



Healthy Diet, Healthy Eyes

Curriculum Unit 02.05.08
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A healthy well-balanced diet is essential to the growth and development of the visual system. This curriculum will help students understand the relationship between a healthy diet and healthy eyes. It will help students investigate the problems that occur when diets are not balanced or are tainted by growth and processing techniques. In addition, students will be made aware of how certain eye conditions can develop or be controlled by certain foods or supplements to diets.

Students will understand the ingredients of a diet needed to develop healthy organs. Teachers and students also will explore the issues that are of concern in the 21st century such as: types of diets, use of vitamin and mineral supplements, food additives, biological contaminants, food safety, and product labeling.

The unit will begin by exploring the role of nutrition in the prenatal development of the visual system. It will also provide information on the problems that occur such as diseases and disorders that are caused or made more problematic because of poor diets. It will also investigate eye disorders and the role of diet in visual problems.

Population

Developed for students in high school, this unit will assist visually impaired and blind students in their efforts to explore, analyze, and understand the importance of good nutrition for the health of an individual. The project will focus on the development and of healthy eyes and visual processing.

This curriculum will be taught to students who are visually impaired and legally blind in my course "Life Skills for Blind and Partially Sighted." In addition, I will teach the unit in the summer school program and in the Extended Day Academy for visually impaired students conducted at Wilbur Cross High. This unit will be of interest not only to visually impaired students but also their sighted peers. In addition, it can be modified for elementary and middle school or special needs students.

Visually impaired students have a strong interest in protecting their remaining vision and have a personal interest in the newest research on diet supplements and the claims that the use of certain nutrients and

vitamins can prevent or improve vision. Therefore, this unit covers a topic that is of great importance to the blind and visually impaired students. Visually impaired and blind students face many issues concerning their diet and their eye problems. For instance, students with diabetes need to be well informed about nutrition and they need to understand the visual problems that may arise when diabetes is not controlled.

The Curriculum

This curriculum will provide information on the role of nutrition and eye health. It will provide students with information on:

1. what makes up a healthy diet
2. how the health of the eye and visual functioning is affected by diet
3. how deficits in diet can place eye health at risk
4. eye diseases and disorders associated with diet such as Xerophthalmia (the leading causes of blindness in underdeveloped countries) and diabetes mellitus (the leading causes of blindness in the United States)
5. which vitamins and minerals are of particular importance to your eyes
6. studies on the use of vitamins and mineral supplements for improving such eye disorders such as cataracts, night blindness, and retinitis pigmentosa

Modifications for Blind and Visually Impaired

This program will offer suggestions and techniques for adapting lessons to allow blind and visually impaired students the opportunity to learn about healthy diets and visual concerns. To derive maximum benefit from this curriculum visually impaired students should be presented with a multisensory approach that allows students to acquire information from several sources of sensory input to compensate for their reduced vision. It should include tactile diagrams, audio narratives, and Braille and large-print translations.

Blind and Visually Impaired

“Every seven minutes, someone In America will become blind or visually impaired.” (1) There are approximately “10 million visually handicapped people in the United States and approximately 2 million are school-age children.” (2)

There are a number of different causes of visual impairments resulting in a wide variety of visual problems. Children can be born blind or become blind as a result of an accident, illness, or eye condition. Some individuals are totally blind while others may see light, shadows, and colors and yet have no useful vision. Depending on the eye condition, others may see images that appear blurry, distorted, or incomplete while others are able to read large print but have difficulty traveling without assistance.

Many of visually impaired children are mainstreamed into regular education classrooms and work along with their sighted peers with the assistance of adapted materials, such as Braille translations of text. It is the job of the Teacher of the Blind to assist both the student and classroom teacher in making this a full and rewarding experience. No student should be excluded from a class or activity due to their visual impairment. However, some subjects are more difficult than others to adapt or modify.

Individuals are classified as visually impaired or legally blind according to their visual acuity, that is, a person's ability to discriminate fine details. The legal definition of "visual impairment" refers to an individual with a visual acuity of 20 / 70 in the better eye with the best correction. The legal definition of legally blind refers to an individual with a visual acuity of 20 / 200 in the better eye with the best correction or a visual field of no more than 20 degrees. In both cases, vision cannot be fully corrected by prescription lenses, optical devices, surgery, or medical treatment. (3)

Low vision can result from a variety of eye conditions, such as cataracts, macular degeneration, retinitis pigmentosa, glaucoma, or diabetic retinopathy.

Teacher of the Blind

A teacher of blind and visually impaired serves as a consultant to classroom teachers and helps to select appropriate methods and materials. The teacher of the blind assists teachers by explaining the types of objects students are able to see and under what conditions. In addition, these specialists deal with instructional problems related to the teaching of specific lessons and concepts. Teachers of the blind also adapt materials and lessons; provide text in Braille and large print; and by teaching specialized skills such as the use of computer programs that produce voice output or Braille translations of text. They work directly with students when they teach Braille and specific skills needed by blind and visually impaired students.

