Organic vs. Non-Organic Foods: Environmental and Health Impacts

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**Introduction**

Organic foods, once found in certain health stores, can now be found in almost every grocery store and supermarket. Although it may be hard to tell the difference between organic foods and conventional foods upfront, they are both grown differently and have different health and environmental impacts. People often buy organic foods because they believe that they are more nutritious and tastier due to healthier soils, and also because of the lower pesticide use. However, the USDA has not made any claims stating that organically produced foods are more nutritious or safer to eat compared to non-organic foods (Frumkin, 2010, p. 659). People also believe the heavy use of chemicals on non-organic foods are causing harm to the environment and to the health of the surrounding populations. When it comes to deciding which type of food to get, weighing the risks and benefits of organic versus non-organic foods is important. While non-organic foods are healthy for people, organic foods may be better for their health and for the environment in the long term. This paper will examine the health and environmental impacts of organic foods when compared to non-organic foods.

**Background**

Organic refers to the “way farmers grow and process agricultural products,” (Mayo Clinic, 2017). There are many practices that these farmers use to grow the organic foods, and there are also many materials that are prohibited in organic farming. Although non-organic foods are regulated as well, organic foods have stricter regulations. All organic foods must meet government standards, which regulate how the foods are grown, handled, and processed. Synthetic pesticides, synthetic growth regulators, or soluble fertilizers are all prohibited from being used. Meats, poultry, eggs, and dairy products that are organic cannot come from animals that have been given antibiotics or growth hormones, even trace amounts. Before any of the foods can be labeled as organic, a government approved certifier has to inspect the farm where the food was grown and the practices used, to ensure the regulations are followed. According to Howard Frumkin, after seven years of Pesticide Data Program testing, scientists found the produce that is grown organically “is less likely to contain detectable levels of pesticide residues than is produce grown using conventional techniques,” (2010, p. 659). Furthermore, produce grown using conventional techniques were found to contain multiple pesticide residue.

The primary reason consumers choose organic foods over conventionally grown foods is that “they believe the products are better for their health; either more nutritious or safer,” (Haspel, 2016). However, this claim is not supported with evidence, which also means that consumers can misinterpret the labels. Another reason is that they believe that the animals are treated better. Animals on organic farms must have access to the outdoors. In the United States, the “minimum outdoor requirement at organic operations… is 120 days a year,” (Greenwood, 2015). Therefore, although they have some freedom to roam around, they are not able to roam outdoors year-round. This may be due to many reasons, such as the weather. Although the USDA requires that animals roam around freely and have access to outdoor areas, “animals on typical organic and free-range farms often spend much of their time confined to crowded sheds or mud-filled pens, just as animals on conventional factory farms,” (PETA, n.d.). However, organic farms are more likely to treat their animals better compared to a conventional farm. Organic farms are also more likely to provide their animals with natural or organic food to eat. Organic foods are costlier because they require a lot more labor, have stricter regulations, and lower crop yields than conventionally grown foods. In the image below, one can see the reasons why people choose to eat organic over non-organic (Carrington & Arnett, 2014).

Non-organic foods are more affordable compared to organic foods. For some people, they have no choice but to stick with conventionally grown foods. Some disparities come with this fact. Organic foods have lower levels of pesticides, which means that they lead to less health problems. For those who cannot afford organic food, this would mean that they would be disproportionately impacted with cancer and reproductive problems. Along with being more at risk for health problems, if they were to get sick, they may not even be able to afford going to the doctor. Although a safer option of foods is available, not everyone has access to them. There are a number of reasons why organic foods are costlier than non-organic foods, including “higher priced organic animal feed, lower productivity, and high labor costs because of the increased reliance on hand weeding,” (Forman, Silverstein, 2012, p. e1412). Although organic foods are safer to eat, there have not been any major studies that “demonstrated health benefits or disease protection as a result of consuming an organic diet,” (Forman, Silverstein, 20120. p. e 1412). Therefore, more research is needed in this area.

