



Quality of Life Investigations: Risk Reductions

Curriculum Unit 02.05.02
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WHAT DO YOU WANT TO DO?

As a past Science Teacher and now in the position of Media Center Assistant, I have come to realize that many students would like to explore environmental topics for their Science Fair Project. Your task is to provide information and guidelines so they may pursue their interests to do a successful project.

HOW WELL YOU WANT TO DO IT?

You will want this unit to give a background on various environmental topics and touch on what is presently happening with these areas. The goal should be to use this unit as a way of helping guide the students through the Science Fair process and complete a meaningful Science Fair Project with a research paper that satisfies all the City-Wide Science Fair standards.

Academic Performance Standards should also be included in this unit.

HOW WILL YOU DO IT?

The student should have the option of doing a Science Fair Project or only the research paper on an environmental topic of their interest. You should encourage the student to do a Science Fair Project.

HOW WILL YOU EVALUATE IT?

Compare the number of students doing the Science Fair Project to those that only do a research paper.

INTRODUCTION

We will begin this unit by doing two probability exercises. The first exercise will be the flipping of coins. The students will be paired with one student flipping the coin and the other student tallying the number of heads per 10 flips. Reverse the role of the student and repeat the exercise. Time will determine the number of repetitions performed by the students but, the more data available, the more reliable the results. After

compiling all the data, the probability of having a head will be about 50%.

The next probability exercise will involve the rolling of a die. We will follow the same procedure for pairing students. One student will roll the die and the other will keep the data sheet and then they will reverse their roles. You can decide what number you wish to track. At the end of data collecting and evaluation, the probability will be 1/6.

After discussing the data ask the student “Is there anyway we can change the results of this data?” After a brief discussion, if this suggestion has not been made ask

“What would happen if we loaded the die or substituted 3 double headed coins?”

You can now explain that the reason for doing this unit is just like loading the die or using two-headed coins. The outcome we want to achieve is to reduce their odds of contracting foodborne disease by making them aware of safer food buying habits, sanitary food preparation and better understanding of food labeling. Like loading the die or inserting two-headed coins, being aware of the dangers present in certain food items and choices we have lessen the probability of contracting foodborne diseases.

If you have access to the kit “Solutions and Pollution,” a good survey is available to have the student complete so that you can have an idea of their perception of a chemical.

Upon completion and discussing the chemical survey, we should introduce how chemical reactions process food in our bodies. The age level and Performance Standards will determine the amount of detail that will be discussed but, they should realize that digestion begins in the mouth, continues in the stomach and in the small intestine where it is absorbed into the blood stream.

If you have a computer lab, let the student go to the website <http://www.brainpop.com> and view two activities in the health section. The two are Digestive system and Body Chemistry. These are short sound movies with a brief explanation about the topic and end with questions to check basic comprehension of the area.

Food and water are necessary for our survival. Our body is like an automobile, if we assemble it properly then we should have few problems if we follow the manufacturer’s guidelines. Proper prenatal and early childhood care should render the same results for a child. However, many people do not understand how to interpret the labeling on foods and feel it must be safe if it is on the shelf and the best laid plans go astray, through no fault of theirs, for having safe food. Some people are forced to purchase food that may not have the same nutritional value or product safety because of financial reasons. The short term financial gain may end up at a long term loss due to a preventable illness. There are also some complaints that meat is not being inspected properly, which is causing problems.

We must be able to rely on the people who ensure that the standards are being met. Our body, like the automobile, runs best when given the proper food. If contaminants get into the supply, problems may result. If an expectant mother puts contaminated food into her body, then birth defects may result as the child and mother share the same materials in the blood. There are also people with very strict dietary requirements and restrictions who need to be aware of potential problems.

RISKS

Pesticides are substances used to control pests and prevent loss of crops or damage to other economic and scenic environments. Because of their toxic nature, we must use them properly and become more aware of

the long-term effects compared to the short-term gain. A great number of animals that eat the pest, we are trying to rid ourselves, die from pesticide poisoning. Reliable toxicity data is available for less than 50% of the pesticides and even less for those more widely used. However, we know that being in pesticide-contaminated water can contaminate fish. Eating contaminated insects or other animals can also serve to contaminate the fish.

According to United States Fish and Wildlife Service, approximately 50 pesticides currently used in the United States have caused birds to die-off. The problem of getting accurate numbers is that many birds die in places where no one will ever find them.

Another problem is that different species of birds have different "Threshold Limits" to pesticides. They are also very mobile and cannot be kept away from areas that use pesticides that are harmful to them.

We are now experiencing a problem with West Nile Virus in the Northeast. The crow is the most susceptible bird to this virus. The death of crows is monitored closely for the cause of death and evidence of the West Nile Virus.

