies with conflicts of interest which reach conclusions that favor those same industries (Belluz,

2016). This Waking Times article also references a quote by Dr. Marcia Angell, Editor-in-Chief of the New England Medical Journal where she states that after two decades as the editor for the Journal that she is sad to report that it is no longer conceivable to have confidence in much of the clinical research that is being published today (Pietrowski, 2017).

The Center for Public Integrity (2015) explains that due to an old loophole in a 57-year-old law, companies are allowed to add substances to their food without consulting with the Food and Drug Administration (FDA) about possible health dangers from those substances (Quinn & Young, 2015). The authors explain further that the original intention of the law was to provide the ability for food manufacturers to add common ingredients like table salt and vinegar to their products without a long safety-review procedure. Today, the food manufacturers are applying that law to any product that they determine is “generally recognized as safe”. The food manufacturer is not required to ask the FDA for approval since the manufacturer has claimed that the substance is safe. (Quinn & Young, 2015)

The Executive Director of the Center for Food Safety, Andrew Kimbrell stated; “The FDA has placed the interests of a handful of biotechnology companies ahead of their responsibility to protect public health” (Center For Food Safety, 1998). Beth H. Harrison, author of *Shedding Light on Genetically Engineered Food* elucidates that a 1992 Statement of Food Policy by the FDA claimed, “Ultimately, it is the food producer who is responsible for assuring safety” (Harrison, 2008). The website, *GMO Awareness*, reveals that in April of 2011, the FDA approved the ability of Monsanto to do their own

impact studies on the novel GMO products they were developing which was pronounced by Science Direct as a conflict of interest in that same month (GMO Awareness, 2011).

The Environmental Working Group, a non-profit organization, explains that The Pew Research Center found that 54 percent of the chemicals that are added to our food have never undergone basic safety tests that are recommended by the FDA. The FDA allows the additive industry itself to submit their own paperwork stating that their chemicals are safe to be added to food after short term testing (Undurraga, 2013). Pew's analysis revealed that the type of testing recommended by the FDA has not been done on 88 percent of chemicals that are of "elevated concern" for reproductive and developmental toxicity.

The organization, U. S. Right To Know, explains that the FDA itself does not actually test whether genetically engineered foods are safe (Ruskin, 2015). The article also explains that citizens of Germany and Switzerland won't allow farming of BASF, Bayer (Monsanto) and Syngenta's GMO seeds due to the health and environmental risks of GMOs, (Ruskin, 2015). On the FDA's website there is a letter which ultimately states, "it is Monsanto's continuing responsibility to ensure that foods marketed by the firm are safe, wholesome, and in compliance with all applicable legal and regulatory requirements" (Keefe, 2018).

In a recent legal case, the jury ordered Monsanto to pay \$289M to Dewayne Johnson in the California Roundup trial. Mr. Johnson contracted non-Hodgkin's lymphoma caused by his exposure to the glyphosate-based herbicide Roundup (Arkin, 2018). In this same article, the Associated Press quoted Robert F. Kennedy, Jr. (2018), "The jury found Monsanto acted with malice and oppression because they knew what

they were doing was wrong and doing it with reckless disregard for human life," Kennedy, was a member of Johnson's legal team. According to Reuters, there are approximately 8,000 U.S. lawsuits that are presently being brought against Bayer's (BAYGn.DE) newly acquired Monsanto due to the suspected cancer risks of glyphosate-based weed killers (Reuters, 2018).

One of the most important cases that exposed the corporate manipulation of research was that of Gilles-Éric Séralini and his team (GMOSeralini, 2012). Séralini, a French molecular biologist, and his team presented data taken from a two-year feeding study using rats that were fed GMO corn with glyphosates. A journalist declared that this study was fraudulent, so the scientific community retracted his research (Healthy Holistic Living, 2016). After a three-year battle, the 17th Criminal Chamber of the High Court of Paris required the journalist to pay a fine for public defamation of the researchers, and also confirmed that Séralini and his team's research was valid. This was the first, and at that time the only, study ever conducted on GMO's and glyphosates outside of Monsanto's own laboratories. Prior to this study, no studies were conducted for more than 91 days, and all in house, by Monsanto researchers (Dudek, Hammond, Lemen, & Nemeth, 2004; Burns, et al., 2005; Dudek R., Hammond, Lemen, & Nemeth, 2006).

Séralini's study covered a two-year span. It was concluded in that study that when ingesting GMO's with glyphosate that all treated groups died 2-3 times more often than the controls. The study revealed that female rats developed large mammary tumors and that the pituitary was the second most disabled organ, the sex hormonal balance was also found to be modified. In the male rats, liver congestions and necrosis were higher and there were severe kidney nephropathies. Male rats also presented 4 times more large

tumors than the controls. The researcher's biochemistry data established very significant chronic kidney deficiencies for all treatments and both sexes (Clair, et al., 2006).

An article written by Joan Conrow in Alliance for Science claims that European studies have refuted the claims put forth by Séralini's research study (Conrow, 2018). It must be noted that the studies referenced were conducted by Grace and G-TwYST. In examination of these research groups it was found that the research was dominated by a "specific group of scientists, who all have a well-established relationship with each other" and that they "also had affiliations with industry or organizations funded by industry" (Test Biotech, 2018). Test Biotech also explains that the European studies are not comparable with the previous rat feeding study using the same maize line because the G-TwYST study used a different rat strain and employed a different design to the original study (Test Biotech, 2018).

The areas that were dealt with in this investigation cover a few of the reasons that addressing GMO's and glyphosate in the diet is so very important for our school age children. The knowledge questions were limited for efficacy, they dealt with specific dangerous, yet prevalent, components in today's conventional diet. The sections provided the scientific research behind the potential for each of these items that may exacerbate a student's absences from school, behavioral issues, and cognitive abilities. These items were broken down into four sections. The first three sections delved into the three knowledge questions on the student survey. The last section looked at the initial question which separated the students into the three groups, those that eat organically, those that wish they could eat organically and those who do not care.

GMO's

David Suzuki, deceased in 2011, was a professor in the department of genetics at the University of British Columbia, also a host of science and environmental television and radio programs in Canada was quoted as stating, “Any politician or scientist who tells you these products are safe is either very stupid or lying” (Genetic Literacy Project, 2018). In the US, GMO's are said to be substantially equivalent to their non-GMO counterparts (GMO Science, 2018). However, one research study done on soybeans resulted in the conclusion that there was a substantial non-equivalence between conventional soybeans and their GMO counterparts (Bøhn, Cuhra, Fagan, Sanden, & Traavik, 2014). This research also provided information that showed organic soybeans to have the healthiest nutritional profile with significantly more total protein and zinc than both conventional and GM-soy. A similar research study was done with corn by an independent group of scientists from Egypt who reached similar conclusions. Abdo, Barbary, and Shaltout (2014) found the GMO corn to have significant differences from conventional corn, finding it to be inferior in quality as well as causing liver damage in the rats that were fed the corn (Abdo, Barbary, & Shaltout, 2014).

The Environmental Working Group reported that \$28.3 million dollars was spent to prevent GMO labeling by lobbyists in the first two quarters of 2014 (Foley, 2015). It was further disclosed that a total of \$63.6 million was applied to prevent GMO labeling in 2014.

In a research study published in 2016, GMO corn (NK603) was compared to its non-GMO counterpart in a peer-reviewed study. The researchers (Agapito-Tenfen, et al., 2016) found that it was not substantially equivalent. The study revealed major

compositional differences between it and its non-GMO relative. The researchers found that 117 proteins and 91 metabolites had their levels altered in the genetic manipulation process even though only one new protein was created in the transgene insertion. Of those alterations one specific protein and 31 metabolites were significantly altered. The research results on the rodents showed troubles in energy utilization, oxidative stress and large increases in specific substances that perform critical functions in living cells (Agapito-Tenzen, et al., 2016). The study by Agapito-Tenzen, et al (2016), gives possible explanations for the study done in 2014 by Séralini, et al which found that the GMO corn biochemical analyses confirmed very significant chronic kidney deficiencies subsequent to a two-year analysis period (Clair, et al., 2014). The research by Clair, et al, also stated that their research revealed that the males in the study presented up to four times more large palpable tumors which started 600 days earlier than in the control group, where only one tumor was noted. The researches stated that these results may be explained by the non-linear endocrine-disrupting effects of Roundup as well as by the mutational effects in the GM maize and their metabolic consequences (Clair, et al., 2014).

Dr. Antoniou (2016) from the above-mentioned study regarding rodents fed GMO corn, explained that one of the important things that came out of the study was the increased risk factor for non-alcoholic fatty liver disease which he felt needed to be recognized by the medical establishment (Agapito-Tenzen, et al., 2016). An unrelated research study discovered a rising trend in non-alcoholic fatty liver disease in adolescents (Beardis & Sokal, 2013). Beardis and Sokal (2013) further emphasized that fatty liver disease is an increasing public health issue that is underdiagnosed and crucial to treat as early as possible in order to avoid the progression of the disease which can lead to end-

stage liver disease. It is interesting to note here that Antoniou (2016) found that feeding GMO corn to rats increased their risk factor of fatty liver disease.

A prior research study found that children with Autism had an increased vulnerability to oxidative stress which they concluded may be a contributing factor to the development of autism (Cutler, et al., 2004). Oxidative stress solicits an immune response and has been implicated in many diseases and has been considered to be a possible cause of disease (NutritionReview.org, 2015).