When it comes to the nutrition content, organic foods are not always more nutritious than their non-organic counterpart. According to a study done by researchers at Stanford University, they concluded that “there was no good evidence that organic fruits and vegetables were more nutritious overall,” (Aubrey, 2016). From a health perspective, what people eat is more important than whether or not they eat organic or non-organic foods. Therefore, the problem with non-organic foods lie in the pesticide use and how they affect the health of people and the environment. In conventional farming, plants are sprayed with herbicides and pesticides to kill weeds and bugs, while organic plants are often left to fend for themselves. Organic farming practices are designed to “encourage soil and water conservation and reduce pollution,” (Chicago Tribune, 2009). The use of chemicals leads to air and water pollution because these chemicals can travel through these mediums. In addition, it could possibly harm the animals that come in contact with the chemicals. Some people choose organic over conventional foods to limit their exposure to pesticide residue.

Organic foods have a different style of agriculture. Organic farmers control the pests that come into the farm by growing a variety of crops. They increase the fertility of their farms by using nitrogen-fixing plants or by using compost instead of a synthetic fertilizer. This can help the environment, as there can be a greater diversity of insect life or less fertilizer running off into the nearby streams. Organic farming is environmental friendly and uses methods such as manure, compost, crop rotation, and natural pest control. However, the manure can lead to problems, as it can carry strands of Salmonella or E.coli to the produce. Conventional farming grows food effectively on a large scale, but uses pesticides, antibiotics, hormones, GMO’s, and synthetic fertilizers to help. The foods that are grown, however, can be preserved longer. Although they do use pesticides, there are still regulations as to how much pesticides can be used.

**Health Implications**

Pesticides that are used on non-organic foods can cling to the foods that people eat, which can cause health problems in the long run. Pesticide exposure is often linked to cancer, neurological damage, and birth defects (Forman & Silverstein, 2012, p. e1411). By choosing organic, this can help lower the amount of toxic pesticides the body is exposed to. The use of pesticides also has many negative environmental health impacts. One impact is runoff, as the chemicals can runoff into the waterways, which will harm the aquatic life and contaminate the water systems. These pesticides could ultimately end up in the water supply, which people drink. While organic foods do sometimes use pesticides, they only use those that are non-synthetic and approved by the USDA for use.

Those who defend conventionally grown foods argue that any pesticide residues found in their food products are too small to pose as a health risk. However, this can accumulate, as people eat multiple foods a day that use pesticides. After a lifetime of consuming these foods, this could possibly lead to health problems. Not only do humans and animals ingest the pesticides, but they also have a chance of coming in contact with it through the polluted air, water, and soil. Although there is evidence that trace amounts of pesticides in food are not dangerous to human health,” there has not been many studies done on the long-term effects of sustained exposure to small amounts of pesticide residue, or even the long-term effects of eating genetically modified foods (Haspel, 2016). Those who work on the farms have a higher chance of being exposed to the chemicals in the pesticides, as they are the ones who are applying the toxins. These farmworkers suffer more chemical-related injuries and illnesses, which can cause “dizziness, nausea, headaches, breathing difficulty, cancer, and reproductive problems,” (Imus, 2014).

Growth hormones are often given to animals to increase the food product yield. An example is bovine growth hormone. Bovine growth hormone (GH) is a common hormone that is used to increase milk yield in cows. Bovine GH is biologically inactive in humans, which means that products with this hormone have no physiological effect on humans (Forman & Silverstein, 2012, p. e1409). There is no evidence that the hormone causes any change in milk composition or vitamin and mineral content. There may be environmental health benefits to this, as less cows could produce more milk, which means less land is needed to feed the cows. Fewer cows would lead to less manure, which could lead to a reduced methane and carbon dioxide production, which would have beneficial effects on global warming. However, the use of antibiotic agents in non-organic foods is a concern for health problems. Antibiotic agents are used to promote growth and increase crop yields. There is clear evidence that “such nontherapeutic use promotes the development of drug-resistant organisms in the animals and that these organisms then colonize the intestines pf people living on farms where the practice occurs,” (Forman, Silverstein, 2012, p. e1410). Therefore, people could get sick from these drug-resistant organisms.

