Teenage Obesity and the Problems it Presents for High School Students

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Overview:

The purpose of the unit is to expose high school students to scientifically based investigations of food. Heart Disease, Diabetes, and low self esteem are some of the problems associated with obesity. Large numbers of high school students suffer from obesity, thereby placing them into a higher risk bracket for developing heart disease and diabetes. Heart disease, diabetes and stroke may all lead to premature death (Wilkenfield).

A majority of the energy required by our bodies comes from carbohydrates and fats. Starches are carbohydrates that are broken down in the intestine of our body into the sugar "glucose". Glucose is soluble in the blood, and inside of the human body, it is known as "blood sugar". Individuals suffering from diabetes have to check their blood sugar before and after meals. Our body uses chemical energy to maintain our body temperature. Fats produce 9 kcal/g, proteins, and carbohydrates produce 4kcal/g. The amount of energy required for an individual depends on the age, weight and physical activity. Excess energy is stored as fats. Whenever our food exceeds the energy we use the body tends to store the surplus as fat.

Students will work over a two week period of time analyzing the properties of polarity, pH, and fuel value of foods. Connections between molecular structure and function will be identified using laboratory investigations, data analyses and surveys. The grade level for these students is 10th grade. The Biology curriculum is offered to the students during their second year of high school. General Physical Science is a prerequisite course because students need to know the basic structure of the atom and the major types of bonding.

Rationale

More than half of the adults in the United States are overweight (Leading Health Indicators, Healthy People 2010). The number of obese adults and school aged students has reached an alarming point. The health care system is faced with an increased number of people suffering from heart disease and diabetes (Obesity, Nemours Foundation). In order for this trend to reverse, obesity must be prevented while children are of school

age. It is important to change the mindset of students. It can impact the entire family because students will become knowledgeable about the importance of eating well. The project involves providing students with information so that they can make healthy life choices. Metabolism and homeostasis are the two major characteristics that sustain life. A good understanding of these two concepts will provide a good foundation. Teenagers need to understand how the body breaks down molecules and uses them in their bodies.

Background Information

The nation is very concerned about obesity in school age students. As a result, at least half a dozen states require in- school BMI (body Mass Index) calculations (Kadaba). Body mass index is defined as weight in kilograms divided by the height in meters squared (kg/gm^2). Evidence now indicates that an increased waist circumference, or waist to hip ratio is a better predictor of mortality from obesity (Lapidus L, Bengtsson C, Larson B, Pennert K, Rybo E, Sjostrom L). The BMI definition for obesity does not consider the distribution of body fat. The intended purpose of these calculations is to alert parents of a potential problem. As a result of the obesity problem the state of Pennsylvania has expanded the screenings to cover grades 5-8 (Kadaba).
Obesity is defined as the presence of excess adipose tissue. In normal individuals the percentage of body tissue considered as adipose tissue varies by gender. The adipose tissue is greater in females after puberty than males (Roche AF, Siervogel FM, Chumlea WB, Webb P.).

It is difficult to examine the full spectrum of obesity in children and teenagers in the United States because there is not a consensus in the medical community about the definition of obesity. Only a few data sets mirror the ethnic and socioeconomic composition of the population (Gidding S, Leibel R, Daniels S, Rosenbaum M, Horn L, Marx G). The 3rd The National Health and Nutrition Examination Survey shows a continuing increase in prevalence of obesity in children. Data on obesity for different racial groups are more sparse. The Bogalusa Heart Study indicates the measures of weight for height have increased for the first 15 years of study (Webber LS, Harsha DW Nicklas TA, Berenson GW).The increase appears higher in children at the higher end of the weight per height percentiles.In this study the weight increased 2%-3% in children at the lowest quartile and 7%-10% in children in the higher quartile. The children in the higher quartile have a greater risk of developing cardiovascular problems. Obesity is an important risk factor the development of heart problems. Increased left ventricular mass and high blood pressure are other problems associated with overweight (Gidding S, Leibel R, Daniels S, Rosenbaum M, Horn L, Marx G).