A discovery from the University of Virginia, School of Medicine raised basic questions about human behavior because researchers there uncovered evidence that the immune system directly controls a person's social behavior, including their desire to interact with their peers (Barney, 2016). The implications of this are that immune system problems will contribute to a student's inability to have normal social connections. They explained that these findings can have pronounced implications for conditions like autism-spectrum disorders. (Barney, 2016)

The immune system is just one of the dangers regarding GMO's. Another issue is that the majority of GMO's are specifically designed to work with pesticides that contain glyphosate (GMO-Awareness, 2017). There is evidence from scientific studies regarding the danger of the combination of the two. According to Dr. Nancy L. Swanson:

"Prevalence and incidence data show correlations between diseases of the organs and the increase in Genetically Modified Organisms (GMOs) in the food supply, along with the increase in glyphosate-based herbicide applications. More and more studies have revealed carcinogenic and endocrine disrupting effects of Roundup at lower doses than those

authorized for residues found in Genetically Modified Organisms. The endocrine disrupting properties also lead to neurological disorders (learning disabilities (LD), attention deficit hyperactive disorder (ADHD), autism, dementia, Alzheimer's, schizophrenia and bipolar disorder). Those most susceptible are children and the elderly." (Mercola, 2013)

The countries that have banned both GMO cultivation and imports as of 2016 are: Algeria, Bhutan, Kenya, Kyrgyzstan, Madagascar, Malta, Moldova, Peru, Russia, Ukraine, Venezuela, and Zimbabwe (Genetic Literacy Project, 2018). The countries that have banned only the cultivation of GMO products are: Austria, Azerbaijan, Belize, Bosnia, Bulgaria, Croatia, Cyprus, Denmark, Ecuador, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Northern Ireland, Scotland, Wales, Norway, Poland, Saudi Arabia, Serbia, Slovenia, Switzerland and Turkey (Genetic Literacy Project, 2018).

There are also some regions that have prohibited the cultivation of GMO's. They are: Tasmania, Australia, South Australia, Australia, Wallonian Region, Belgium, Montville County, Maine, Boulder County (and Boulder City), Colorado (planned ban on GMO corn and sugar beets on county-owned land by 2019 & 2021 respectively), San Juan County, Washington state, and in California, Humboldt (and Arcata City), Marin, Mendocino (and City of Point Arena), Trinity and Santa Cruz (Genetic Literacy Project, 2018). Russia will only allow GMO's in their country for scientific research (Genetic Literacy Project, 2018).

Glyphosate

A research study published in 2007 found strong human epidemiological evidence for persistent nervous system damage that followed acute intoxication with organophosphates (Firestone & Keifer, 2007). The researchers of this study felt that further investigation was necessary to determine whether persistent nervous system damage would follow chronic low-level exposure to pesticides. Subsequently, a research study was conducted in 2011 to examine whether chronic exposure to glyphosates at lower levels could adversely affect children's cognitive development (Barr, et al., 2011). The researcher's wanted to examine associations between prenatal and postnatal exposure to organophosphate pesticides and cognitive abilities in school-age children. The research concluded that prenatal urinary organophosphate concentrations were associated with poorer intellectual development in 7-year-old children (an average deficit of 7.0 IQ points) even though the maternal urinary concentrations were within the range of levels measured in the general U.S. population (Barr, et al., 2011).

In March of 2015, The World Health Organization (WHO) found sufficient evidence to re-classify the carcinogenicity of glyphosate (commonly known as Roundup) and four other organophosphate pesticides (malathion, diazionon, tetrachlorvinphos and parathion). The reclassification was based on a review of current evidential research. The International Agency for Research on Cancer (IARC), an agency under WHO, upgraded the carcinogenic status of the herbicide glyphosate from a 2B carcinogen (a possible carcinogen) to a 2A carcinogen (a probable carcinogen) (SafeWork NSW, 2015).

A similar study to the organophosphate study above conducted by Barr, et al, conducted by a predominantly different team of scientists, including Barr, concluded that their findings also indicated that prenatal exposure to organophosphates was negatively associated with cognitive development, essentially perceptual reasoning, with evidence of those effects starting at 12 months and then continuing through early childhood (Barr, et al., 2011). This particular study examined children's cognitive development at the ages of 12 and 24 months and then again at 6-9 years of age. An earlier study in 2007 by a diverse group of researchers reported that elevated prenatal levels of organophosphates showed adverse associations with mental development and pervasive developmental problems at 24 months of age in Mexican children (Barr, et al., 2007).

Research conducted by Bernard Weiss of the Department of Environmental Medicine, University of Rochester School of Medicine and Dentistry, Rochester, New York, posited that due to the pronounced vulnerability of the developing brain to most neurotoxicants, that children will exhibit even more pronounced responsiveness to the neurotoxic properties of pesticides than adults (Weiss, 2000). He also stated that latent toxicity, also regarded as silent toxicity, may not become apparent until additional challenges are added to their functions, such as the demands of the classroom as well as aging (Weiss, 2000).

In a research study by Sultatos, (Sultatos, 1994) he explains that the extensive use of organophosphorus compounds utilized in pesticides and herbicides has led to numerous poisonings of unintended species, including many human fatalities. This unintended affect was explained as the result from the inhibition of the enzyme acetylcholinesterase which in turn led to the acute mammalian toxicity associated with

the exposure to organophosphorus pesticides. Dr. Lester Sultatos explained further that other toxicities, some of which are life-threatening are not related to acetylcholinesterase inhibition, yet they have been witnessed following exposure to organophosphorus compounds.

Reuter's reporter, Gillam (2011), conducted an investigation regarding the use of Roundup in two farming regions of the United States. In that investigation she spoke with the head of the agricultural chemicals team of the U.S. Geological Survey Office, P. Capel, about the outcomes of his studies in the farming regions of Mississippi and Iowa. Capel documented the consistent occurrence of glyphosate (an organophosphate) in every stream and rain sample examined over a 2-year period in both Mississippi and Iowa. He went on to explain that people are being exposed to this toxic chemical through the air that they breathe. Gillam (2011) also included the information that in the 15-year period from 1992 to 2007 that glyphosate use, through Monsanto's Roundup, had increased from 11,000 tons to 88,000 tons per year.

A study published in *Pediatrics* (Bellinger, Bouchard, Weisskopf, & Wright, 2010) was designed to examine the association between the concentrations of metabolites of organophosphates (OPs) and attention deficit/hyperactivity disorder (ADHD) in children age 8 to 15. The statistical results found that children with higher urinary concentrations of OPs, were more likely to be diagnosed as having ADHD. They determined that their conclusions supported their hypothesis that organophosphate exposure, at levels common among US children, may be contributing to ADHD prevalence (Bellinger, Bouchard, Weisskopf, & Wright, 2010).

Brett Cherry had a study published in *Science in Society* that investigated the

numbers associated with any increase in herbicide (glyphosate) use which may reflect the increased production of herbicide resistant GMO crops. Cherry discovered that according to statistics from the US Department of Agriculture (USDA) that in one year, from 2007 to 2008 herbicide use increased by 383 million pounds (Cherry, 2010). Cherry attributes the increased use of herbicides to the increased production of herbicide tolerant crops (GMO's). Cherry's research also showed that data from the US National Agriculture Statistics Service (NASS) indicated that between 1996 and 2008, that GM soybeans alone accounted for 92 percent of the increase in herbicide use (Cherry, 2010).

When reviewing research, it appears that there are some serious flaws in both the EU and the US regulatory processes. The present system does not require evaluations by independent researchers, the regulatory process is allowed to use the industry's own studies, exclusively. This poses an ethical issue when considering the extreme conflict of interest that resides in the data presented to the boards. It was interesting to discover that there has been systematic dismissal of international research studies by US science publishers that indicated any ties between glyphosate exposures and health risks. I uncovered a research article in the National Institutes of Health that was to review research studies done in Argentina among the farming communities. The researchers decided that even though there were extraordinarily high incidences of ADHD and birth defects where the glyphosate was used that those results were considered 'elusive' and could not conclusively be linked to glyphosate exposure (Araujo, Delgado, & Paumgarten, 2016).

This present research study sought to investigate possible correlations between research studies conducted in countries outside the United States as well as looking at

findings within the United States. There are increasing amounts of information gathered from multiple research studies that link glyphosate exposure to a variety of health problems. The studies indicate that Glyphosate (the key ingredient in Monsanto's Roundup Ready weed killer) is becoming a global problem with consequences that are just beginning to be understood through independent sources (Bellinger, Bouchard, Weisskopf, & Wright, 2010; Araujo, Delgado, & Paumgarten, 2016).

Gress, Lemoine, Puddu, Séralini, and Rouet (2014) published a research article in Springer Science & Business Media which referenced their research study done with Swiss mice which concluded that chronic exposure to glyphosates can result in liver and kidney damage with potential significant health problems for human populations (Gress, Lemoine, Puddu, Rouet, & Séralini, 2015). At nearly the same time another research study explained that the most debilitating public health issue in some farming areas of Sri Lanka was a new form of chronic kidney disease among paddy farmers (Gunatilake, Jayasumana, & Siribaddana, 2015) where glyphosates were heavily applied. These studies used completely different control groups, yet both came to extremely similar conclusions, referencing serious kidney problems (Gress, Lemoine, Puddu, Séralini, and Rouet, 2014; Gunatilake, Jayasumana, & Siribaddana, 2015).

Prasad, Singh, Shukla and Srivastava (2009) conducted research at the Indian Institute of Toxicology Research discovering that even just a single dose of glyphosate caused significant chromosomal damage in mice. These researchers went as far as to state that the glyphosate had clastogenic effects, which means that it can induce disruption or breakages of chromosomes, causing chromosomes to be deleted, added, or rearranged. A study done in Mexico found that glyphosate was a neurotoxin that is

capable of crossing the blood-brain barrier which resulted in hypo activity and could possibly affect additional neurotransmitter structures that are involved in motor control (Diaz-Munoz, Giordano, Hernández-Plata, & Rodriguez, 2014).

The national and international evidence appears to be mounting regarding the lack of safety when using glyphosate, whether as a farmer or as a consumer. The independent research studies generated in Mississippi, Iowa, (Gillam, 2011) Argentina (Araujo et al., 2016), and Sri Lanka (Gunatilake et al., 2015) all indicate that there are significant health risks to farmers that rely on glyphosates in their fields. The studies have also shown that there is an increased risk to the children of agricultural workers in the form of ADHD and birth defects (Diaz-Munoz et al., 2014).

The multinational studies done in Switzerland (Gress et al., 2014) and India (Prasad et al., 2009) shed light on the fact that glyphosate has far reaching effects on the populations that are not exposed to it in the field or in industry. The findings of these studies indicate that consumers ingesting foods that were grown using glyphosates can also result in seriously detrimental outcomes. The glyphosate components have been shown to find their way into the human body, which then pose permanent harmful effects on the body's chromosomes and on motor control through decreased brain function (Gress et al., 2014; Prasad et al., 2009). These researchers have done their research without bias since they have nothing invested in the outcome of their research. The public needs to have access to this unbiased data.