Turning to organic foods “could bring down health-care costs by eliminating toxic lifestyles and the unnecessary disease and illness they cause,” (Weber, 2009, p. 48). Chemicals added to foods have “buried toxic waste everywhere and polluted and depleted water systems, worsened global warming and exacerbated ailments ranging from cancer to diabetes to obesity,” (Weber, 2009, p.48). People in the lower socioeconomic status may not be able to afford these foods, which could mean they are at greater risk of health problems. As a result, human disease that is caused by these antibiotic-resistant organisms can spread throughout the food chain. Organic farming prohibits the use of antibiotic agents, which lowers the threat of human disease that is caused by the drug-resistant organisms.

Organic farming has been shown to have less of an environmental impact than conventional farming. This is because organic farms do not “use or release synthetic pesticides into the environment, some of which have the potential to harm soil, water, and local terrestrial and aquatic wildlife,” (Forman, Silverstein, 2012, p. e1411). Organic farms are also thought to be better at sustaining diverse ecosystems, including “populations of plants, insects, and animals, because of practices such as crop rotation,” (Forman, Silverstein, 2012, p. e1411). Organic farms also use less energy and produce less waste. Organically managed soil also has demonstrated to be of higher quality and have higher water retention, which will be helpful during a drought. Although this is true, it remains a controversy over whether organic foods can provide adequate food supply to sustain the world population. A 20-year study done by Cornell University comparing organic and conventional farms found that organic farms had almost equal the productivity of the conventional farms. At the same time, the organic farm had 30% lower environmental pollution yet a 15% increase in labor costs (Forman & Silverstein, 2012, p. e1412).

Although organic foods do not contain high amounts of pesticides as non-organic foods do, they could still cause health problems. There is no evidence that “directly demonstrate health benefits or disease protection as a result of consuming an organic diet,” (Forman & Silverstein, 2012, p. e1406). Pesticides lead to many health problems. From 1998 to 2005, “3,271 cases of agricultural occupational acute pesticide poisoning were reported,” (Forman, Silverstein, 2012, p. e1411). Farmers deal with more exposure to the chemicals, due to their close contact with them. Chronic exposure to the chemicals has been associated with many health problems, including “respiratory problems, memory disorders, dermatologic conditions, depression, neurologic deficits including Parkinson diseases, miscarriages, birth defects, and cancer,” (Forman & Silverstein, 2012, p. e1411). Also, “prenatal organophosphate pesticide exposure has been associated with adverse birth outcomes, such as decreased birth weight and length and smaller head circumference,” (Forman & Silverstein, 2012, p. e1411). According to a report from the National Research Council in 1993, “the primary form of exposure to pesticides in children is through dietary intake,” (Forman & Silverstein, 2012, p. e1411). An organic diet can greatly reduce the risk of coming into contact with pesticides and its harmful effects.

**Methodology**

 In order to get a general reception about organic foods versus non-organic foods, many studies have conducted surveys to see what people prefer to buy. Many other studies that have been conducted in this area were meta-analysis studies. These studies combine the results and statistical data from multiple studies into one big study. Comparisons between organic farms and conventional farms have also been studied, as well as a comparison between organic foods and non-organic foods. The soil of organic and non-organic foods have also been tested. Most of the research that implicates the health consequences of pesticides comes from case-control or cross sectional studies. Surveys and studies have been conducted to compare the environmental issues of organic and non-organic foods. Studies, specifically the Pesticide Data Program, have compared the amounts of pesticide residue found on organic and non-organic foods. As is evident, there has been a wide array of studies and research that has been done on this topic. However, there is always room for more research.