This curriculum will be taught in "Life Skills for the Blind," - a course that helps visually handicapped students assimilate into the community. It will also be shared with classroom teachers such as science teachers and others that may use the curriculum with students in their classroom.

Individual Considerations

Individual considerations are very important in teaching a student with a visual impairment. Teachers must understand that different approaches are necessary depending on such factors as partial or total loss of vision, age of onset of the impairment, and ability of student to use adaptive equipment such as magnifiers.

Other factors such field of vision, near and distance acuity, color vision, and ability to Focus is also important considerations. Teachers should use rich descriptive terminology that describes qualities and experiences and take into account the student's remaining senses. Thus they will have a real and rich meaning for the child.

The Importance of A Well-Balanced Diet

A healthy well-balanced diet is of great importance to the development, maintenance, and perhaps even improvement of vision. Understand the function of nutrients in the body is important to selecting appropriate foods to maintain the health of the eye.

In summary:

1. Carbohydrates provide energy.
2. Protein repairs cell tissue and promote growth.
3. Fats protect vital internal organs and provide warmth.
4. Vitamin A improves vision and assists in the growth of children.
5. Vitamin B releases energy from foods.
6. Vitamin C is needed for healthy skin, hair and gums.
7. Vitamin D and calcium are needed for healthy bones and teeth.
8. Sodium maintains the water balance of the body. It is needed for all body fluids, such as blood, urine and perspiration.
9. Fluorine is needed for healthy teeth.
10. Iron is needed to produce the chemical hemoglobin, which enables the blood to carry oxygen round the body. (4)

The Role of Vitamins and Minerals in Eye Problems

There are certain vitamins and minerals that are of particular importance to healthy eyes:

Vitamin A

Source : Dairy products (milk, cheese, butter, cream, margarine), meat, eggs, cheese, green and yellow vegetables (spinach, carrots, yellow squash, sweet potatoes, pumpkins) and orange fruits (papaya, mangoes).

Eye Function: Vitamin A as retinol is part of the visual pigment in the human eye. A leading cause of blindness in third world countries is vitamin A deficiency.

Eye Problem: Poor vision in dim light, Nightblindness

Vitamin A is helpful for many types of eye problems including poor vision in dim light or at night. Vitamin A is a fat-soluble substance that is divided into retinol and provitamin A. Retinol is the active form of vitamin A usually found in animal products, while provitamin A is found in fruits and vegetables.

Meat products are better sources than vegetables. Citrus fruits do not contain any vitamin A. This vitamin has a great impact on mortality and growth. Vitamin A deficiency can cause blindness

Vitamin A Deficiency

In the United States, foods including most dairy produces are fortified with Vitamin A. Therefore, Vitamin A deficiency is very rare in Americans unless individuals have certain chronic intestinal illnesses.

The second-leading cause of blindness in the developing world is lack of Vitamin A. In developing regions such as Africa, Asia, South America, and the Western Pacific. (5)

B complex

Source: Wheatgerm, wholegrain cereals, brewer's yeast, yeast extract

Eye Function: B complex is required to keep eyes healthy. A deficiency of B2 can lead to bloodshot, burning or gritty feeling eyes, cataracts and sensitivity to bright lights.

B complex is critical components in cellular function, including recycling antioxidants.

Eye Problem: Cataracts, sensitivity to bright lights, bloodshot eyes, and burning or gritty eyes

Vitamin C

Source: Citrus fruits, potatoes, green vegetables, tomatoes

Eye Function: Vitamin C is being investigated as a prevention of cataracts and glaucoma. Vitamin C is concentrated in the vitreous humor and in the lens of the eye at levels generally ranging 10-50 times higher than the bloodstream.

Eye Problem: Cataracts, glaucoma

Vitamin C is important for healthy eyes. Available in fat and water-soluble forms.

Vitamin A (as retinol) is part of the visual pigment in the human eye.

Vitamin E

Source: Wheatgerm

Eye Problem: Cataracts, retina and blood vessels disorders

Zinc

Source: Shellfish, red meats, eggs, nuts and seeds, liver, sardines

Eye Function: Zinc is required in a high concentration for the retina to function properly.

Zinc is also required to release vitamin A from the liver for use by the eyes. Numerous studies into the nutrition of macular degeneration have focused on the importance of zinc. Eye Problem: Retina dysfunction

Selenium

Sources: fish and shellfish, sesame and sunflower seeds, wholegrain cereals.

Eye Function: Selenium may help to prevent cataracts and to slow the aging of the eye. (6)

Fetal Development

Stages of Eye Growth

Parts of the eye develop during in the following periods:

A. 3 - 4 weeks: The Eye Fields, Optic Vehicle

B. 5 - 6 weeks: The Optic Cup, Lens Vehicle, Choroid Fissure, Hyaloid Artery, Cornea

C. 7 - 8 weeks The Anterior Chamber, Pupillary Membrane, Lens, Retina, Iris D. 9 -15 weeks: Ciliary Body 8-10 weeks: Eyelids (7)

Nutritional dependence of the embryo

The eye is a delicate and complex organ that is greatly influenced by nutrition. Throughout the pregnancy good nutrition and avoidance of toxins are important to the development of all organs including the eye. The first 8 weeks is the most critical period in the development of the eye. Improper nutrition and contact with toxins, such as pesticides, are most dangerous to the development of the eye in this stage.