An article published in BioMed Research International (Mesnage, Defarge, Séralini, & Spiroux de Vendômois, 2014) stated,

It is commonly believed that Roundup is among the safest pesticides. This idea is

spread by manufacturers, mostly in the reviews they promote, which are often cited in toxicological evaluations of glyphosate-based herbicides. However, Roundup was found in this experiment to be 125 times more toxic than glyphosate. Moreover, despite its reputation, Roundup was by far the most toxic among the herbicides and insecticides tested. This inconsistency between scientific fact and industrial claim may be attributed to huge economic interests, which have been found to falsify health risk assessments and delay health policy decisions. (R. Mesnage et al., 2014, p. 4)

This research article also explains that the adjuvants in the Roundup formulation play a significant role in toxicity. The proposed purpose of the adjuvants is to increase the active participants (glyphosate) solubility and to protect it from degradation, which also increases its half-life which helps cell penetration. This activity enhances its pesticidal activity and consequently the side effects. The adjuvants can even add their own toxicity (Mesnage, Defarge, Séralini, & Spiroux de Vendômois, 2014).

Recent research in the U.S. shows that glyphosate, the active ingredient in Monsanto's Roundup herbicide, used in large quantities on genetically engineered Roundup Ready crops, limits your body's ability to detoxify foreign chemical compounds (Mercola, 2013). As a result, the damaging effects of those chemicals and environmental toxins are magnified, and may result in a wide variety of diseases, including brain disorders that can affect behavior. Mercola (2013) explains that Glyphosate-contaminated food has been implicated in the intense rise of ADHD and autism, the latter of which is clearly more extreme in terms of behavioral difficulties. Still, both problems

appear to be rooted to some degree in abnormal gut flora, which is where glyphosate begins its path of destruction (Mercola, 2013).

Milk:

The American Dairy Science Association began in 1917. In minutes from their January 2018 meeting they were discussing coming up with a more organized system for attaining, organizing and using statistics relating to the marketing of dairy products (Potts, 2018). Today the dairy industry has grown and developed into an internationally organized entity. The International Dairy Foods Association has a membership of nearly 525 companies within a \$125 billion industry annually (International Dairy Foods Association, 2018). More money is now available for more creative marketing tactics which can target specific audiences. The relevance here is that their meetings are spent deciding how to spend large amounts of money on milk sales, specifically, not on the quality of their product.

In 1992 a research study about childhood diabetes was done in Finland that discovered that the disease was triggered by an albumin in milk (Akerblom, et al., 1992). Dr. T. Colin Campbell, author, created a chart that related the consumption of dairy products to the rate of type 1 diabetes in children aged zero to fourteen. The chart illustrated the stark correlation between the incidence of the disease as compared to milk consumption of the twelve countries in the study. The children in Finland were 36 times more likely to contract type 1 diabetes than those in Japan, Finland had the highest consumption of dairy products and Japan had the lowest. (Campbell & Campbell, 2006)

Milk has been traditionally considered to be a healthy beverage for children. In 2003 two large dairy groups within the US joined forces (creating the National Dairy

Council) to combine their monies and focus to promote liquid milk. Their key target was to increase the sales of milk to school age children between six and twelve because they felt this would create a large group of lifelong consumers (Campbell & Campbell, 2006). The approach that they chose to accomplish this task was to target the educators, parents, teachers, students and food service professionals. Their goal had nothing to do with the health of their target population, it was only geared to increase sales and profits.

However, Robert Cohen and his colleagues found a protein in milk that they feel is a probable cause of ADHD, autism and schizophrenia (Moyer, 2015). They also discovered that after the children were put on a milk free diet that eight out of ten children with ADHD and autism were symptom free. Dr. Jaak Panksepp also observed that a component in milk aggravated symptoms of autism (Panksepp, 1979). He further stated that he felt that autism could be an emotional response to an upset of the opiate system in the brain due to that milk component. A third researcher produced evidence from his research that led him to believe that milk may be the major factor in the cause of autism (Wing, 1988). All these research findings predate the push to increase milk sales in the public schools.

A large study Group was used that included Finland, Sweden, Norway, Great Britain, Denmark, United States, New Zealand, Netherlands, Canada, France, Israel, and Japan to correlate the diabetes incidence of children from ages 0 to 14 (Dahl-Jørgensen, Hanssen, & Joner, 1991). The results concluded that cows' milk may contain a triggering factor for the development of insulin-dependent diabetes mellitus (IDDM). The Cambridge University Press published a study produced by two researchers who wanted a better understanding of the mechanism by which milk may be triggering diabetes in

children (Kolb & Wasmuth, 2000). Kolb and Wasmuth (2000) found that the immune system (gut-associated) plays a major role in disease development. They felt that milk proteins may provide a type of dietary regulation of autoimmunity which would also apply to other dietary proteins, excluding mother's milk.

According to Arjun Walia (2013) about 75% of the human population is lactose intolerant, which means they cannot digest milk (Walia, 2013). But, digesting it is only part of the problem. The other thing to take note of is what is actually in the milk that is being offered to the children. The USDA (US Department of Agriculture) claims that one in six dairy cows in the U.S. suffers from clinical mastitis, the disease is revealed in the levels of somatic cells in the conventional American milk supply. When a cow is diseased, more than 90% of those cells are known as neutrophils, which are the cells that form pus. That means, each spoonful of U.S. milk typically includes 1,120,000 somatic cells (Greger, 2011). The USDA also allows as much as 1.5 million white blood cells per milliliter of conventional milk (Group, 2015). That does not account for the numerous pesticides, particularly organochlorine pesticides, antibiotics, heavy metals and chemical residues that were also found in every sample tested (Jahed Khaniki, 2007).

Organic Diet

The first question on the student survey administered asked whether or not the person adhered to an organic lifestyle. This first question separated the surveyed into three groups. That question sought to discover if knowledge of the above items (GMO's, glyphosate and milk) had any bearing on the diet choices of the students. The reason for that interest is that it will drive future investigations regarding how to reach those students who show apathy or indifference toward an organic diet. An organic, milk free

diet would certainly mitigate many sources of distress on the children's systems, as revealed above. There is evidence that eating organically can improve student's success rates due to the lack of stress on the immune system alone.

As mentioned in the introduction, there was great success with the pilot program at Bayside MLK Jr. Academy where the pilot program served 156 students. The program was considered so successful in 2013 that the program was expanded and adopted by Willow Creek Academy in 2015 (EcoWatch, 2015). The superintendent of the Sausalito Marin City School District claimed that discipline cases had dropped dramatically, that attendance had improved, and food waste was down (Sausalito Marin County School District, 2015). A recent publication applauded the Martin County School District in Florida for adopting a district wide initiative to bring healthier eating habits to all the schools it serves (Schlanger, 2017). The district received a USDA Annual Best Practices Award (a reward for outstanding practices in School Food Service Authorities and Schools).

Research published by the European Parliament warned of the costs of present levels of exposure to pesticides which is especially dangerous for children and pregnant women (Donnelly, 2017). The report also warned of growing evidence that residues from insecticides are "damaging the brain and reducing the IQ of the population" (Donnelly, 2017). The study also raised concerns that these chemicals may also cause cancer as well as damages to the reproductive system.

Another reviewer of the commissioned study by the European Parliament revealed further that there is sufficient existing scientific evidence that pesticides can cause brain damage and organic food is the food of the future (Zatat, 2017). The study

was commissioned to determine whether organic food was healthier than conventionally grown crops. One of the research studies referenced was a California based study which revealed that the children born to mothers who had traces of organophosphate metabolites in their systems (glyphosate is an organophosphate) during pregnancy were more often to have adverse mental development by two years of age, attention problems at both three-and-a-half and five years of age, and lowered intellectual progress at age seven (Zatat, Pesticides can cause brain damage and organic food is the future, EU report says, 2017).

An open Peer reviewed report regarding the impact of organic food consumption was conducted by a group of researchers from Denmark, France, Belgium, Sweden, USA and Poland (Andersen, et al., 2017). Their research review noted that, “Epidemiological studies have reported adverse effects of certain pesticides on children’s cognitive development at current levels of exposure” (Andersen, et al., 2017). The review also reported that the prevalent use of antibiotics in conventional animal production was a key driver of antibiotic resistance in the population whereas antibiotics are used less intensively in organic production and therefore is preferred. They also stated that the evidence suggests that “organic food consumption may reduce the risk of allergic disease and of overweight and obesity” (Andersen, et al., 2017).

Due to the study that was carried out at the University of Virginia by Dr. Robert Barney, (mentioned in the introduction) explaining that the immune system actually controls social behavior, and all the subsequent information that indicates the immune destruction by the products reviewed, it would seem to be extremely beneficial to review the conventional attitude regarding healthy, organic food choices. The research from Virginia claimed that when the immune system was restored it fixed both hyperactive and

abnormal behavior (Barney, 2016). This discovery could have enormous implications for neurological conditions such as autism and schizophrenia.

A recent article in Parenting online magazine, a traditionally conservative publication, explained that even though hormones and chemicals in conventionally grown foods are small, new research indicates that they are still damaging in low concentrations over an extended period of time (Salazar, 2018). The substances they referred to are suspected of being causal to early puberty in children. The article went on to explain that switching to an organic diet drastically reduced their exposure to organophosphates, which affect the nervous system (Salazar, 2018). A study done in Taiwan indicated that there is a link between children with increased exposure to organophosphates and a possible twofold to threefold increased risk of being diagnosed with ADHD. The study concluded that organophosphate pesticide exposure may have damaging effects on children's neurodevelopment and the development of ADHD (Chen, et al., 2016).

A research study done in Seattle, Washington was able to demonstrate that organic diets provide dramatic and swift protection against organophosphorus pesticide exposures (Barr, et al., 2005). They explained that the National Research Council concluded that children are being exposed to organophosphorus (including glyphosate) chemicals through their diet (Barr, et al., 2005). The researchers indicated that this was the first study that provided a dietary intervention that assessed children's exposure levels to pesticides before and after implementation. After the intervention was implemented, switching to an organic diet substantially removed the organophosphorus chemicals from their systems (Barr, et al., 2005).