Thematic Unit Overview

Student involvement is a key component for measuring the success of this unit. Students will be actively engaged in hands on experimentation. They will have the opportunity to collect data, examine labels on food, plot graphs and diagram several macromolecules eg. lipids, carbohydrates, proteins and nucleic acids. Upon completion of this unit, students will have a <u>better</u> understanding of organic compounds. They will understand the relationship between the structure of an organic molecule and the properties

exhibited by that substance. The lessons provide students an opportunity to work cooperatively together in groups using hands on activities that promote inquiry. They will also have an opportunity to create graphs using Excel software. The biology students will also be involved in a poster contest that will promote healthy eating. Approximately five days are required for the assignments. The unit will require two weeks with approximately two days for remediation bringing it to a total of 12 class periods.

Objectives

My goal is to make my students informed consumers. I want my students to examine the data generated from this unit to reflect and assess the different food groups for their nutritional value. The health and development of adults depends upon how we take care of our bodies. I want the students to realize the importance of physical activity and good nutrition.

Strategies

Students will be placed into cooperative learning groups. When students are working in groups they tend to feel at ease among their peers. The key factor in learning through cooperative grouping is it takes a considerable amount of structure to form an effective group. **No** group should consist of only high performance level students or low performance level students. You do not want the students to think there is a "smart group" and a "dumb group".

Concept mapping will also be used in this unit because it will enable students to cross linkages. Students will be able to **"connect the dots".**
Many students learn through visual cues diagrams will be incorporated into the unit. I find that my students are really into music, and poetry. I will enable my students to develop a rap song or a poem that will illustrate that they have understood the concepts of this unit.

The unit is organized into the following stages according to the activities:

a. Basic knowledge of an atom. (Lesson #1)
b. Atoms combine to form compounds and mixtures. (Lesson #1)
c. Compounds have polarity and this will influence how substances react. Our digested food is going into an acidic environment inside of our stomach. Students need to become aware of the chemical reactions that occur in living systems are sensitive to pH.(Lesson #2)
d. Human blood is slightly basic with a normal pH of 7.35-7.45. The stability of cell membranes depends on the ph of our blood. (Brown, LeMay, Bursten, Burdge)
e. Most of the energy required by our body comes from carbohydrates and fats. The body uses the chemical energy from foods to maintain the body temperature, contract muscles and repair tissues. Any excess energy is stored

as fats. Fats are insoluble in water and produce more energy per gram than either proteins or carbohydrates. Lesson #3, Lesson #4. (Brown, LeMay, Bursten, Burdge)

f.

The following contests will be incorporated into this unit:
$25.00 poster contest
$25.00 model contest
$25.00 slogan contest
$25.00 rap (no profanity or derogatory comments)
$25.00 poetry contest
The Philadelphia School District allotment for teacher's is $100 per school year, the extra $25 can be written off in your taxes.

Lesson #1 (two days)

Atomic structure determines the chemical behavior of a molecule. An understanding of atomic structure of a molecule will provide a good foundation of how it reacts and the amount of heat energy given off**.**

Objectives:
a. To differentiate between atoms and elements
b. To analyze how compounds are formed

Activity#1

Materials: periodic table, unlined paper, colored pencils
1. Ask student to write the symbols for carbon, hydrogen and oxygen.
2. Using the periodic table write the atomic number and the round off the atomic mass to the nearest whole number.
3. Calculate the number of neutrons for the three elements. Using the formula Atomic mass-atomic number= number of neutrons
4. Draw a picture of each element showing the location of the following particles proton(s), neutrons(s), and electron(s).
   *students should indicate the different particles using three different colored pencils.

Written assignment: Have students to write a written explanation about each picture. Indicate why some atoms have more particles then others. Students should relate their answers to the difference in the atomic mass for each element.

Activity #2 Demonstration: performed teacher

Student have learned about elements in the first activity In this activity they will learn the elements can combine to form compounds and mixtures. They will have the opportunity to see the difference between these two substances. What makes a mixture differ from a compound.

Materials: bunsen burner, sulfur powder, iron filings, goggles, lab apron, 2 test tubes, test tube holder, 2 spatulas, magnet.

1. Mix 10 grams of sulfur and 10 grams of iron in a test tube.
2. Pour the mixture onto a sheet of paper.
3. Place the magnet into the mixture.
4. Have students observe.
5. Mix 10 grams of sulfur and 10 grams of iron into another test tube.
6. Heat the mixture.
7. Allow the test tube to cool down (do not place the tube into water, it will break)
8. After the test tube cools down scrape the mixture out of the test tube.
9. Place the magnet into the mixture.
10. Have students observe.