**First Supporting Case/Example**

In the first example, organic and conventional strawberry farms in California were studied to see the difference in fruit and soil quality. Strawberries were chosen as the fruit of study because of their high economic value as a fruit, nutritional benefits, popularity among consumers, and suitability for sensory evaluation (Reganold, Andrews, Reeve, Carpenter-Boggs, Alldredge, & El Shemy, 2010). They also chose California because it is a leading producer of strawberries. In order to see if there were differences in the food and soil quality, harvested strawberry varieties and soils were repeatedly sampled at multiple times in 2004 and 2005 from 13 adjacent pairs of organic and conventional fields. Each of the farms had the same soil type and the same type of strawberry variety planted. Both the organic and non-organic strawberries were studied under equal conditions. Overall, the organic strawberries and the soil on the organic farms were of higher quality, compared to the conventionally farmed strawberries and soil.

 Organic strawberries had longer survival times than conventional strawberries. No fungicides were applied to the organic strawberries, whereas they were applied to the conventionally grown strawberries. Organic strawberries were smaller than the non-organic strawberries, but the organic berries were darker red. Both were equally firm. Organic strawberries also had “higher total antioxidant activity (8.5% more), ascorbic acid (9.7% more), and total phenolic (10.5% more) than conventional berries, but significantly less phosphorous (13.6% less) and potassium (9.1% less),” (Reganold, et. al., 2010). The strawberries were tasted by a consumer-sensory panel, and the organic ones were found to be sweeter and had a better appearance compared to conventional strawberries. The table below shows some of the differences in the organic and non-organic strawberries (Reganold, et. al., 2010).

Soil quality was also examined in this experiment. The organically managed soil contained “greater total carbon (21.6% more) and nitrogen (30.2% more),” (Reganold, et. al., 2010). The microbial biomass in organic strawberries was also higher, by 159.4%. The microbial biomass is more efficient and under less stress than conventionally farmed soil. Genetic diversity was also greater in the organically farmed soil in all the detected genes.

**Second Supporting Case/Example**

A second example includes a study that was done on many conventional and organic fruits and vegetables. The Pesticide Data Program is a residue monitoring program that samples, tests, and reports the amount of pesticide residues on produce that are sold in America (United States Department of Agriculture, n.d.). The Environmental Working Group (EWG) did an analysis of tests that were done by the U.S. Department of Agriculture (USDA). There were more than 36,000 samples that were taken by the USDA. All of these samples were analyzed by the EWG for pesticide content. The USDA personnel tried to mimic the consumer practices, by washing and peeling how consumers would. They ranked the foods based on how much pesticide residue the produce items had. Every year, the EWG comes out with a Shopper’s Guide to Pesticides in Produce.

The EWG found that “nearly 70% of samples of 48 types of conventionally grown produce were contaminated with pesticide residues,” (2017). The USDA found 178 different pesticides and pesticide breakdown products on the produce samples analyzed (EWG, 2017). Even when the produce was washed, and in some cases peeled, there were still pesticides that were present. There are some produce items that are higher in pesticide amounts, and some that are lower in pesticide amounts. Each year, the EWG creates 2 lists. One lists which produce items are higher in the pesticide residues, and which consumers should try to buy the organic version of these produce, if they can. The other lists which produce items are lower in pesticide residues, and which consumers should be able to buy the non-organic version without worrying about too much pesticide residue remaining on the produce. The image below, obtained from the EWG’s website (2017), shows the two lists:

Among the many fruits and vegetables that are high in pesticide residue, apples consistently rank close to the top on the dirty dozen list. A study done by the USDA Pesticide Data Program found 47 pesticide residues on apples, based on apples from 2010, which is the most recent year they were tested. Pesticide residue has also been found in apple juice and apple sauce (Shapley, 2015). Among the pesticides that were used, six were known or probable carcinogens, 16 were suspected hormone disruptors, five were neurotoxins, 6 were developmental or reproductive toxins, and 11 were honeybee toxins (What’s On My Food, n.d.).