A study done a few years earlier came to the same conclusion as Barr, et al (2005). The research took place in Seattle, Washington, with preschool children as the subjects (Curl, Elgethun , & Fenske, 2003). Their research showed that the metabolite concentration of organophosphates was approximately six times higher for those children consuming conventional diets versus the children with organic diets (Curl, Elgethun , & Fenske, 2003). They concluded, “.. consumption of organic fruits, vegetables, and juice can reduce children's exposure levels from above to below the U.S. Environmental Protection Agency's current guidelines, thereby shifting exposures from a range of uncertain risk to a range of negligible risk” (Curl, Elgethun , & Fenske, 2003).

These scholarly research studies provide evidence of how the intervention of an organic diet effectively removes harmful chemicals from children’s bodies. (Barr, et al., 2005; Curl, Elgethun , & Fenske, 2003) Switching to an organic diet may be able to provide a simple way for parents to reduce their children's exposure to organophosphate risks. Organic foods appear to be very beneficial for the consumer and all those around them, so why then is so much ambivalence prevalent? It could be solely due to knowledge. A study done in Hong Kong sampled 222 respondents and found that knowledge had positive influences on the consumer’s attitude about organic foods (Cheung, Lam, & Lau, 2015).

Current Study

The current study was undertaken to discover the knowledge base of highschool students concerning GMO’s, glyphosate and milk and how that knowledge effected the student’s food choices. There are no prior study’s that address these particular issues of this area of research. Study’s have been done that have tried to understand how student

knowledge about healthy eating affects their food choices but those studies only addressed knowledge of the benefits of fruits and vegetables. The results of those studies were mixed.

The study that was conducted in Iran (Fakhri, et al., 2014) among elementary and junior high school students resulted in exposing that even those students who had greater knowledge did not practice better eating habits. A study was done in rural China that assessed knowledge, behavior and attitude through the use of a questionnaire which was used for outcome measurement. The results indicated that increased knowledge did improve behavior but had no effect on the student's attitudes (Hu, Shen, & Sun, 2015).

A novel research study was done in New York State high schools to determine if knowledge about healthier eating would impact student's attitudes and behavior toward a healthier diet (Bukhari, Fredericks, & Wylie-Rosett, 2016). The program taught and trained students, who became peer educators. The teens conducted cooking demonstrations in their respective schools and at community events which did prove to be quite effective. The study conclusions reported positive behavioral changes and "greater awareness of opportunities for and interest in healthful eating at home and at school" (Bukhari, Fredericks, & Wylie-Rosett, 2016). This study had very positive results, yet, the issues that this current study is addressing had no influence on the research conducted there because it did not address GMO's or glyphosates.

A University of Arkansas undergraduate student conducted a study for an honors thesis (Heymsfield, 2014). The study was created to assess the knowledge and dietary practices of high school seniors. The results did indicate one positive, yet statistically

insignificant, trend between knowledge and physical activity. The researcher concluded that high school seniors do not have adequate nutritional knowledge (Heymsfield, 2014).

The Centers for Disease Control and Prevention lists health surveys that encompass large public school populations (Centers for Disease Control and Prevention, 2018). The webpage encompasses multiple surveys that cover multiple years of data. The data focuses on numerous topics with one that does address diet; that one concentrates on obesity. There is a gap in the research which the current study under investigation was created to uncover.

Research Questions

1. What are the attitudes about food choices and the chemicals and GMO's used in producing food among high school students?
2. Do attitudes concerning food choices, glyphosates in food, and GMO's correspond with adopting a more organic lifestyle?
3. Do students report acquiring knowledge within the school system about GMO's or glyphosate?
4. Do students report any peer pressure for adopting a more organic lifestyle?
5. Are there differences between nationality groups with respect to attitudes and knowledge about food choices and adopting a more organic lifestyle?
6. Do students believe that organic milk is a healthy diet choice?

Chapter 3: Methodology

The purpose of this Quantitative correlational non-experimental research study was created to discover the underlying factors regarding both student knowledge and attitudes and their choice of diet using a self-administered survey (see Appendix C). The use of a correlational study was the best choice for this research because the study is designed to determine if there is a relationship between variables (Waters, 2017). Non-experimental research does not manipulate the randomly assigned independent variable. The research questions can be about a single variable or a noncausal statistical relationship between variables. The research question can also be about a relationship between variables that are not manipulated. (Chiang, Jhangiani, & Price, 2018)

The current study was designed to determine the extent of the relationships between multiple variables using statistical data. The relationships among several variables were sought for further interpretation. The research also includes a section on demographics (Appendix B). The demographics were employed to locate any differences that may originate between cultural groups within the student body. These are additional factors of interest within the study.

Comparative research endeavors to define the relationship between two or more variables using statistical data. This type of research design investigates relationships between a number of facts which are pursued simultaneously and then interpreted. This type of research recognizes trends and patterns in data without analyzing the causes for the observed patterns. The variables are not manipulated in this type of research, they are only observed and identified in a normal setting.

Study Setting

The study took place in two suburban public high schools in Florida. The first public high school that was chosen is a magnet school for ESE (Exceptional Students Education) and ESOL (English for Speakers of Other Languages) students. The school alternatively provides a wide variety of advanced placement classes and programs for advanced and gifted students. The school population is also comprised of magnet students that attend the various technological industry certification courses offered. The vast array of programs accessible at the school allow for an exceptionally well-balanced variety of students. The second school that was chosen for this study had a similar demographic to the first school which indicates that it is comprised of a very diverse group of students.

Research Design

The research design used in this study was a Quantitative non-experimental research design. A General Linear Model design (Keppel & Wickens, 2004) was used for the statistical analysis. The use of this ANOVA design was beneficial because it has been found to be very useful when dealing with unequal population samples. A random (unplanned) study has no control over the quantity or type of participants from each group within the school that would end up answering the survey, it allowed for separate statistical analysis within each group so to provide an accurate accounting for each population under investigation.

Population and Sampling Plan

The population of the study comprised a cross section of all the students in the two schools. There were students surveyed from both the advanced placement programs

and the regular mainstream classes. All the classes were comprised of students from a wide variety of ethnicities. The demographics of the high schools being used were nearly identical to the demographics of the total public school population of the United States (US Census Bureau, 2017 & US Census Bureau, 2017). The benefit of this phenomenon is that the study may be used as a model for public schools in general.

Data Collection Procedures

The data was collected through the use of the completed surveys. The survey had two types of questions. The first questions, dichotomous, separated the respondents into three groups that were then assessed separately and comparatively. The remainder of the survey questions were done in a likert scale method to get a deeper understanding of the respondent's attitudes toward the issues being assessed.

The implementation of the survey required two separate days to speak with the students. The first meeting with the students was needed to explain the purpose of the study, explain its anonymity and to ask them to secure their parents' consent. A six-page consent form was provided to all the students with the assurance that there were no penalties for those who did not want to participate as well as no risks and no benefits for those who chose to participate. The second meeting with the students provided the opportunity for all those who had brought back signed consent forms to participate in the study. The questionnaire was provided to all eligible students and then collected upon completion.

The use of three types of variables were employed in this study. The independent variables were the questions from the survey that used a likert scale of zero through five. The dependent variable was the food choice of the students from the initial question on

the survey. Mediator variables of interest were found through the demographic questions on the first page of the survey regarding ESE, ESOL, male/female, grade, and country of origin of the family. The mediator variables were employed to help identify and explain any possible influences that underlie the observed relationship between the independent variables and the dependent variable (Statistics Solutions, 2018; (Baron and Kenny, 1985).

Data Gathering Plans (instrument)

The data gathered was generated through the instrument of the survey questionnaire that was developed, Appendix A. The instrument included 3 scales: attitudes, knowledge, and eating habits. The survey was reviewed by a local medical doctor, Dr. Tara Solomon, and the CEO of a cancer clinic, Mr. Charles White. I asked them for their input and corrections or additions as they saw fit. The instrument provided is relatively short, to insure ease of administration. This short survey concept was used to increase its use and acceptability and assure greater response rates than would a long-involved questionnaire (Briefel, Cabili, Cohen, & Grau, 2009).

The research conducted in this study was designed to gain a better understanding of the knowledge and feelings that the respondents had about their diets and the reasons behind the choices that they made about their chosen diet. We used the questionnaires to identify some of the basic factors that determined the decisions that the respondents made concerning their diet choices and their fundamental understandings about the ramifications that result from those choices.

The item structure for the questionnaire survey about diet choices consisted of closed format questions. This questionnaire design was very basic and provided the

advantage of ease at performing preliminary analysis as well as being ideal for calculating simple statistical data, since the answer set is known. Closed ended questions can also be administered repeatedly to monitor changes in the respondent's attitudes and/or choices over time. (Outsource Market Research Services, 2017)

The first two questions were Closed-Ended Dichotomous Questions. Those questions were used as the preliminary tool to separate all the respondents into the initial three groups for research identification. The first group were those who already had chosen an organic diet. The second group were those who desire to eat organically. The third group were those who do not and have no desire to eat organically.

Likert scale questions were used on the informational gathering portion of the survey because they are useful for assessing how a respondent feels towards a certain issue. Importance rankings were employed because the respondents can then rate the importance of each particular issue on a scale of 1 to 5 which helps the researchers to understand which items hold the greatest significance for the respondents. These types of questions also help to elicit attitudes from the respondents without the need for words as well as allowing the researchers to measure the exact content that it sought to pinpoint. (Wilson, 2005, p. 156)

The intended research required the collection of the same, comparable information from numerous students, so the survey questionnaire was the best method to employ (Skillsyouneed, 2018). The questionnaire was given to all possible students in the schools. The questionnaire has been kept confidential and was statistically analyzed using the equivalent to ANOVA, the Kruskal-Wallis H test, followed up by the Man-Whitney U tests and Frequency tables.

Chapter Four: Analysis and Results

Introduction

The purpose of this study was to gain a better understanding of the factors that are associated with the habits and attitudes that high school students presently have regarding their food choices. The study was conducted using a self-administered questionnaire at two high schools in Palm Beach County. This research design used was both a descriptive and comparative design that did not involve experimental manipulation of an independent variable. Demographics are presented, followed by results separated by each research question. Demographics are presented in Table 1.