The pesticides, being used to control the spread of this virus, have a down side of killing some natural predators of the mosquito. Does the danger to human health warrant the use of pyrethroids and organophosphates?

If we study the chart below, we see that large animals are not as likely to have large concentrations of pesticides because of their size.

. FDA TOTAL DIET STUDY INFORMATION

(chart available in print form)

Evidence has proven that pesticides can cause cancer and other serious illnesses. However, a greater demand for food is causing some people to take the opportunity to make more money rather than worry about health risks. The pesticide industry has lobbied that absolute proof of harm to children does not exist therefore no change in standards are necessary. The foods most contaminated are strawberries, apples, and peaches grown in the United States. The people in the greatest danger are those working in the field as they are the ones that have long-term exposure to these pesticides.

The biggest pesticide risk to children is methyl parathion. The culprit is neurotoxic organophosphate insecticides. This is related to the amount of apple products eaten by children. Children consume much more apples and apple products than adults. Couple this with the difference in size and weight and we can understand why the risk factor is greater for children than for adults. The good news is that the neurotoxic organophosphate is no longer allowed on apples as of 2001. However other OP insecticides are still permitted.

Tests in animals have shown that pesticides affect the developing nervous system, as well as learning, behavior, and memory. Most children are exposed to these pesticides by the food they eat. Conventional food that we eat are combinations of pesticides believed to cause brain and nervous system damage, cancer, and disruption of the endocrine and immune systems. Food analysis shows that children between the ages of one and five eat from 15 to 20 different pesticides each day.

Pesticide level in foods are regulated by the EPA through a system called food tolerances. The problem with

this system is that the pesticide effect is looked at by itself instead in combination with other pesticides that the child may consume. If you have been trained with Science Education for Public Understanding Program (SEPUP) Kit “Threshold Limits,” now would be a good time to demonstrate what is meant by threshold limits. Use the lesson entitled “Taste Test for Salt Solution.” What this does is to let students determine their threshold of taste for salt in water solutions by tasting drops of salt water of known concentrations. What they discover is the meaning of threshold limits and how it differs among individuals.

Pesticides also may contaminate our water supply. As we know, water is called the universal solvent because it dissolves more substances than any other single substance. If you have access to the kit “Investigating Groundwater: The Fruitvale Story,” this will be a good time to study the factors affecting groundwater movement. In this exercise students investigate an area where test wells have indicated an unsafe level of pesticides in the water. The first activity deals with factors that affect the movement of groundwater. The second considers concentration and dilution. The third activity the students receive and discuss reports of water contamination. Potential contamination sources are identified and they must decide where to drill three test wells to determine the source of contamination.

Again depending on your Performance Standards, you may want to discuss how the water enters the plants.

Food Additives and Processed Food

The first question we should ask is “Why are food additives used?” As we have all witnessed, food does not last forever, in fact some foods do not last for more than one day. In the beginning people would salt, pickle or smoke food to help preserve it. As the demand for food increased, better methods of food preservation developed.

Purpose of food additives:

Improve shelf life: Inhibit growth of microbes that cause food poisoning.

Convenience: preparation

Increase nutritional value: additives (vitamins)

Improve flavor: artificial flavors

Improve appearance: emulsifiers

Like most things in life, there are the good and the bad. You must be aware of how your body functions and be aware of which additives too stay clear or use in moderation.

Food packaging protects the food and keeps it in better condition, over a longer period of time, until it is to be used.

Packaging also:

Protects it from contamination and damage.
Labels contents.
Provides visual observation of product.
Reduces waste by packaging edible parts.

Comparing countries with sophisticated storage, packaging and distribution systems, food waste was calculated at between 2-3%, while countries without these systems, the waste is between 30-50%.

The packaging industry is trying to implement the 3-R's', Reduce, Re-use and Re-cycle in response to environmental concerns.

Food colours are used for cosmetic reasons. All colours used have been tested and found satisfactory for human consumption. If we think about it, most of us gravitate to food that looks appealing rather than think about the nutritional value. The article (Food, Science & Technology) suggests food without color would be like watching black and white TV instead of the color TV we now enjoy.

Genetic Engineering

Genetically engineered foods have now reached the shelves in our grocery stores. There is concern that not enough is known about the long-term effects of these foods on the human body. According to the Environmental Defense Fund, "Scientists can now readily shift genetic material from one species to virtually any other species. Genetic material can also be synthesized in the laboratory and then transferred into organisms. As a result, a virtually limitless number of genetically encoded substances...can now be added to organisms used as food." A big concern is that many of these substances have never been part of the human food supply.