Vitamin A is important to the development of healthy eyes. Women in their first trimester of pregnancy should be conscious of their intake of vitamin A. They should be careful not to take too much vitamin A, but they should also not to take too little.

Vitamin A will remain an important factor even after the birth of the child. Infants need a great deal of Vitamin A because they are growing rapidly. In some cases, the severe shortage of this important vitamin results in a vitamin A deficiency. (10)

Premature infants are at risk for vitamin A deficiency and are often given supplements after birth. It is not uncommon for children to develop a Vitamin A deficiency especially after they been weaned off breast milk, a natural source of the vitamin. Supplements of vitamin A may be used to help correct the deficiency or prevent it from occurring. (11)

Also, vitamin A deficiency is common in women who are pregnant or lactating and in children 8 months to 8 years old. However, too much vitamin A given to children could be toxic, while too little increases a child's risk for infection. (12)

Eye Diseases and Disorders Related to Diet

Common eye problems as they relate to our diets include A. Night Blindness B. Xerophthalmia C. Cataracts D. Macular Degeneration E. Macular Edema F. Glaucoma G. Diabetes mellitus (13)

A. Nyctalopia (Night Blindness)

Nyctalopia, also known as “Night Blindness,” is the inability to see in dim light and to adapt from light to darkness resulting from a deficiency of retinol. Nyctalopia may be caused by numerous diseases that cause degeneration of the rods of the retina (the sensory cells needed for vision in dim light). Nyctalopia also may occur due to a result of vitamin A deficiency. The vision usually returns when adequate levels of the vitamin are taken. (14)

Night blindness is one of the first problems experienced due to the deficiency of vitamin A. Night blindness occurs because a pigment in the retina (rhodopsin) requires vitamin A (retinol) in order to function. The cells lining or covering organs (the epithelial cells), can degenerate due to deficiency in vitamin A. This lack of deteriorate vitamin A may cause the conjunctiva and cornea in the eye to resulting poor vision or blindness. (15)

B. Xerophthalmia

Xerophthalmia is an eye condition caused by a severe or prolonged lack of vitamin A. In this condition, the conjunctiva becomes dry, wrinkled and thickened. Eventually the cornea may become scarred and perforated which results in total blindness. Sensitivity to light is also a problem. (16)

It is estimated that as many of 500,000 new cases of this disorder are reported every year. Nearly half of these cases result in a loss of vision. (16) In fact, vitamin A deficiency is the second-leading cause of blindness in the developing world, according to Stephen McGowan, M.D., professor in the University of Iowa, Department of Internal Medicine. (17)

There are three major reasons why children in developing countries develop a vitamin A deficiency: 1. the mother is usually undernourished with a low vitamin A content resulting in children born with low stores of vitamin A 2. there is little or no vitamin A (or carotene) in the diet of young children or 3. the absorption of vitamin A is impaired due to protein malnutrition. (18)

In India, 52 000 children are go blind every year due to vitamin A deficiency. A higher number of cases of Xerophthalmia were observed in lower socioeconomic status where there often was a low intake of nutrients and calories. The mother often is illiterate with a family of 6 or more. (19)

Improvised East Asian countries such as Bangladesh, India, Indonesia and the Philippines have the highest incidence of xerophthalmia found in infants and young children. Complicating the problem, these areas also are plagued by various infections that further cause or aggravate vitamin A deficiency. (20)

The World Health Organization has made the prevention of xerophthalmia a top priority in developing nations. They have reduced the problem by providing high doses of vitamin A in capsule form twice a year. They recognize, however, that in the long-term they must educate individuals to understand the need for mothers and infants to regularly eat carotene rich foods such as dark green leafy vegetables, pawpaw, mangoes, yellow corn, sweet potatoes, squash and pumpkins. (21)

C. Cataracts

The lens is crystal clear and allows light to pass through and focus on the retina in normal situations. Cataracts are cloudy areas in part or the entire lens of the eye. There is a decreased visual acuity because the cataract prevents light from easily passing through the lens. Print appears hazy and contrast is limited. Individuals have difficulty seeing in poorly lit environments due to decreased contrast. Distance vision can be blurred especially outdoors. Colors appear faded or changed in hue. Many people experience an increased sensitivity to light and glare. Visual functioning may be enhanced with the use of low vision devices such as microscopic and telescopic glasses, lenses that filter light, and magnifying glasses.