There were 444 participants that were selected from the two schools. The first school chose to use students from nine English classes and all the ROTC classes. This selection provided 173 participants. The second school chose to provide students from all the physical education classes on a given day. This approach provided 271 participants. The total participant population included ninth through twelfth grade students from both remedial and advanced educational classes. The sample included a good range of representation of ages, sex, ethnicity, and educational level for high school students served by Palm Beach County, Florida public schools. The population also had many immigrant children and some with moderate learning disabilities.

Table 1. *Demographics of the Sample (N = 444)*

Variable	Frequency
Grade	
9 th	115
10 th	129
11 th	113
12 th	86
Gender	
Male	234
Female	210
Country of Origin	
USA	347
Non-USA	97
Cognitive Impairment	
Yes	50
No	394
Educational Rank	
High	336
Regular	108
Diet Choice Groups	
Organic	119
Desire Organic	183
No Interest in Organic	142

Table note: Educational rank refers to the classes the students are enrolled in. High indicates students who are enrolled in at least one honors class. Regular indicates students who are enrolled in only regular core curriculum.

Results for Research Question 1. The first research question asked, “What are the attitudes about food choices and the chemicals and GMO’s used in producing food among high school students?” To aid in interpretation of means, items pertaining to attitudes and knowledge were based on a Likert scale as follows: 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree or Disagree, 2 = Disagree, 1 = Strongly Disagree. Tables 2 and 3 show the descriptive statistics for items pertaining to this research question 1.

Table 2. *Frequencies of Responses for the Attitudes about Knowledge For GMO’s Question 5: “Do you know what GMO’s are?”.*

Variable	Frequencies Per Response
Strongly Disagree	67
Disagree	42
Neither Agree or Disagree	36
Agree	113
Strongly Agree	152
No response	34
Median	4

Table 3. Frequencies of Responses for the Attitudes about Knowledge For Glyphosate Question 7: “Do you know what Glyphosates are?”.

Variable	Frequencies Per Response
Strongly Disagree	147
Disagree	100
Neither Agree or Disagree	50
Agree	56
Strongly Agree	37
No response	47
Median	2

The findings from both questions concerning perceived knowledge about GMO’s and Glyphosates were further examined to determine whether or not students were more aware of one or the other type of food-related issues. The median response for the two perceived knowledge questions were 4 and 2 respectively. These medians indicate that in general the students are more aware of what GMO’s are (4) than they are about what Glyphosates are (2). The Wilcoxon signed ranks test was used to determine if responses on the two perceived knowledge items were significantly different from each other. The Wilcoxon signed ranked test is the non-parametric equivalent to the paired-sample *t*-test. The Wilcoxon signed rank test resulted in *z* value of -11.220 and *p*-value of $p < .001$. Thus, the *p*-value indicates that the students were significantly more aware of what GMO’s are than glyphosates.

Results for Research Question 2. Research question 2 asked “Do attitudes concerning food choices, glyphosates in food, and GMO’s correspond with adopting a more organic

lifestyle?” Students were put into dietary interest groups based on the following procedure; students were first asked “Do you eat an organic or mostly organic diet now?” If students indicate “yes” then they were placed into Group 1 (Organic, Group 1). If students indicated “No, then they were administered the following question “If you do not eat organic, would you like to eat organically?”. Those who indicated “yes” were placed into Group 2 (Desire Organic, Group 2). Finally, those who indicated no to the second question were put into the third group (No Interest in Organic; Group 3). The two items used to answer research question 1, that measured attitudes about their own knowledge concerning GMO’s and glyphosates, were compared with respect to the three groups defined above. Table 4 shows the frequencies of responses to both knowledge questions segregated by organic lifestyle group. Interestingly, it would appear that students in Group 3 had the least amount of knowledge concerning both GMO’s and glyphosates. Also, students clearly reported more agreement toward knowing about GMO’s versus glyphosates.

Analyses were conducted to statistically test for median rank differences between the groups to confirm whether the pattern of results reported in Table 4 reflected group differences that were not due to chance. Since the items were ordinal in scale, the nonparametric equivalent of the ANOVA was conducted first (i.e., the Kruskal-Wallis H Test). These tests were followed-up by the nonparametric equivalent to the independent-samples t-test, the Mann-Whitney U. The omnibus Kruskal-Wallis H test for the GMO attitude about knowledge question was $H = 8.872(2)$, $p = .012$, and the corresponding statistic for the Glyphosates question was $H = 20.695(2)$, $p = .001$. Thus, omnibus effects were found for differences among the three groups with respect to both attitude questions.

Having shown that the omnibus Kruskal-Wallis H Test findings were significant for both questions, planned comparisons were next conducted using the Mann-Whitney U test statistic. Tables 5 and 6 show contrasts between each of the dietary interest groups with respect to median ranks between groups on both questions 5 and 7 (i.e., perceived knowledge about GMO's and Glyphosates, respectively). Turning to the results concerning GMO's, the planned comparisons indicated that groups 1 and 2 were more likely to agree to stating that they had knowledge concerning GMO's than group 3. Thus, the pattern of median differences between the dietary interest groups were supported by the Mann-Whitney U Test. The same pattern emerged for glyphosates with respect to Mann-Whitney U Test results that contrasted the first two groups with Group 3. That is, both the Organic and the Desire Organic groups reported more knowledge than the No Interest in Organic Group. Another surprising finding was that although the median ratings were the same for both Groups 1 and 2, the Mann-Whitney U indicated greater perceived knowledge for those in Group 1 versus Group 2. This finding is possible because the Mann-Whitney U Test is used to examine median differences in ranks of performance and not the raw ratings scores. To better interpret the findings, means were computed. The mean for Group 1 was 2.58 and for Group 2 the mean was 2.01. Thus, the ratings indicated a subtle yet statistically significant difference between Groups 1 and 2, with perceived knowledge being greater for the Organic group than the Desire Organic group.

Table 4. Frequencies and Medians for Responses to Items 5 and 7, Segregated by Group.

Group	Group 1	Group 2	Group 3
<i><u>Question 5: "You know what GMO's are."</u></i>			
Strongly Disagree (1)	12	27	28
Disagree (2)	11	15	16
Neither Agree or Disagree (3)	15	9	12
Agree (4)	28	60	25
Strongly Agree (5)	48	60	44
No response (0)	5	12	17
n	119	183	142
Median	4	4	3
<i><u>Question 7: "You know what Glyphosates are."</u></i>			
Strongly Disagree (1)	24	63	60
Disagree (2)	32	44	24
Neither Agree or Disagree (3)	14	24	19
Agree (4)	23	20	13
Strongly Agree (5)	17	13	7
No response (0)	9	19	19
n	119	183	142
Median	2	2	1

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 5. *Medians, Mann-Whitney U and p-value for Attitudes About GMO's Per Group.*

Attitude	Medians	Mann-Whitney U	p-value
Group 1 vs Group 2	4 vs 4	-1.099	.272
Group 2 vs Group 3	4 vs 3	-2.052	.040*
Group 1 vs Group 3	4 vs 3	-2.897	.004*

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 6. *Median, Mann-Whitney U and p-value for Attitudes About Glyphosates between Groups.*

Attitude	Median	Mann-Whitney U	p-value
Group 1 vs Group 2	2 vs 2	-3.245	.001*
Group 2 vs Group 3	2 vs 1	-1.664	.096
Group 1 vs Group 3	2 vs 1	-4.407	.000*

Table note: Group 1 – Organic, Group 2 – Desire Organic, Group 3 – No interest in Organic

Results for Research Question 3. Research question 3 asked “Do students report acquiring knowledge within the school system about GMO’s or glyphosate?”

This question was answered through the student’s survey questions six and eight. The two questions related to any instruction that may have been acquired through instruction in school by the participants. Question 6 on the survey: “You have been taught about GMO’s in school”, referenced instruction about GMO’s. Question 8 referenced any memories the participants would have regarding instruction in school about glyphosates: “You have been taught about glyphosates and their effects on humans

in school.”. The second question was more inclusive since it also included instruction about the hazards of the product as well as the chemical by name.

The results indicated that when it comes to GMO’s, the majority of the entire school sample believed that they were not taught about GMO’s in school (see Table 7). Only about 18% of the school sample surveyed felt they had heard about GMO’s in school. The results indicated that when it came to Glyphosates, 63% of the students gave a rating of 1 or 2 (i.e., Strongly Disagree or Disagree) on the Likert scale, indicating that they perceived to have not learned about this chemical in school. Twenty three percent of students from Group 1 felt that they learned about Glyphosates in school.

There were no significant differences found between any of the groups in the analysis of the question about GMO’s being taught in school. The GMO question results reported in Table 8 indicated, via the Mann-Whitney U test, that no *p*-values approached conventional levels of significance. The clear majority of all the students surveyed feel that they lack education from the school system regarding anything about GMO’s. Reviewing the results for glyphosates being taught in school, there was a significant difference indicated in the Mann-Whitney U test between Groups 1 and 3 (see Table 9). Group 1 (Organic) showed a significant difference from Group 3 (No Interest in Organic). Thirty-eight percent of the students from Group 1 felt that they had been taught about the dangers that Glyphosates plays on human health whereas the majority of the students from Groups 2 and 3 did not.

The Kruskal-Wallis H Test for question 6 was 5.573(2) with *p*-value = .062 and pertaining to question 8 the Kruskal-Wallis H Test generated a score of 1.493 (2) and a *p*-value = .474. Neither of these omnibus tests revealed any significance, but further

investigation was carried out to investigate which group(s) may have felt they may know about GMO's or glyphosates than their peers. Question 6 asks about the students perceived understanding about GMO's being taught in the schools, "You have been taught about GMO's in school." The frequency tables indicated that the analysis about the students perceived feelings about GMO's being taught in schools showed that 149 of the 444 respondents gave it a 1 or 2 on the Likert scale indicating that less than half of the students felt the schools were offering this information. (A one or two on the Likert scale indicates that the students strongly disagree (1) and disagree (2)). Question 8 asks, about the students perceived understanding about Glyphosates being taught in the schools, "You have been taught about glyphosates and their effects on humans in school." The frequency tables indicated that the analysis about the students perceived feelings about Glyphosates being taught in schools showed that 283 of the 444 respondents gave it a 1 or 2 on the Likert scale indicating that more than half of students felt the schools were not offering this information. (A one or two on the Likert scale indicates that the students strongly disagree (1) and disagree (2)).