Conclusions:
1. Students will notice that the magnet is attracted to the iron in the mixture.
2. Students will notice that the iron was not attracted to the mixture when it was heated.
3. When heat energy was applied to the mixture the elements combined chemically and formed another substance. (Iron sulfide)
4. Mixtures can be physically separated.

Lesson #2 (two days)

Objectives:

a. To examine the properties of polarity.
b. To interpret a pH scale.
c. To examine the properties of acids and bases.

Activity #1:
Materials: 4 heads of lettuce, 4 large ripe tomatoes, 4 cucumbers, 4 plastic colanders, 6 bottles of vinaigrette salad dressing, 1 box latex gloves (powder free), 24 paper salad bowls, 4 large plastic salad bowls, 24 plastic forks , 24 plastic knives, 4 new plastic tablecloths, paper towels.
*Check with each student to see if anyone is allergic to latex. Also purchase the plastic equipment from the $1.00 store. The $1.00 store is a teacher's best friend.
Procedure:
1. Students should wash their hands with antibacterial soap.
2. Place plastic tablecloth on the lab tables.
3. Roles for students:
    a. One student should break up the lettuce and wash it in the colander, dry the lettuce. Remember to wash the colander and dry it.
    b. One student should wash one tomato and cut each tomato into 1/4 sections, then cut each section into 1/2 sections.

c. One student should wash the cucumber and remove the skin using a plastic knife. Cut the cucumber into bite size sections.
d. One student should wash the large plastic salad bowl and dry it with paper towels.
e. One student should place all of the ingredients into the large salad bowl.
f. one student should mix the ingredients altogether.

4. Shake the salad dressing with the cap one securely. Everyone should look at the bottle and observe. Discuss what you see.
5. Allow the bottle to sit for about 10 minutes. Observe. Discuss what you see.
6. Mix the salad dressing again by shaking it. Pour onto the salad in the large bow
7. Place salad into the small salad bowls and enjoy.
8. Clean up.
9. Discussion time:
   a. Explain why the oil and vinegar eventually separated. Explain in terms of the polarity of each substance.

Activity #2

Materials: 8 small cartons of milk (get from the school lunchroom), 1 bottle of vinegar, ammonia, hand soap, orange juice (get from the school lunchroom), white construction paper, rulers, red pencils, blue pencils, bottle of water, antacid (liquid) Mylanta. Teacher should write the ingredients of the household ammonia on the board (safety reasons)

1. Distribute a sheet of construction paper for every two student.
2. On the construction paper each group should make a pH scale.
3. Allow students to handle the materials with the exception of the ammonia.
4. Have students to identify the acids and the bases in the products.
5. Classify the acids and the bases as strong or weak and place on the pH scale.
6. Students should indicate the acids using the red pencil. The stronger the acid the darker the color.
7. Students should indicate the bases using the blue pencils. The stronger the base the darker the color.
8. Indicate that the charts should be neat and range from a scale of 0-14.

Lesson #3 (two days)

Objectives:
a. To summarize the characteristics of organic compounds.
b. To compare the structures and function of different types of biomolecules.

Activity #1

Materials: butter, lard, canola oil, crisco, diagram of a saturated fatty acid, diagram of an

unsaturated fatty acid, colored chalk (large play ground size pieces), peanut oil.
Procedure:
1. Place the diagram of the saturated fatty acid on the chalkboard.
2. Place the diagram of the unsaturated fatty acid on the chalkboard.
3. Place butter, lard crisco on the side of the saturated fatty acids.
4. Place the canola oil and the peanut oil on the side of the unsaturated fats.
5. Ask students to look at the picture of the molecules on the board.
6. Write down what you see, name the major elements found in the two acids.
7. Look at the examples of the saturated fatty acids and the unsaturated fatty acids
8. Describe their state of matter.
9. Students should observe that unsaturated fatty acids have double bonds and saturated fatty acids have no double bonds. Students should also observe the saturated fatty acids are in the solid state of matter at room temperature.

Activity #2

materials: computer, www.scilinks.org. (foods as fuels), chart paper, markers.
1. Students will work in groups of 6.
2. Students will go to the web site: www.scilinks.org
3. They will go to the Link "Foods as Fuels"
4. Together they will make a chart .
5. Group A's title is "Lipids", Group B's title is "Nucleic Acids", Group C's title is "Proteins", Group D's title is "Carbohydrates".
6. Each group is responsible for identifying the major characteristics their topic, and give examples for each topic.
7. The charts should be posted around the classroom, as students get a better understanding of each topic they should add more information to their chart

Lesson #4 (two days)

Objectives:

a. To identify carbohydrate, fat, and protein contents in our foods.