In classroom settings, students may be assisted by:

1. Use of bright primary colors with high contrast.
2. Reading materials that have high contrast, such as large black print on white or light Yellow paper.
3. Use of black felt-tip pens and bold, enlarged print a minimum of 18 point.
4. Reduction of glare by avoiding direct sunlight. (22)

D. Macular Degeneration

The macular is the area in the center of the retina that allows sharp visual detail. Macular degeneration, central vision is blurred or distorted. There is a “blind spot” in the center of the field of view. Individuals have difficulty recognizing faces and colors, reading, and doing near point work. Symptoms include blurry areas on printed text; a wavy or bent appearance to straight lines of text; and dark spaces blocking the center area of vision. Macular degeneration develops gradually and is not usually noticed during early stages because there is no pain associated with the disorder. There is no known treatment that prevents this disorder or that can restore the loss of vision. (23)

E. Macular Edema

In the condition, macular edema, blurred vision occurs because the macula swells due to leaking fluid. New vessels may grow on the surface of the retina and can bleed into the eye, blocking vision. The disease also may progress a long way without symptoms.

The use of various types of equipment can assist the victim of macular degeneration, such as:

1. The use of magnifiers and high-intensity lamps may help when reading print or performing near-point tasks.
2. Telescopes may be used for distance vision tasks such as reading a blackboard or reading a sign
3. A closed-circuit television (CCTV), which magnifies and projects, printed material onto a television screen may help in reading tasks. (24)

F. Glaucoma

Glaucoma is an eye condition that involves an increase in pressure inside the eye due to a buildup of excess fluid in the eye. In the early stages peripheral vision becomes a problem. In later stages it destroys all peripheral vision and then the central vision, Resulting in total blindness.

Glaucoma may also become a problem. A person with diabetes is nearly twice as Likely to get glaucoma as other adults. And, as with diabetic retinopathy, the longer you Has had diabetes, the greater your risk of getting glaucoma. Glaucoma may be treated with medications, laser, or other forms of surgery.

Treatment for glaucoma attempts to bring down the pressure in the eye to prevent damage to the optic nerve. Damage already done to the optic nerve by high pressure cannot be reversed. Early detection, ongoing treatment, and the use of specialized low vision device and services allows individuals to live productive lives at home, work, and travel. Special lenses allow the user to make the best use of available vision. Using specialized devices and techniques can retain Independence, productivity and quality of life. (25)

G. Vision Problems Caused By Diabetes

Diabetes

Diabetes is the leading cause of blindness in the United States) (26) Every year between 12,000 and 24,000 people become blind due to diabetes. (27) This serious disease also can cause problems like heart disease, kidney failure, and amputations. Diabetes may be controlled, to some degree, with medications, exercise and good diet. Without treatment or intervention severe visual impairments or blindness may occur. (28)

Visual impairments such as glaucoma, cataracts, diabetic retinopathy and corneal diseases are frequent complications of diabetes. Individuals with diabetes have a high rate of blindness due to the complications of these eye disorders: 1. Diabetic retinopathy--damage to the blood vessels in the retina. 2. Cataract--clouding of the eye's lens. 3. Glaucoma--increased fluid pressure inside the eye that may lead to optic nerve damage and loss of vision. 4. and corneal diseases. (29)

Diabetic Retinopathy

Diabetic retinopathy, the major cause of blindness in people with diabetes, is a disorder where the small blood vessels of the retina form abnormalities such as weakening of blood vessel walls or leakage from blood vessels. (30) This condition occurs when blood vessels stop nourishing the retina properly. In the early stages, retina blood vessels may swell and leak fluid to the retina. In the later stages, serious vision loss is caused when new blood vessels grow and send blood to the center of the eye.

These changes may result in vision loss or blindness. However, often there are none in the early stages of the disease. Vision may not change until the disease becomes severe. All people with diabetes need to get a dilated eye exam at least once a year. (31)

Diabetic retinopathy may result in the following: 1. Changes in focus and changes in refraction. 2. Increased sensitivity to bright lights and glare 3. Poor color vision 4. Overall blurred or hazy vision making printed text distorted 5. Clouding of the vitreous (light normally passes from the lens through the vitreous to the retina.) (32)

Non-proliferate retinopathy is a common form of this disorder. This is often a mild form of the disease and does not usually interfere with vision. However, when Non-proliferate retinopathy is left untreated it can progress into a more harmful form known as proliferate retinopathy. In this form new blood vessels multiply and spread throughout the retina and surrounding areas. This often affects the macula, the area of the retina that provides sharpness and detail in vision. Proliferate retinopathy may also cause bleeding in the fluid-filled center of the eye or swelling of the retina and leading loss of vision or blindness. (33)

The Role of Diet in Diabetes

The longer someone has diabetes, the more likely he or she will get diabetic retinopathy. Nearly half of all people with diabetes will develop some degree of diabetic retinopathy during their lifetime. (34)

A healthy diet will allow diabetic patients to control blood glucose levels is an important step in preventing eye

problems. To reduce the risk for complications of diabetes, including vision loss or blindness, diabetics need to control their blood glucose levels. This requires frequent testing of glucose levels and monitoring by a specialist in diabetes. (35)