Table 7. *Frequencies and Medians for Responses to Items 6 and 8, Segregated by Group.*

Group	Group 1	Group 2	Group 3
<u>Question 6: "You have been taught about GMO's in school."</u>			
Strongly Disagree (1)	24	44	33
Disagree (2)	20	36	26
Neither Agree or Disagree (3)	25	20	22
Agree (4)	25	36	25
Strongly Agree (5)	21	34	26
No response (0)	4	13	10
n	119	183	142
Median	3	2	3
<u>Question 8: "You have been taught about glyphosates and their effects on humans in school."</u>			
Strongly Disagree (1)	40	78	66
Disagree (2)	31	43	25
Neither Agree or Disagree (3)	12	23	20
Agree (4)	13	16	13
Strongly Agree (5)	13	6	4
No response (0)	10	17	14
n	119	183	142
Median	2	1	1

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 8. *Median, Mann-Whitney U and p-value for Attitudes About GMO's being taught in school.*

Attitude	Median	Mann-Whitney U	p-value
Group 1 vs Group 2	3 vs 2	-1.117	.264
Group 2 vs Group 3	2 vs 3	-.041	.967
Group 1 vs Group 3	3 vs 3	-1.045	.296

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 9. *Median, Mann-Whitney U and p-value for Attitudes About Glyphosates being taught in school.*

Attitude	Median	Mann-Whitney U	p-value
Group 1 vs Group 2	2 vs 1	-1.936	.053
Group 2 vs Group 3	1 vs 1	-.450	.653
Group 1 vs Group 3	2 vs 1	-2.194	.028*

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Results for Research Question 4. Research question 4 asked “Do students report any peer pressure for adopting a more organic lifestyle? This question was answered through the student’s survey questions three and eleven. The two questions related to any peer pressure or peer influence that may be felt by the participants. Question 3 on the survey: “Some students at school make fun of you if you eat organically”, referenced the possible stress students may have about feeling bullied. Question 11 was directed to ask about their feelings regarding peer influence: “Your friends greatly influence your food choices”. The second question is a subtler way to uncover any stress caused by peers that

may be felt by the students surveyed. The frequency tables indicated that the analysis about bullying showed that 328 of the 444 respondents gave it a 1 or 2 on the Likert scale indicating that the vast majority of students felt this was not an issue. A one or two on the Likert scale indicates that the students strongly disagree (1) and disagree (2) with the statement regarding their perceived feelings about their friends having an influence on their dietary choices.

The Kruskal-Wallis H Test for question 3 was .043(2) with p -value = .979 and pertaining to question 11 the Kruskal-Wallis H Test generated a score of 3.472(2) and a p -value = .176. Neither of these omnibus tests revealed any significance, but further investigation was carried out to investigate which group(s) felt bullied since approximately 25% did claim some hesitations due to their peers. Question 11 asks, about the students perceived feeling about being bullied through the statement, "Some students at school make fun of you if you eat organically." The frequency tables indicated that the analysis about the students perceived feelings about their friends influencing their dietary choices showed that 283 of the 444 respondents gave it a 1 or 2 on the Likert scale indicating that the majority of students felt this was not an issue (A one or two on the Likert scale indicates that the students strongly disagree (1) and disagree (2)). 64% of the students were in disagreement that this was an issue.

Planned comparisons were conducted using the Mann-Whitney U test statistic, to determine which dietary interest group felt more like they were either victims of peer pressure or peer influence. Tables 10, 11 and 12 show contrasts between each of the dietary interest groups with respect to median ranks on both questions 3 and 11 (i.e., perceived peer pressure and influence about diet choices, respectively). The Mann-

Whitney U test and p -values for Attitudes About students making fun of them at school are in Table 11. The results indicate no significance between any of the dietary interest groups. Peer pressure does not appear to be more of a problem for students who eat organically or have an interest in organic eating lifestyle than students who are not interested in eating organically. The Mann-Whitney U test and p -values for attitudes about their friends influencing their diet choices at school are located in Table 12. The analysis indicates significant difference only between Groups I and 3. Group 3 (no interest in organic) does feel more influenced by their peers than those in Group 1 (organic) about their diet choices. Evidently, those students with little interest in eating organically show a greater tendency to be pressured by their friends with respect to dietary choices than those students who eat organically.

Table 10. *Frequencies and Medians for Responses to Items 3 and 11, Segregated by Dietary interest group.*

Group	Group 1	Group 2	Group 3
<u>Question 3: "Some students at school make fun of you if you eat organically."</u>			
Strongly Disagree (1)	24	44	33
Disagree (2)	20	36	26
Neither Agree or Disagree (3)	25	20	22
Agree (4)	25	36	25
Strongly Agree (5)	21	34	26
No response (0)	4	13	10
n	119	183	142
Median	3	2	3
<u>Question 11: "Your friends greatly influence your food choices."</u>			
Strongly Disagree (1)	40	78	66
Disagree (2)	31	43	25
Neither Agree or Disagree (3)	12	23	20
Agree (4)	13	16	13
Strongly Agree (5)	13	6	4
No response (0)	10	17	14
n	119	183	142
Median	2	1	1

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 11. *Median, Mann-Whitney U and p-value for Attitudes About “Some students at school make fun of you if you eat organically”.*

Attitude	Median	Mann-Whitney U	p-value
Group 1 vs Group 2	3 vs 2	-1.117	.264
Group 2 vs Group 3	2 vs 3	-.041	.967
Group 1 vs Group 3	3 vs 3	-1.045	.296

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 12. *Median, Mann-Whitney U and p-value for Attitudes About “Your friends greatly influence your food choices”.*

Attitude	Median	Mann-Whitney U	p-value
Group 1 vs Group 2	2 vs 1	-1.936	.053
Group 2 vs Group 3	1 vs 1	-2.194	.653
Group 1 vs Group 3	2 vs 1	-.450	.028*

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic, respectively.

Results for Research Question 5. Research question 5 asked “Are there differences between nationality groups with respect to attitudes and knowledge about food choices and adopting a more organic lifestyle? Table 13 depicts the differences between cultural groups with respect to each of the attitudes and knowledge about GMO’s and Glyphosates and adopting a more organic lifestyle question.

Table 13. *Frequencies and Medians for Responses to Items 5 and 7, Segregated by Group.*

Group	Group 1	Group 2
<u>Question 5: "You know what GMO's are."</u>		
Strongly Disagree (1)	44	23
Disagree (2)	30	12
Neither Agree or Disagree (3)	29	7
Agree (4)	94	19
Strongly Agree (5)	132	20
No response (0)	18	16
n	347	97
Median	4	2
<u>Question 7: "You know what Glyphosates are."</u>		
Strongly Disagree (1)	121	26
Disagree (2)	76	24
Neither Agree or Disagree (3)	49	8
Agree (4)	42	14
Strongly Agree (5)	28	9
No response (0)	31	16
n	347	97
Median	2	2

Table Note: Groups 1 is American born, Group 2 is Foreign born.

Table 14. *Medians, Mann-Whitney U and p-value for Attitudes About GMO's Per Group.*

Attitude	Medians	Mann-Whitney U	p-value
Group 1 vs Group 2	4 vs 2	-4.883	.000*

Table Note: Group 1 is American born, Group 2 is Foreign born.

Table 15. *Median, Mann-Whitney U and p-value for Attitudes About Glyphosates between Groups.*

Attitude	Medians	Mann-Whitney U	p-value
Group 1 vs Group 2	2 vs 2	-.417	.676

Table Note: Group 1 is American born, Group 2 is Foreign born.

The results of the Mann-Whitney U test analysis showed a significance difference between the groups regarding GMO knowledge. It turns out that students born in the USA have more knowledge about GMO's than foreign born students. Frequency table 13 provided a clear illustration of those statistics. Sixteen percent of foreign born students surveyed could not give an answer to the question about GMO's whereas only five percent of the American students surveyed could not provide an answer to the question. Surprisingly, students born outside the USA were even less informed than United States students regarding GMO's. The question about glyphosates revealed no significant difference between the nationality groups. Both groups appeared to be equally uneducated about glyphosates.

Results for Research Question 6. Research question 6 asked, “Do students believe that organic milk is a healthy diet choice?” To aid in interpretation of means, the Likert scale was coded for the belief that milk is a healthy diet option as 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree or Disagree, 2 = Disagree, 1 = Strongly Disagree. The omnibus Kruskal-Wallis H test was 5.538(2) with a p -value of .063, which indicates no significance between the groups. To examine this research question further, the participants were separated into group based on their response to the organic lifestyle item. Table 16 illustrates the student’s belief about milk segregated by dietary interest group via frequencies and medians.

Table 16. *Frequencies and Medians for Responses to Question 3, “Do students believe that milk is a healthy diet choice?”, Segregated by Dietary Group.*

Group	Group 1	Group 2	Group 3
<i>Question 4, “You believe organic dairy is healthy.”</i>			
Strongly Disagree (1)	15	13	04
Disagree (2)	12	18	10
Neither Agree or Disagree (3)	26	28	29
Agree (4)	36	75	57
Strongly Agree (5)	29	44	41
No response (0)	1	4	1
n	119	183	142
Median	4	4	4

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 17. *Medians, Mann-Whitney U and p-value for Attitudes About Organic Milk being a Healthy Diet Choice*

Attitude	Medians	Mann-Whitney U	p-value
Group 1 vs Group 2	1 vs 2	-1.238	.216
Group 2 vs Group 3	2 vs 3	-1.274	.203
Group 1 vs Group 3	1 vs 3	-2.367	.018*

Table Note: Groups 1 thru 3 were Organic, Desire Organic, No Interest in Organic.