The pesticides that were found the most often on apples include diphenylamine (DPA), thiabendazole, and pyrimethanil, found 82.8%, 81.0%, and 75.2% of the time, respectively (What’s On My Food, n.d.). Pyrimethanil is a possible carcinogen, slight bee toxin, and a suspected hormone disruptor, while thiabendazole is a probable carcinogen and a developmental or reproductive toxin. DPA is a marine pollutant, and is toxic to aquatic life (CDC, 2015). The packaging and labeling also says that it could be harmful if come in contact with skin (CDC, 2015). As a result of short term exposure, it is irritating to the eyes and also the respiratory system (CDC, 2015). As a result of long-term exposure, it can have effects on the kidneys and the blood (CDC, 2015).

**Analysis**

The results of the first study indicate that organic strawberries would have a longer shelf life than non-organic strawberries due to slower rotting and dehydration. Since no fungicides were applied to the organic strawberries, this suggests that organic strawberries use an innate system to fight off infection rather than relying on chemicals. Organic strawberries were found to have higher content of antioxidants, but lower content of some minerals. Dietary antioxidants offer health benefits for protecting against diseases, which is why they are important. Even though the organic strawberries had less phosphorous and potassium, strawberries are not the richest sources for these minerals. These minerals could easily be obtained from another food source.

More carbon was present in the soil, which is beneficial, as it can enhance the soil structure and fertility and also increase the water infiltration and storage. Also, the greater carbon that is trapped in the soil, the less that is in the atmosphere (Weber, 2009). Carbon dioxide emissions “contribute to global warming, the gravest environmental threat of our time,” (Weber, 2009, p. 58). More nitrogen was also present in the soil, and nitrogen is a major component of chlorophyll, which helps plants in photosynthesis to produce sugars. It is also an important component in amino acids. Genetic diversity was also greater in the organically farmed soil in all the detected genes. This greater diversity can help support the strawberries in a broader range of environmental conditions.

According to an article in the Huffington Post, organic strawberries are still sometimes grown using some pesticides. However, far fewer chemicals are used and the berries are planted away from civilization. On the other hand, conventionally grown strawberries are said to be “grown with more pesticides than most other crops,” (O’Connor, 2015). In fact, strawberries are listed as number one on the EWG’s Dirty twelve list (EWG, 2017). The pesticides used on these non-organic foods contaminate the air, and can have a great effect on farmworkers and nearby residents.

In the second example, it is clear that organically grown food has lower detectable levels of pesticide residue when compared to conventionally grown foods. However, organic foods may still have a small amount of pesticides on them, which have to be approved pesticides by the USDA. Another way pesticides can be present on organic produce is if airborne pesticides from conventional farms traveled to the organic produce. More pesticides are used on conventionally grown foods, and many of these pesticides have different health and environmental effects.

Apples are one produce item that contain many pesticide residues on them. According to an article in CNN, “apples account for 18.9% of fruit intake among people ages 2 to 19 in the United States,” (Sennet, 2015). Since apples are easy to eat and are the go to fruits for people, especially kids and adolescents, people are consuming these pesticide residues, possibly without even knowing it. Although pesticide residues were found on apples, they never went over the maximum amount that is allowed by the USDA. This amount is different for each pesticide, as each pesticide has different chemicals and properties. For example, for the pesticide DPA, there were 38.7 micrograms of the pesticide found on the non-organic apples, whereas the maximum amount that could be present is 430 micrograms. On the organic apples, there was 0.5 micrograms of the DPA pesticide residue, whereas the maximum limit is 2.5 micrograms. This shows that pesticides are sometimes used even on organic foods. While neither of the pesticide residue amounts were close to the maximum amounts allowed, chemicals are chemicals, and limiting exposure to them can lead to a healthier life. DPA, which is a marine pollutant, has the potential to cause health problems for aquatic life. This causes pollution to the nearby waterways, and could lead to water pollution. Many of the pesticides that were used were also associated with health and environmental problems as well. Even small amounts of these chemicals could cause health problems. There are limited studies on the long-term effects of pesticides, which is an area that needs to be further researched.