The better control of blood sugar level slows the onset and progression of retinopathy and lessens the need for laser surgery for severe retinopathy. Individuals who keep their blood sugar levels as close to normal as possible had much less eye, kidney, and nerve disease. (36)

The American Diabetes Association estimates that “nearly all patients who have Type 1 diabetes for about 20 years will have evidence of diabetic retinopathy.” (37) They also calculate that “up to 21% of people with Type 2 diabetes have retinopathy when they are first diagnosed with diabetes, and most will eventually develop some degree of retinopathy.” (38)

The New England Journal of Medicine reported the results of a 10-year study named the Diabetes Control and Complications Trial in September 1993. This study indicated that when Type 1 patients improved their blood glucose levels they prevent or delayed the onset of diabetic retinopathy. It also reported that when therapy reduced blood sugar levels to close to normal they reduced the damage to the eyes by 76%. (39)

Pesticides and Vision Problems

A number of pesticides are linked to health concerns including problems with severe eye deformities. The herbicide cyanazine and the pesticide benomyl will be investigated, in this curriculum, due to their link to deformities of the eye.

Pesticides

Pesticides are widely used in producing food worldwide. Pesticides are products such as insecticides, fungicides, rodenticides, weed killers, and antimicrobials that are designed to prevent, destroy, or repel pests. There are 469 pesticide active ingredients or high-hazard inert ingredients used on food. (40)

Organophosphates, a group of about 40 pesticides, have gained much attention due to their possible link to health problems in humans. The EPA, in fact, has listed organophosphates as posing the greatest risk by placing them in the highest priority group. They are documented to have an acute and chronic effect on both humans and wildlife. (41)

Organophosphates make up approximately one half of all insecticides sold or used in this country. The public is exposed to organophosphates on a regular basis through their use on many food crops, ornamental plants and lawn care. They are used on major crops such as cotton, corn, wheat and many fruits, nuts and vegetables. In addition, they control termites and mosquito and diseases such as malaria and encephalitis. (42)

Pesticides may leave residues in or on fruits, vegetables and other foods. When the foods are washed or processed the residue may be removed. In some fresh produce and processed foods, however, traces of the pesticide remain. (43)

The EPA sets a maximum residue limit or tolerance that may remain in produce And other products to ensure safety. Pesticide tolerances are set by the EPA according to: the toxicity of the pesticide, the amount and frequency of application, and how much of residue typically remains. The EPA evaluates pesticides before they can be sold in the United States. It is the responsibility of the EPA to make certain these products will not harm the health of humans or the environment before they are allowed to be sold. In 1996, “The Federal Insecticide, Fungicide, and Rodenticide Act” and “The Federal Food, Drug, and Cosmetic Act,” set requirements to ensure pesticides meet current safety standards. The Food and Drug Administration and the U.S. Department of Agriculture monitor the food produced or imported into the United States. (44)

The Fungicide --Benomyl

Benomyl is a fungicide that is toxic to microorganisms and invertebrates. It is used on a wide range of fungal diseases for field crops (cucumbers, tomatoes), fruits (berries), nuts, ornamentals, mushrooms, and turf. Benomyl is known by the commercial names: Benlate, Agrodit, Benex, Benosan, Fundazol, Fungidice 1991, and Tersan. (45)

The chemical company DuPont produces benomyl using the brand name Benlate. First manufactured in 1987, (46) Benlate50 DF, is one of the most widely used and controversial fungicides in the world. (47) Benomyl is the primary ingredient of Benlate. (48)

Benzoate comes in several forms: wet and dry powder, and dispersible granules. #1000 Crops are often sprayed, however, in ornamental nursery leaves are sprayed and the soil is also drenched. (49)

Benlate is the focus of a numerous health complaints. Many individuals who worked or came in contact with the substance complain of suffering with kidney failure, cancers, respiratory problems, frequent sore throats, aching joints, chronic nosebleeds, swollen joints and glands, fatigue, nausea and memory loss and serious eye disorders. (50)

Eye Disorders and Benomly

Two very serious problems have been linked to the use of benomyl are the eye disorders known as anophthalmia and microphthalmia. Microphthalmia, is an eye condition resulting in children who are born with smaller eyes. A severe form of this disorder is anophthalmia, an eye condition in which the eyes do not form. (51)

Anophthalmia

The condition termed anophthalmia refers to children who are born without eyes. In this condition one or both eyes didn't form during the early stages of pregnancy. (52) There are three classifications for this condition.

1. Primary anophthalmia--the complete absence of eye tissue 2. In secondary anophthalmia --the eye begins to develop but stops. The result is that the infant has only residual eye tissue or extremely tiny eyes.