Table 16 depicts the differences between the three diet choice groups with respect to their belief about milk as being a healthy diet option using frequency tables to illustrate how the respondents answered the question. This table should be interpreted as follows. The more the students agree with the response the more they are lacking knowledge about the milk question. All three groups received a median score of 4 which indicates that they all agreed that organic milk is a healthy diet choice. These scores indicate that all three groups are all poorly informed about the truth about all milk products. Table 17 provides Mann-Whitney U results with respect to difference in responses between the dietary groups. The Milk question found no significant differences between Groups 1 and 2 and again between Group 2 and 3. Significant differences were found between Group 1 and Groups 3. The *p*-value (.018) for the comparison between Groups 1 and 3 reached conventional levels of significance. This *p*-value indicates that students from Group I, the Organic group, were significantly more aware than Group 3, those uninterested in an organic diet, that even milk that is organic is not a healthy diet choice. The lower the median number in this question indicates that the students disagree with

that statement that organic milk is a healthy choice which reflects a more educated answer.

Chapter 5: Discussion

Introduction

The current research investigation focused on uncovering student knowledge about the difference between foodstuffs that are organic versus commercially grown foods. This type of study had not been done before, this is where the gap in the research emerged. The research items developed in this study focused on student knowledge about GMO's, glyphosate and milk. The latter, milk, is an item that has been an American food staple for a few generations. GMO's and glyphosates are components that are new additions to our food supply. This current research study generated a new body of evidence that had not been previously investigated. The statistical analysis indicated that knowledge played a significant role in diet choices among the high school populations surveyed. The data generated from this study provides new insights about the present knowledge and attitudes of teens from a diverse selection of American high school students. To investigate this issue, 6 research questions were examined. The answers to each research question will be summarized next, followed by implications of the findings, limitations, and future research directions.

Summary of Findings

The first research question asked, "What are the attitudes and knowledge concerning food choices regarding glyphosates and GMO's used in producing food among high school students?". The initial results from this question concerning perceived knowledge about GMO's and Glyphosates indicated that students were more aware of what GMO's were than they were about Glyphosates. The statistical analysis determined that the students were significantly more aware of what GMO's were than

glyphosates.

The second research question asked, “Do attitudes concerning food choices, glyphosates in food, and GMO’s correspond with adopting a more organic lifestyle?”. The students were separated into three groups to track any differences in the responses from each group. The groups were identified as: Group 1 (Organic), Group 2 (Desire Organic) and Group 3 (No interest in eating Organically). The statistical analysis provided separate data for each item in the question. The analysis regarding GMO’s found that the Organic and the Desire Organic groups reported more knowledge than the No Interest in Organic Group. Further analysis showed that the Organic group professed more knowledge about GMO’s than the Desire Organic group as well. The analysis regarding glyphosates found the same pattern as in the GMO results. The Organic group had significantly more knowledge than either of the other two groups.

The third research question asked, “Do students report acquiring knowledge within the school system about GMO’s or glyphosate?”. The clear majority of all the students surveyed felt that they lacked education from the school system regarding anything about GMO’s and glyphosates. The initial statistical analysis revealed no significant difference between any of the groups regarding either of these dietary components. Further investigation did show a significant difference between the Organic group and the other two groups regarding their perceived ability to learn about glyphosates in school. The organic group felt that they had learned about this product in school.

Research question four asked, “Do students report any peer pressure for adopting a more organic lifestyle?”. This question was broken down into two components, one

regarding bullying and one regarding peer pressure. None of the groups felt bullying was an issue regarding their diet choices. Significance was found between group one (Organic) and group three (No interest in organic), Group three had a greater tendency to feel that they were pressured by their friends with respect to their dietary choices than those students who ate organically.

Research question 5 asked, “Are there differences between nationality groups with respect to attitudes and knowledge about food choices and adopting a more organic lifestyle?”. This question split the participants into two groups; Group 1 (American born) and Group 2 (Foreign born). The analysis indicated that students born outside the USA (Group 2) were even less informed than United States students (Group 1) regarding GMO’s. The question about glyphosates revealed no significance, both groups appeared to be equally unaware of information about glyphosates.

Research question 6 asked, “Do students believe that organic milk is a healthy diet choice?”. The current research showed no appreciable difference across the groups in their belief that milk is a healthy part of the diet. The statistical analysis showed that 282 of the 444 respondents believed that milk was healthy while only 72 felt it was not a wise option. Since the initial frequency analysis indicated that 302 of the students were organic and/or desired to be organic, this would indicate that even those students that appear to be more aware of the differences between organic foods and their commercial counterparts are still under the impression that organic milk is healthy. It must be noted though that a significant difference was indicated between the organic group and the other two groups in the study.

Interpretation of Findings

In general, the data generated from this study regarding knowledge about GMO's and glyphosates indicated that the students with greater knowledge about these substances tended to adhere to an organic diet while those with little or no knowledge were inclined to be indifferent about their diet choices. The data also indicated that a large portion, 41%, of the students surveyed desired to eat organically.

All three Groups were in general agreement that they were not learning about GMO's in school and only Group 1 felt that they were learning anything about glyphosates in school. This led to examining another question that was provided on the survey. The question on the survey asked if the students were learning about these substances at home.

Addressing the question on the survey that pertained to students' knowledge about GMO's and Glyphosates follows. This one question asked if the participant was taught about GMO's and glyphosates at home. The participants' median value for this question was 2. The lower the median number in this question indicates that the students disagree with that statement that they have learned about GMO's and Glyphosates at home. Comparisons between diet groups were examined. An omnibus Kruskal-Wallis H test was 13.012(2) with a p -value of .001, which indicated a significant difference between the diet groups. The median score was 2 for Groups 1 (Organic) and 3 (No Desire for Organic), while Group 2 (Desire for Organic) received a median score of 1. Mann-Whitney follow-up analyses indicated that group 1 was significantly different from groups 2 and 3 with respect to median responses (p 's < .001). The Mann-Whitney U between Groups 1 and 2 was $z = -3.266$; p -value of .001; The Mann-Whitney U between

Groups 1 and 3 was $z = -3.093$; p -value of .002; The Mann-Whitney U between Groups 2 and 3 was $z = -.178$; p -value of .859. These scores indicate that Group 1, the organic group showed significantly different views about learning about these products at home from the other two groups. Yet, the median scores indicate that all the groups tended to disagree with the statement that they learned about GMO's and Glyphosates at home. Further examination of the data indicated that the frequency analysis showed that 36% of the Organic Group felt they learned about GMO's and glyphosates at home while only 30% of the Desire Organic Group and 18% of the No Interest in Organics Group indicated learning at home about these substances at home. These values indicate an overwhelming agreement that none of the groups felt that they received extensive instruction at home about GMO's and glyphosates.

In summary, the statistical results of the question being referred to that asked if the participants felt they were being taught about GMO's and glyphosates at home provided interesting information. Groups 1 (Organic) and 2 (No desire for organic) both received the same median score on this question which indicated they both had the basic same feeling that they were learning about these substances at home. So why then is there such a dramatic difference in the outcome of that knowledge. In general, the values indicate an overwhelming agreement that none of the groups felt overwhelmingly that they received instruction from home about GMO's or glyphosates. The question then arises as to why then is there a rather large number of students (41%) that desired to eat organically. This is surprising since that group (2) indicated that they felt they had received the least amount knowledge about these substances from home.

The data regarding milk indicated that only the organic group had any awareness

regarding the dangers of consuming milk. The schools surveyed both provide approximately one-third of the student population with free and reduced lunches. That implies that these children are receiving milk at both meals that they eat in school every day. The information uncovered about milk consumption revealed that nearly all the children who avoided milk were adhering to learning that was taught at home. A study published in Health Education Research found that parental modeling had the greatest positive effect on their children's eating habits (Brown & Ogden, 2004). The data generated from this study concurred with this prior study. Yet, even though significance was found between the Organic Group and the other two Groups, the majority of all the participants surveyed believed that organic milk was a healthy diet choice.

The information received from the survey poses the question as to why approximately 41% of the students without parental or scholastic input regarding GMO's or glyphosates were interested in eating organically. The group that was indifferent about eating organically comprised only about 32% of the student population surveyed which indicates that 68% of the student population have legitimate concerns about their diet.

Context of Findings

Past research conducted among school age children has focused on student knowledge and implementation of diet changes solely based on the types of food eaten. Prior studies have been based on the public's understanding that the consumption of fruits and vegetables would lead to a healthier body. This former research has indicated that the knowledge of this subject resulted in different outcomes from the selected populations. Two outcomes were observed from those studies; those that adhered to a better diet upon receipt of instruction regarding diet and those that still chose to eat as

they had before intervention (Banjari , Mandić, & Milosavljević, 2015; Özfer Özcelik & Uçar, 2008T; Huang & Sangkumchalianga, 2012; Hu, Shen, & Sun , 2015; Gibney, Hearty, Kearney, & McCarthy, 2006). But the past research conducted among school age children has focused solely on student knowledge about the types of food eaten and not about the sources of those foods or the implications of those sources.

The current study indicates that there appears to be a lack of knowledge about the research that has been published about the many adverse health risks associated with milk, GMO's and Glyphosates. The literature review uncovered independent research which indicated that milk is one of the possible roots of ADHD, autism and schizophrenia (Moyer, 2015) and diabetes (Akerblom, et al., 1992). Milk has also been associated with being a major factor in the cause and/or the aggravation of symptoms of autism (Wing, 1988; Panksepp, 1979). Milk researched by multiple independent groups has also uncovered it to be a cause of childhood diabetes (Dahl-Jørgensen, Hanssen, & Jøner, 1991; Kolb & Wasmuth, 2000; Akerblom, et al., 1992; Campbell & Campbell, 2006).

GMO's and glyphosate are newer substances that have crept into the food chain. The first studies of these substances came directly from the manufacturers of these items, as approved by the FDA (Undurraga, 2013). The literature review elaborated on the multiple studies that have shown that GMO's and glyphosates have staggering negative impacts on children which included decreased sociability, increased behavioral problems, immune system decline and an increase in cognitive difficulties. The results of the analysis regarding student knowledge in this area indicated a significant difference in knowledge regarding glyphosates and GMO's between those surveyed that have no

interest in an organic diet and those that do adhere to an organic diet and those that have a desire to eat more organically. The students who ate organically as well as those who desired to eat organically both showed a significant difference in their knowledge about these substances as opposed to those who were indifferent about organic foods. This outcome indicated that in this case knowledge does make a difference in the diet choices of the respondents. The outcome also indicated that the original theoretical model, the information deficit model, accurately predicted the source of indifference in this study. It seems prudent to try to uncover a method that will provide effective communication of science facts to students to help them understand the information coming from experts.