The two examples support each other, as they both expose the possible health and environmental benefits of organic foods. They both also support part of the hypothesis, which is that organic foods may be better for health and the environment. The part where there was not enough evidence on was that organic foods are better for health and the environment in the long term. Therefore, this is an area that more research is needed in.

 Although the research shows that organic foods are safer to consume, for the most part, than non-organic foods, it is important to remember that organic foods can still lead to health problems, such as bacterial contamination. This risk is the same as conventional foods (Mayo Clinic, 2017). Bacteria and other pathogens are commonly found in the environment, and can affect organic foods as well. Organic foods are also handled by various people, including farmers, grocery store workers, packagers, and those who load and unload the food from the trucks, which is the same as what happens with non-organic foods. Therefore, they both have a risk of contamination from an infected worker.

Organic foods also need to be washed and managed the same way that non-organic foods need to be. Although there is less use of pesticides, organic products may still have some residue from something else, such as airborne pesticides. Many people often believe that because the food they are eating is organic, that they do not need to take the same precautions or steps as non-organic foods. However, as was mentioned before, even organic foods can sometimes lead to health problems. Knowing which produce items have higher pesticide amounts can help people decide which produce they really need to purchase as organic and which they can purchase as non-organic. However, the important thing to remember is that eating a balanced diet filled with fruits and vegetables is healthier than debating whether or not to buy organic or non-organic foods.

**Solutions**

 Across many of the articles that were used in this research paper, there was a key theme. This was to focus more on eating a nutritious and healthy diet rather than worrying about organic and non-organic foods. Nutritious foods are those that are nutrient dense. If people focus more on eating a healthy diet, then they can still be healthy. People should not avoid fruits and vegetables simply because they cannot afford to buy the organic counterparts.

Sustainability should also be the main focus when it comes to how foods are produced. It is not likely that the conventional way to grow produce will go away, due to the money and time that is saved. However, it is still important to keep the environment healthy in order to ensure that the future generations can live in it and have enough resources to use. By using less “fossil fuels and chemicals, and by trapping and building carbon in the soil instead of the atmosphere, organic is a profound weapon in the fight against air pollution and global warming,” (Weber, 2009, p. 59). Organic foods may be the key to making this happen. Although organic foods still pose some risks, these risks are not as great as non-organic foods. If all production methods were required to turn to sustainable farming, and were regulated this way, this could ensure that less chemicals would be used on the foods that are eaten, and that the environment would be a healthier place to live for all humans and animals.

 More research is needed on the long term impacts of pesticides and the health of humans and the environment. More research is also needed on whether eating organic foods is more nutritious in the long run compared to eating conventionally grown foods. These are two gray areas when it comes to the topic of organic or non-organic foods. Continuously doing more research on these topics will only be beneficial for the public and can help improve the food and environmental standards.

**Conclusion**

 Nutrition wise, organic and non-organic foods are both healthy and can provide health benefits for people. As long as people have a sound, balanced, and nutritious diet, then they can be healthy no matter what they eat. Conventional foods are as nutritious as organic foods, as there is no sound evidence to prove that organic foods are more nutritious than non-organic foods. Fresh foods should always be eaten to receive the most nutrients. Environmentally, organic foods are healthier. With the decreased use of pesticides, this leads to a lesser chance of damage to the environment and the populations around it. This also leads to a lesser risk of getting many illnesses and diseases associated with exposure to pesticides and chemicals that are used. The most important thing to remember is to focus on eating a balanced and healthy diet. Reading the labels and doing research is something that can aid a person in making a decision on what foods to buy. Everyone is different, and therefore, everyone needs to make sure they meet their needs based on what they can afford.

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