The purpose of genetically altered food is to improve production, reduce the use of herbicides and pesticides and increase yields to feed a growing world.

Again we are faced with not knowing long-term results. Some concerns are the damage that may affect the ecosystem. Genetic mistakes are irreversible and irretrievable. Once they are released into the environment, they pass these characteristics on to others and the evolution begins.

What will happen to plants and animals that have developed immune systems to certain diseases? What will happen if new species are introduced to their environment?

A list of concerns :

1. Increased pollution of food and water supplies- Plants can tolerate larger amounts of herbicides.
2. Unsafe track record -- 1989- 37 people died, 1500 permanently disabled and 500 became very ill by being exposed to a genetically engineered form of the food supplement tryptophan. Any guarantees this will not happen again?

3. Allergic reactions -- May transfer new and unidentified proteins from one food to another triggering allergic reactions.
4. Unpredictable, permanent changes in the nature of our food -- Genetic engineering is not an exact science.
5. Harmful effects may not be discovered for years -- No long-term studies available to prove safe or unsafe.
6. Decreased effectiveness of antibodies -- Antibiotic-resistance genes are incorporated into nearly every genetically engineered organisms.
7. Sick and suffering livestock -- Early experimental failures with cows and pigs.
8. Deletion of important food elements -- Genetic engineers may intentionally remove or inactivate a substance they consider undesirable in food.
9. Counterfeit freshness -- Cannot accurately judge the quality of the produce we buy.
10. Infringement of religious freedom -- Violation of religious beliefs of natural food products.

RISK REDUCTION

We must remember that everyone does not have the same tolerance. What may bother one person may not bother the other. If you remember the activity “Determining Threshold Limits,” different people have different tolerances.

Probably the best way to reduce foodborne diseases is to become educated how they are caused and how to reduce the risk of contracting these diseases. It will not be easy, especially with older children. When they are

out of the parents dietary control, you have to hope that you set a good example and have given them the background to make intelligent decisions. But even the best laid plans may go astray.

Foodborne diseases result in an estimated 1 to 6 billion dollars a year in medical expenses and lost productivity. Of the 76 million people who suffer foodborne disease in the United States, 325,000 are hospitalized and more than 5,000 die.

There are more than 250 known foodborne diseases. Bacteria is the chief cause followed by viruses and parasites. Following certain food handling procedures can reduce the risk of contraction foodborne diseases.

What are some ways to prevent foodborne diseases?

Wash your hands before preparing food.

Clean work area with hot soapy water after preparing poultry or meat.

Cook beef and beef products thoroughly, especially hamburg.

Cook poultry and eggs thoroughly.

Eat cooked food promptly and refrigerate leftovers within 2 hours.

Wash fruits and vegetables thoroughly.(Not with soap and water as soap is not meant to be consumed.)

Drink only pasteurized milk and juices and treated surface water.

Wash hands carefully after using the bathroom.

Babies and young children are those we have the most dietary control. Babies are not mobile enough and young children do not have the financial means to purchase the food of their liking. Therefore, it is very important that you start dietary education from this early age.

Tests have shown that pesticides are routinely found in baby foods consumed by babies during their first six months of life. Although the levels are within federal standards, this can be misleading as they do not take into account the age or size of the child. Another problem is that we do not know the effect of these toxins on small children. Be aware that fruit products contained more pesticides and at higher levels than vegetables. A probable human carcinogen, iprodione, was found in peaches and plums at higher levels than any other pesticide.

The FDA is responsible of the testing of baby foods. Four times a year they test 234 samples from one geographic location and test them for pesticides and other contaminants. It would be in your best interest to check testing results from some non-government agencies to get more data. Remember, when analyzing data, investigate the source so a more valid conclusion can be made.

The following is a chart from the website: http://eartheasy.com/eat_pesticides_produce.htm

This chart not only tells which fruits and vegetables have the highest levels of pesticide residue, they also give you a list of safer substitute fruits and vegetables.

(charts available in print form)

Organic Food

Organic farming is one of the fastest growing agricultural endeavors in the world. The following page shows a chart from <http://www.organic.aber.ac.uk/stats.shtml> documenting this growth between the years 1993-1999.

Buying organic, when possible, is the safest way to buy uncontaminated food at this time. The certification process is very strict and they monitor their own farms and farm products. Organic food products are generally grown in soil that has been replenished with organic materials which supply the needed minerals to children.

Ultimately, the choices you make with food purchases and consumption are your responsibility. Hopefully, this brief introduction to food risk will motivate you to investigate more thoroughly your eating and food buying habits.

A way to involve students would be to encourage and guide them through an area of their interest for a Science Fair Topic.