3. In degenerative anophthalmia --the eye begins to form and but degenerates. One reason for this may be a lack of blood supply to the eye. (53)

Anophthalmia may affect one eye (monocular) or affect both eyes (bilateral). Anophthalmia indicates that there may be some outside interruption during fetal development that occurred very early after conception. (54)

Prosthetic eyes can be fitted to the empty eye sockets for cosmetic purposes. In some cases, conformers - balloon-like devices can be expanded inside the socket, are also help to promote the growth of the eye socket. (55)

Microphthalmia

Microphthalmia is a condition that means the eye(s) started to form during pregnancy but for some reason stopped forming, resulting in small eyes. The size of the eye can vary from child to child. (56) Microphthala may affect one or both eyes. Some children with microphthalmia have extreme reduced vision while other children may have some residual vision. (57)

Both birth defects are rare in humans. (58) True anophthalmia occurs in approximately 1 in 100,000 births. Microphthalmia occurs in approximately 1 in 10,000 births. Around 2 thirds of these cases are believed to be genetic. The remaining cases may be caused by environmental factors such as drugs, pesticides, radiation, toxins or viral causes. Some viruses linked to these conditions are toxoplasmosis, rubella and certain strains of the flu virus. (59)

Case Studies

Research into the cause or causes of these eye conditions has intensified over the past few years in the hope that a cause will be identified. (60) The health effects of Benlate have been of great concern in England, Australia and New Zealand, as well as the United States. Birth defects of newborns with eye abnormalities, such as Anophthalmia and Microphthalmia, have been reported in clusters in some areas.

United States

A jury awarded \$4 million in damages to the parents of a child born without eyes. The lawsuit alleged that the mother had been exposed to the fungicide Benlate when she was six weeks pregnant. The mother reported the chemical that was being sprayed on tomato fields that bordered her residential neighborhood in Homestead, Florida soaked her. (61)

The Castillo family lived in Homestead next to a farm where the fungicide was used on crops. Their son, John Castillo Jr. was born without eyes. When his mother joined a support group for children with the same the birth defect, she learned about cases in other countries where Benlate was being investigated as a possible cause of similar eye disorders. (62)

A number of cases have been reported concerning the health issues revolving around Benlate including:

1. a nursery owner whose four children experienced serious nosebleeds and headaches after playing greenhouses and fields treated with the chemical. In addition, a family pet who died of poisoning.
2. a family who suffering sore throats, headaches and rashes after working in fields and greenhouses where Benlate was applied.. Their family dog also died.
3. a puppy was chronically ill but recovered after being removed from the greenhouse .
4. reports of no living insects inside or outside of greenhouses treated with the fungicide even though the last application was nine months prior. (63)

Worldwide

Teachers and other professionals were concerned about the clusters of visually impaired children in the rural areas of England, Scotland, and South Wales. (64) Other problems were reported in New Zealand, and Australia. Benlate and other environmental and genetic causes are being investigated as the possible cause of these problems. One chemical, Benlate, is a prime suspect. (65)

The following problems occurred:

1. In 1993, in a 40-mile radius of North Lincolnshire, England, nine children were born with eye abnormalities.
2. In Fife, Scotland, 27 children were born between 1981 and 1993 with micro or anophthalmia. In these cases, 5 of the cases, the condition was found to be genetic. The reminder was 22 cases are left unexplained. Benomyl and similar fungicides were used ten times as much in Fife compared to other areas of Scotland. (66)
3. In England and Scotland parents who believe their children had similar birth defects filed a class-action lawsuit against Dupont, believing their children have been born with eye defects because Benlate, a controversial product manufactured by this company. (67)

4. In New Zealand, concern was widespread after news reports of birth defects in children born to three women employed by a parks department who used horticultural sprays containing benomin. One child was born with a cleft palate and no eyes. (68)

5. In New Zealand several cities banned the pesticide after learning that three children were born with birth defects to mothers who were exposed to Benlate. (69)

Investigations Into The Causes

If it is determined that there is no genetic reason for a visual problem, doctors may investigate the possibility of a complication that occurred during the early part of the pregnancy. This is the period when the eyes develop. (70) Researchers wanted to find out if this chemical had interrupted fetal development and caused children to be visually impaired.

Animal experiments suggest a possible link between benomyl and anophthalmia. (71) In the USA, for instance, research indicated that rats were heavily exposed to this fungicide they produced offspring had other eye abnormalities including an ophthalmic and microphthalmic. (72) It was reported that 43 percent of the offspring of pregnant rats that were fed benomyl developed malformations. (73)

On the other hand, medical researchers are also checking into environmental causes such as viruses or toxins as well as looking for a genetic cause of the defect. Potential environmental causes of the eye birth defects include toxins and drugs including: prenatal exposure to ethambutol compound (used to treat tuberculosis); thalidomide (a sedative) and Vitamin A. (74) Also, the U.K. Ministry of Agriculture concluded in April 1993 that there is no evidence to link eye defects in infants with the use of or exposure to benomyl. (75)

Dupont Denials

The manufacturer of Benlate, DuPont, firmly denies that Benlate does not pose a risk to human health. In fact, they maintain that the fungicide does not damage plants, pets, or humans. They has rapidly expressed denials that the fungicide is dangerous and indicated that according to their research when used according to label, Benlate does not cause any adverse health effects. (76)

Furthermore, DuPont claimed there was no evidence that there is no credible evidence that Benlate exposure results in birth defects. Defenders also maintain that the studies conducted were flawed. For instance, they point out that the rats in some studies were fed 1,000 times the estimated dose of benomyl that farm workers would be expected to be exposed to normally. (77)

In addition, Dupont and other agencies point to the fact that there are numerous chemicals used in agriculture and, therefore, it is difficult to single out Benlate or any other chemical as the cause of the deformities.