Activity #1

Materials: food labels, rubber cement, chart paper.
1. Have students bring in 10 different food labels from home.
2. Have students sit into groups of four.
3. Each group should examine the labels and identify the carbohydrate, fat and protein content for each label.
4. Place this information on the chart paper.
5. Attach the label on the chart paper in full view.
6. Have each group present their findings to the class.
7. Hang up the chart paper in the class.

Activity #2

Contests: Each student will either make a model, poster, rap, poem or a slogan.
The following rubric will be used; the rubric is used as a method of students evaluating their work. The effectiveness of why healthy eating is so important.
Originality 0-4 points
Creativity 0-4 points
Presentation 0-4 points
Neatness 0-4 points
Understanding 0-4 points
Judges: Teachers in the science department and one administrator.
Time allotment: four days including a weekend.
Prize: $25.00, one homework pass given by the administrator, a certificate.

Annotated Bibliography for Teachers

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<http://www.americanheart.org/presenter.jhtml?identifier=4670> (Identification treatment and prevention of overweight children).

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United States Department of Agriculture, Steps to a Healthier You, 2005. <http://www.mypyramid.gov>(The new food pyramid and how to use it.)

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Connect with Kids, Teen obesity Cuts Life Expectancy, Adam Wilkenfeld <http:://www.connectwithkids.com>(Students and parents explain how they cope with obesity problems)

Filbkins, William L., *Teen Obesity: How Schools can be the number one solution to the problem*, Rowan & Littlefield Education Oct. 28, 2006.
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Annotated Bibliography for Students

http:www.exrx.nt/Fatloss/Childobesityintervention.html. Article about childhood and teenage obesity and intervention strategies.

http://www.health.gov/dietaryguidelines. Article discussing the need to choose a diet low in fat, saturated fat and cholesterol, also dietary guidelines for Americans.

http://circ.ahajournals.org/cgi/content/full/94/12/3383. Article from the American Heart Association highlighting the definition, epidemiology, morbidity, etiology, prevention and treatment of obesity.

http://www/connectwithkids. Article dealing with teen obesity and how it cuts life expectancy.

Appendices

Key Words

blood pressure- the force exerted by blood as it moves through blood vessels. Normal blood pressure is 120 for systolic pressure and 80 for diastolic pressure. A normal reading would be written 120/80 mm HG. The blood is pushing against the artery walls with a pressure of 120 mm Hg as the heart contracts and 80 mm HG as the heart rests.

acid- a substance that is able to donate a H^+ ion a proton and hence increases the concentration of H^+ (aq) when it dissolves in water.

base-a substance that is an H^+ acceptor, a base produces an excess of OH^- (aq) ions when it dissolves in water.

BMI- body mass index weight in kilograms divided by height in kilogram squared

calorie- the amount of heat required to raise the temperature of water one degree centigrade; a unit equivalent to the large calorie expressing heat-producing or energy-producing value in food when oxidized in the body.

carbohydrate- any organic compound that is made of carbon, hydrogen, and oxygen and that provides nutrients to the cells of living things.

cellular respiration- the process by which cells produce energy from carbohydrates.

covalent bond- bonds that result from a sharing of electrons.

electron- negative particle found in an atom.

heat-the flow of energy from a body at higher temperature when they are placed in thermal contact.

ionic bond- bonds that result from a transfer of two or more electrons.

lipid-a type of biochemical that does not dissolve in water, including fats, oils, waxes, steroids. Lipids store energy and make up cell membranes.

non-polar compound- does not dissolve readily in water.

nucleic acids-macromolecules that control the development of organisms and the production of substances essential to life.

obesity- the presence of excess adipose tissue.

polar compound-ability to dissolve in water

proton- positive particle found in the nucleus of an atom.

solubility-the amount of a substance that dissolves in a given quantity of solvent at a given temperature to form a saturated solution.

Academic Standards

The Philadelphia Standards that align with the Pennsylvania State Standards

Grade 10 Science
3.3 Academic Standards for Science and Technology
3.3.10. (A) Explain the structural and functional similarities and differences found among living things
3.3.10. (B) Describe the relationship between the structure of organic molecule and the function they serve in living organisms. Explain cell functions and processes in terms of chemical reactions and energy changes.

Additional Background References

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