Percentage of Organic Farms in EU Countries

(chart available in print form)

LESSON PLAN 1

CHEMICALS IN FOODS: ADDITIVES

Purpose: To learn the role of food additives.

Objective: The student will be able to read the label on various foods and determine the additives and the purpose of the additive for that food product.

Procedure: Follow the directions for performing Activity two-“What’s on the Label.”

Observations: Additives:

Change existing physical characteristics of food during processing.

Enhance the nutritional content of food.

Enhance the color of food.

Enhance the flavor of food.

Preserve the food.

Conclusion: Most foods contain additives. People with allergic reactions to food must read labels carefully.

LESSON PLAN 2

DETERMINING THRESHOLD LIMITS

Purpose: To understand what is meant by "Threshold Limit."

Objective: The student will realize that "thresholds" are different for different individuals.

Procedure: Follow the directions for Activity one- "Taste Test for Salt Solution."

Observations: Not everyone had the same threshold for the salt solution.

Conclusion: Taste alone cannot be used to determine the presence or absence of a Substance.

Teacher/Student Bibliography

Wargo, John. *Our Children's Toxic Legacy, How Science and Law Fail to Protect Us from Pesticides*. Yale University Press: Yale University 1996

An excellent resource for teachers. A good background on pesticide policies and the dangers faced by improper use of pesticides.

Environmental Science Series -- Copyright 1995 Globe Fearon Educational Publisher 240 Frisch Court, Paramus, New Jersey 07652

Changing Populations

Deals with human populations. Can use this for increased food production demands.

Water and Air

Contains case studies dealing with water supply, quality, conservation and air pollution issues.

Land Use

Discusses the various ways land is used and provides interdisciplinary connections. A good way to discuss organic farming needs.

SEPUP -- Science Education for Public Understanding Program Lawrence Hall of Science, University of California, Berkeley

Chemical Survey & Solutions and Pollution

Students respond to a questionnaire concerning their perceptions about chemicals. You can investigate more activities that apply acid-base chemistry to deal with some of our water pollution problems.

Risk comparisons

Students are introduced to the concepts of probability, risk, risk comparison, and decision making.

Determining Threshold Limits

How do chemists analyze samples to determine what and how much of a certain chemical is present? A good activity to demonstrate the need for better standards of pesticide use and the labeling of products containing pesticides.

Investigation Groundwater: The Fruitvale Story

Illustrates how the source and the extent of well contamination are determined. Activity can be used to explain how pesticides can enter groundwater and may contaminate wells.

Chemicals in Foods: Additives

Investigates why chemicals are added to food. Activity can be used to show there are “trade-offs” and risks with food preservation.

eartheasy Pesticides and Produce http://eartheasy.com/eat_pesticides_produce.htm>

Food Safety Research Agenda Risk assessment and the Research Agenda <http://www.fsis.usda.gov/OPHS/fsragend.htm>

About Organic Frequently Asked Questions About Organic Farming http://www.ofrf.org/general/about_organic/index.html

Environmental Working Group

Chapter 1- Pesticides in Baby Food

Chapter 2- Sampling Plan and Testing Methods

http://www.ewg.org/pub/home/Reports/Baby_food/Baby3.html

Healthy Child online Articles and Resources

Hass, MD Elson M. Food Additives and Human Health http://healthychild.com/database/food_additives_and_human_health.htm>

Sheppard, Jane Whole Foods for Healthy Kids http://healthychild.com/database/whole_foods_for_healthy_kids.htm

Mothers for Natural Law Genetic Engineering-Safe or Sorry?

http://www.healthychild.com/database/genetic_engineering_safe_or_sorry_.htm>

Special Problems of Pesticide Exposure for Children

http://www.healthychild.com/database/special_problems_of_pesticide_exposure_for_children.htm

The Environmental Working Group Pesticides Pose Health Risks for Children

http://www.healthychild.com/database/pesticides_pose_health_risks_for_children.htm>

BrainPOP LLC Science Movies- Health- Digestion & Body Chemistry <http://www.brainpop.com>>

Maverick Ranch, Natural Lean Beef Pesticides and other Issues <http://www.maverickranch.com/pesticides.htm#3>>

Food Science & Technology FAQs

Food and Nutrition FAQs <http://www.ifst.org/ifstfaq1.htm>>

Food Safety FAQs <http://www.ifst.org/ifstfaq2.htm>>

Additives and Packaging FAQs <http://www.ifst.org/ifstfaq3.htm>

Science and Food FAQs [Http://www.ifst.org/ifstfaq4.htm](http://www.ifst.org/ifstfaq4.htm)

Environmental Issues Organic Farming-Trends in the United States.

<http://environment.about.com/library/weekly/blorganic5.htm>

<https://teachersinstitute.yale.edu>

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