In short, Dupont attorneys argued that there was no scientific evidence that the chemical caused the birth defects. They pointed to government and scientific studies that said “there is no credible scientific evidence linking the use of Benlate to human health effects.” (78)

The Herbicide Cyanazine

Cyanazine is a synthetic pesticide manufactured by DuPont and sold under the name Bladex. Cyanazine, which is atrazine with cyanide attached to it, has been used since 1971. It is the fourth most widely used synthetic chemical pesticide applied in the United States. Millions of pounds are used on cornfields every year to control grasses and broad leaf weeds. Cyanazine, under certain conditions, will remain at significant levels in surface water for over a year. It has been reported in groundwater up to 29 ppb and surface water in many states. (79)

There are a number of birth defects attributed to the use of Cyanazine including abnormalities of the eye, diaphragm, and brain in several species of animals. Deformities such as cleft palate and skeletal development are also being investigated. (80)

Three separate studies conducted on rabbits and rats reported a dose-related increase in anophthalmia and microphthalmia. These problems occurred at doses from 4 mg / kg in rabbits and 25 and 75 mg /kg in rats. (81)

Improved Nutrition Could Help Prevent Vision Loss

According to some studies vision loss associated with aging may be preventable, or even reversible, through improved nutrition.

Preventing Blindness by Good Diet

A growing body of research suggests that nutrition plays an important role in Macular Degeneration and possibly in other eye diseases. Improving diet, or adding appropriate vitamin supplementation, may slow deterioration and could conceivably enhance overall vision. More importantly, diet may help prevent the onset of undesired conditions.

Several research studies focus on the role of a group of antioxidants called carotenoids. Yellow pigments of carotenoids may protect against Macular Degeneration by helping to block harmful wavelengths of light from damaging the sensitive retina.

There is a growing body of medical literature discussing benefits from nutritional supplementation on Macular Degeneration and Cataracts. Recent studies sponsored by the National Institute of Health find that people

eating the highest amounts of carotenoids have a 43% lower risk of developing macular degeneration, compared to those who eat the least. A diet including at least four servings of vegetables high in these carotenoids (such as spinach & Kale) may lower risks. ()

Ocular Nutritional Supplements

Nutritional supplements may be a beneficial alternative to those who can not consume adequate nutrients directly from fresh fruits & vegetables. Researchers are investigating the claims that certain nutrients are beneficial to eye health. For instance:

1. Bilberry Extract: European studies have suggested that bilberry may be associated with improving night vision and dark adaptation.
2. Ginkgo Biloba: This extract appears to increase blood flow to the eyes, interferes with platelet aggregation factor, and dilates blood vessels. It also may be useful in stabilizing micro blood vessel walls possibly influencing retinal hemorrhages as in diabetic retinopathy. There is some evidence it may influence recovery from eye diseases, which involve blood flow such as glaucoma to optic neuritis.

Lesson Plan #1 - "Make A Food Pyramid for Healthy Eyes"

Goals: To assist students in understanding how to balance their daily food intake to increase their chance of maintaining healthy eyes

Objectives:

1. Students read information on eye disorders that may result due to poor nutrient
2. Students will create learn about the nutrients needed to promote healthy eyes
3. Students will learn about the eye disorders: diabetic retinopathy, night blindness,
4. Students will learn about the development of the eyes in prenatal development
5. Students will create daily menus that will likely assist in the development and care of healthy eyes
6. Students will create a food pyramid that will increase the chance having healthy eyes

Grade Levels: 9, 10, 11, and 12

The food pyramid shows individuals what to eat in a day based on how much your body needs from each food group. Some people, with medical problems or at risk of having certain medical problems, might adjust the pyramid to meet their individual needs.

The students will discuss the food pyramid recommended by the FDA. They will also adjust the pyramid to for certain needs such as diabetes. Individuals with diabetes need to control their diet to control their medical condition and thus to prevent or control the possibility of damage to their eyes.

Teacher Prep

Teacher will discuss s healthy model to plan meals.

1. Grain, Beans, and starchy vegetables for energy. These foods are high in carbohydrates. Six servings a day are suggested. This group makes the biggest component of the diet, so they form the bottom or widest layer of the food pyramid.

2. Fruits and vegetables are also carbohydrates. They also provide, however, important vitamins and natural sugars. This layer next on the pyramid. Three to five servings of vegetables and 3-4 servings of fruit are suggested.