Past research concluded that attitudes and/or motivation towards healthy eating habits was related to lifestyle which led them to believe that future research is needed to learn how to create an attitude change towards dietary alterations among some groups of the population. The studies by Gibney et al (2006) also illustrated that a lack of knowledge is what led to a lack of motivation among portions of the population.

The current research provided ample scholarly, peer reviewed research about the dangers of the substances under investigation, yet, even though this peer reviewed research data exists, it appears that it is not being taught at the high school level. The research question from the current study that inquired about whether these items were being taught in school resulted in significance from only one group. This data indicated that scholastically, the majority of the student body is either uninformed or misinformed. There appears to be a need here for further research on this specific item because the conclusions based on the results from this study indicate that the single greatest factor that impacts a student's organic diet choice is that of knowledge.

Implications of Findings

The data collected from this study may be relevant to another broader problem due to the impact that the components in this current investigation have on children. That problem is one of student retention. Student retention in high school has been linked to absenteeism and absenteeism has been linked to an increase in high school dropout rates (Bennet, 2017; Bourgault, 2015). This current study did nothing specifically to compile data on that issue. But the significant debilitating effects that may be caused or influenced by these substances which are commonly consumed by the student population lead to the question as to how these substances may be contributing to student absenteeism.

The current study suggests that lack of knowledge about healthy food choices may be one of the factors that exacerbates cognitive, social, immune system and discipline issues (Sausalito Marin County School District, 2015), all of which can lead to frustration levels and eventual departure from the school system. The current study uncovered that approximately one-third of the students who were surveyed are receiving free and reduced meals due to financial hardships. According to a report in the Annual Review of Public Health, school provided foods that are high in sugar and fat are lower in cost than fresh fruits and vegetables, especially when considering caloric intake (Glanz, Kaphingst, Robinson-O'Brien, & Story, 2008). This indicates that in economically strapped households it is necessary to opt for the less nutritional and more fattening foods if they want to feel full. The study also showed that the obesity rates in these households is higher than the norm. This implies that the students at the highest risk are also the least well-nourished.

The literature review indicated that the consumption of the products under investigation in the survey had numerous negative impacts on their consumers. The negative outcomes included decreased sociability, discipline issues, a compromised immune system and cognitive impairments. The literature review also revealed that in schools where early diet intervention (organic) was practiced, removal of these substances from the student's diets resulted in fewer missed school days, increased sociability as well as fewer discipline problems (Sausalito Marin County School District, 2015).

The data from the schools' records above provide the knowledge that implementation of an organic diet for the student's referenced, which removes GMO's and glyphosates from their diet, reduced absenteeism while also ameliorating sociability and discipline problems. Absentee records are easily quantified while sociability and discipline issues may be harder to quantify. The reduction of absenteeism will help to reduce drop-out rates (Bartholomew, Heinrich and Hickman, 2008). Absenteeism is a significant issue which has been linked to a larger scale problem that effects not just the education system but the public at large. The reduction of absenteeism has the potential for extremely large fiscal reductions for society.

The research studies conducted regarding high school dropout rates indicate that school absenteeism is directly associated with high school dropout rates as well as lower student test scores (Bennet, 2017; Bourgault, 2015). Multiple research studies conducted in the United States have tracked the collective futures of high school dropouts. Insights gained through the information being gathered from recent analyses link high school drop outs to various problems that result in escalating costs for the American taxpayer (Mattie

C. Stewart Foundation, 2017).

The U.S. Department of Education, National Center for Education Statistics Current Population Survey finds that in the year 2015 the dropout rate was 5.9 percent (U.S. Department of Education, National Center for Education Statistics, 2017).

According to the statistics from the US government census bureau the dropout rate overall is 4.5% (United States Census Bureau, 2017). Both figures are alarming. The fiscal cost of high school dropouts falls into two broad categories; one is in the reliance on public assistance and the cost of decreased wages which affects taxes, the other is in crime and incarceration costs.

The unemployment rate is also highest among high school dropouts as compared to a high school graduate (Kokemuller, 2017; Rumberger, 2013). According to J. Breslow (2012) the average loss in wages of the high school dropout as compared to a high school graduate is approximately 10,386 less per year (Breslow, 2012). N. Kokemuller (2017) similarly approximates the difference to be \$9,412 per year less. The estimated lifetime loss in wages of the high school dropout is \$200,000 (Johnston, 2011).

Crime and incarceration are the other factors that start putting the onus of the problem onto the working-class people that pay their taxes. Two separate sources both cite that 75% of the prison population is comprised of high school dropouts (Mattie C. Stewart Foundation, 2017; DoSomething.org, 2015) and that 8 out of 10 high school dropouts end up in prison (Mattie C. Stewart Foundation, 2017). The cost of incarceration is escalating annually. The Bureau of Prisons, Justice Branch, claims that in 2015 the average annual cost per prisoner was \$31,977.65 (Kenney, 2016). In Los Angeles, the cost was \$75,560 per prisoner, per year in 2017 (Associated Press, 2017).

The Associated Press (2017) explains that in California alone, this added up to \$11.4 billion for the corrections department for the year. In New York, the price per inmate is about \$69,000 per year (Associated Press, 2017). According to J. Breslow (2012) each high school dropout will end up costing the taxpayers approximately \$292,000 over a lifetime due to the costs of incarceration and the other factors mentioned previously. The Mattie C. Stewart Foundation (2017) adds up all the costs associated with high school dropouts and puts the annual cost to our nation at 329 billion dollars.

Limitations of the Study

The quantitative analysis type of research is useful for generating a large pool of data but is limited in its scope. It would be prudent to get a clearer understanding of where students are finding data regarding organic foods which is best uncovered through a qualitative analysis. A qualitative study may uncover specifics that cannot be ascertained through the quantitative survey style.

One of the limitations of this study concerned what is presently being taught in schools about the substances covered in the study as well as what exactly is being taught at home. There was some indication that some of the students were taught that GMO's and glyphosates are fine for public consumption since some of the respondents in Group 3 (No Desire for Organics) felt they learned about these substances in school and still maintained indifference about their diet. The present study only covered if they were taught, not what they were taught. Further research needs to be done in this area.

Another limitation of this study and a word of caution for future studies, concerns the student's ability to return the consent forms along with their ability to complete the survey. The current study required the distribution of over 800 consent forms to acquire

444 consent forms that were returned along with properly completed surveys. When all the forms and their corresponding surveys were assessed, there were more consent forms obtained than surveys with useable data. Some of the students failed to fill out both sides of the survey, so, even though the survey was kept quite short, it was still more than some wanted to complete. To compile accurate data in the future it may be wise to target specific groups and keep the survey very short.

Future Research Directions

This current research study is the beginning of a larger conversation that requires further investigative research. The data from this research study indicates that more research is required to investigate:

- What is being taught in our schools about GMO's and glyphosate.
- What is being taught in the school's regarding milk?
- Why is milk required for the public-school lunch program?
- Where is the information coming from for those students who desire to organically?
- Has the graduation rate increased at those schools that have adopted an organic breakfast and lunch program?
- What is the actual cost increase when providing organic food stuffs for our public school students?
- What are the potential financial savings that early intervention (supplying an organic diet) could have on the fiscal health of our nation?
- How can the science facts from experts be effectively communicated to students?

Conclusion

In conclusion, the current study sheds light on an important issue that has been neglected in US education and more broadly the entire populace. The findings revealed clear evidence for the need for educational reform in the area of knowledge about what constitutes healthy foods and food choices. Further research is needed to find the best practices for teaching youth about what GMO's and Glyphosates are and the implications of this knowledge on their quality of life. It may also be necessary to conduct research to uncover what teachers and administrators know about these same substances and how these substances are affecting their student body because they cannot teach or act upon information of which they are not aware.

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Appendix A
Instrument

Instrument

Thank you for taking part in this study. A non-disclosure agreement has been provided for you and your student's protection. The agreement ensures complete anonymity for those participating in the study. The names, gender, ages and ethnicity of all students will remain completely confidential. The findings of the study will only provide data about the patterns and trends from the data regarding attitude and knowledge about current dietary choices of today's high school age students.

The questions in this study are designed to discover your understandings and your feelings about your diet and the choices that you make about your diet. There are many reasons for diet choices and many influences that can determine those choices. We are trying to pinpoint some of those deciding factors.

The first two questions will just be yes/no questions and then the next group of questions will all be multiple choice type questions. You are free to pick the answer that best represents how you feel. If none of them seem right to you, we have provided that option as well. There are no right or wrong answers on the questionnaire. Honesty is the only thing we need. Honest answers will allow the researchers of this project to understand what influences the decisions that you make and how those decisions may be influencing your health and welfare.

Please answer all the questions with the best answer that fits with your understanding about the question or how it makes you feel. If the question is not able to be answered because it doesn't really pertain to you, then just mark the N/A box on the answer portion. Thank you for your help and your participation.

DEMOGRAPHICS

QUESTION	YES	NO
<u>A.</u> Do you eat an organic or mostly organic diet now?		
<u>B.</u> If you do not eat Organic, would you like to eat organically?		

Demographics:

Informational data: (No names are necessary all information is confidential)

Check ALL that are apply:

Male _____ Female _____

Grade level _____

ESE _____

_____ ADD/ADHD _____ Autism _____ 504 Plan _____

_____ Gifted _____ AP classes _____ AICE classes _____ Honors classes _____

ESOL _____

Are you born in The United States?

Yes _____

No _____

Appendix B
Questionnaire

Appendix B

Questionnaire:

QUESTION	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not Important	N/A
1. Does your family consider an organic diet to be important?						
2. Do you consider an organic diet to be important?						
	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	N/A
3. Some students at school make fun of you if you eat organically.						
4. You believe organic dairy is healthy.						
5. You know what GMO's are.						
6. You have been taught about GMO's in school						
7. You know what glyphosate is.						
8. You have been taught about glyphosates and their effects on humans in school.						
9. You learned about GMO's and glyphosates at home from your parents.						
10. The prices of organic foods are too high and finding them is difficult.						
11. Your friends greatly influence your food choices.						

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