3. The next layer is the meat and dairy layer. These foods contain a great deal of protein and calcium to keep bones strong. It is suggested that 2-3 serving of dairy products (milk or yogurt) and 2-3 serving of meat products (meat or fish) should be in this layer of the pyramid.

4. The top the pyramid contains the sweets and fatty foods. They should be used in moderation with a suggested one serving per day.

Lesson Plan # 2-- “ Evaluating Food Labels”

Grade Levels: 9, 10, 11, and 12

Resources / Materials: food labels brought from product students’ use, websites

Overview:

Analyzing food labels is an excellent method to teach nutrition using readily available resources. This activity can easily be integrated into related activities such as: math (measurement, price comparison) and social studies (government regulatory agencies such as the FDA and USDA; and art and language development (packaging design, advertisements and commercials, letters of inquiry; computer skills (locating and use of websites.)

Purpose:

To help make healthy and intelligent dietary choices students need to be aware of the nutritional value of food products.

Goal: Students will be taught to read labels on food packages to determine the nutritive values of the contents

Objectives:

Students will:

1. become familiar with the basic dietary needs of the human body
2. become aware of the nutritional information presented on food labels
3. recognize that food processing package and label products to attract consumer to maximize their sales
4. learn to write a letters to officials who play a part in determining the food available to consumers (food processors, fast food companies, dietary planners (cafeteria administrators), and government officials.

Activities and Procedures: Teams will examine food labels:

1. Review the six basic dietary requirements for maintaining a healthy body (carbohydrates, protein, fat, vitamins, minerals, and water)
2. Thoroughly read information provided on packaging. List complete ingredients and grams of protein, carbohydrates and fat per serving.
3. What nutrients do in the body

Discuss the type of packaging and labeling techniques used to attract and presumably inform the consumer. Note what is included (additives, cholesterol, calorie count), what is misleading (terms such as organic) and what is not included (type of pesticides)

4. Request or research information from companies concerning their products including fast food chains, websites on products, information fact sheets produced by the company or consumer groups. Analyze information provided by company vs. Information from governmental and consumer organizations.

Lesson 3 - "What's for Lunch?"

Grade Levels: 9, 10, 11, and 12

Students will investigate and analyze the meals they purchase at school with the meals they purchase at fast food restaurants. For a period of one month students will keep a log of food purchases.

Goal: To compare the nutritional values of food selected by high school students

Objectives:

1. Students will read and discuss the book "Fast Food Nation."
2. Students will keep a log of lunch and after school meals they purchase

3. Students will analyze the meals according to:

A. fat B. carbohydrates C. calories D. sugar E. portions

4. Students will analyze what “super-sizing” will do to the daily food intake

5. Students will analyze how their lunch and after school snacks fit into their overall diet and nutritional needs

6. Students will speculate which pesticides may have been used (For instance: a hamburger might contain hormones in the beef, chemicals on the lettuce, tomato, onions, preservatives in bun, etc.)

7. Students will investigate nutritional contents of fast foods by visiting official website of fast food restaurants or collecting “fact sheets” from the restaurant

8. Students will share their results and concerns with the school administration and corporate public relations personnel

Procedure:

Students will be divided into teams.

Students will analyze the lunches provided in the school canteen.

Students will analyze the foods from local fast food restaurants

Students will compare the choices to food pyramid.

At the end of each week students will discuss how the lunches rate compared to the food pyramid.

Teacher Reading List

Wargo, John, “Our Children’s Toxic Legacy: How Science and Law Fail to Protect Us from Pesticides,” Yale Univ Press; 2nd edition, April 1998.

This book helps us to understand how U.S. law fails to protect us and the environment from pesticides. This informative and well-documented book was written by an expert on environmental law and health risks for children. It warns of the dangers of pesticides to food, water, soil, as well as the special dangers pesticides have on children. It provides an understanding what the legal and scientific community must do to control the health risks of pesticides.

Student Reading List

Schlosser, Eric, *Fast Food Nation: The Dark Side of the All-American Meal*, HarperCollins, 1st edition January 8, 2002. A very interesting and readable book that will change how students and teachers view fast food establishments and the meals they serve. The history of the fast food industry and the men who created applied the principles of a factory assembly line to a commercial kitchen and transformed America’s diet, landscape, and economy.

Carson, Rachel, *Silent Spring*, Reprint edition September 1994. Thirty five years ago Rachel Carson changed the way we look at our environment. This is an important book that will help students about pesticides and their affect on nature.

Useful Internet Resources:

The Food Guide Pyramid- Your Personal Guide to Healthful Eating

<http://ific.org/relatives/17200.PDF>

Network Nuggets: Physical Education, Sports, and Health

http://www.cln.org/lists/nuggets/pe_health.html

The Food and Nutrition Information Center

<http://www.nal.usda.gov/fnic/>

USDA: Educational Resources - FNS

<http://www.fns.usda.gov/fncs/>

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