Phat Math

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Overview

One of the challenges the nation faces today is obesity. The Centers for Disease Control and Prevention have found that though there has been an alarming increase in the number of Americans who were overweight over the past 25 years, although there was no significant increase between 2003 to 2006 among adults. However, the levels are still high with 34 percent of the adult population being obese. Conversely, there was an increase in overweight among children and adolescents in that same period. During that time there was also an increase in diabetes, a disease associated with obesity. This increase was found even among children and teenagers, indicating obesity is not just a major problem but has become a national epidemic.

I teach at Overbrook High School, a comprehensive high school comprised exclusively of African American students. Since epidemiological studies indicate obesity is higher among adolescents than in other groups, I feel it is essential to constantly reinforce health issues related to obesity and the importance of eating healthy and staying fit. I teach Algebra 2 to 10^{th} and 11^{th} graders at Overbrook High school. Since data analysis, statistics, ratios and proportions are part of the math curriculum, I plan to use this module as a real-life connection.

Too often students loose interest in math as they do not see its immediate relevance and therefore consider it unimportant. Since food and fashion are always a point of interest I plan to incorporate obesity related information into my lessons and have students discover for themselves where they fall on the BMI percentile scale. In addition, they will apply their math knowledge to interpreting nutrition facts on food labels. Hopefully this lesson will not only enrich their awareness and motivate their interest in eating the right kinds of food to stay healthy and fit, but also educate them about the ill effects of consuming certain types of food.

Rationale

Overweight and obesity has become a serious health issue due to the dramatic increase in various diseases related to obesity. The results from the 2003-2004 National Health and Nutrition Examination Survey (NHANES) indicated that 17 percent of children and adolescents in the age group 2 – 19 years were overweight. The results also showed that overweight increased from 7.2 to 13.9 percent among 2-5 year olds, from 11 to 19% among 6-11 year olds and from 11 to 17 percent among adolescents.(Journal of the American Medical association, April 5, 2006)

The survey also indicated significant differences in obesity among various race and ethnic groups. Overweight in Mexican-American and non-Hispanic black girls was higher than non-Hispanic white girls. Among boys Mexican-Americans ranked higher compared to non-Hispanic black or white boys. Although obesity is high throughout the entire population, Hispanic, non-Hispanic black, and Native-American children and adolescents are disproportionately affected when compared to the general population (Preventing childhood obesity – Health in the Balance)

In another study on childhood obesity and adult cardiovascular mortality, by David J Gunnell et al.,, it was evident that overweight in childhood is associated with increased cardiovascular disease mortality. It was also noted that obese children became obese adults. The analysis on the relationship between childhood BMI and adult cardiovascular disease was done with a 57 year follow up of a cohort study based on the Carnegie Survey of Family Diet and Health in Britain. The data for 1,165 men and 1,234 women, aged between 2 an 14, were available for the follow-up study (David Gunnell et al., AJCN 1998). Since this study found a direct association between childhood Body mass index and adult cardiovascular deaths, having a normal weight in childhood became an important public health perspective.

An imbalance of physical activity and food consumption results in obesity and overweight. National data have shown increased calorie consumption by adults and lack of physical activity. Since obesity is a complex issue that is related to lifestyle, environment and genes there are other factors besides calorie consumption and lack of physical activity. There has been increased time spent watching television, on the computer and paying electronic games. We are eating increased portion sizes, lacking outdoor exercise due to fear of crime and consuming more sugar sweetened drinks. All and more only adds on to the existing problem. (Obesity - Still a Major Problem, NCHS)

Obesity is not just a cosmetic problem; it is a serious health issue. In the United States, roughly 300,000 deaths per year are directly related to obesity, and more than 80% of these deaths are in patients with a body mass index over 30. Obesity also increases the risk of developing a number of chronic diseases including insulin resistance, type 2 diabetes, hypertension, high cholesterol, stroke, congestive heart failure, gallstones, heart attack, cancer, gout … the list does not stop here.

Although United States ranks the highest in prevalence of obesity among the developed countries, increases in prevalence of overweight and obesity among children have been observed all over the world. This being the present scenario, it is essential for high school students to be seriously aware of the impact of obesity on health and the consequences of negligence.

What is obesity?

Obesity is the chronic condition of excess amount of body fat. A certain amount of body fat is necessary for energy, shock absorption, heat insulation and other functions, but excess levels lead to other diseases. The normal amount of body fat is between 25 - 30% in women and 18-23% in men. Above this limit is termed obese. One of the measures to assess overweight and obesity is Body Mass Index (BMI). Though not an accurate method it is widely by clinicians and general population across the globe as a measure.

What is BMI?

BMI is a mathematical relationship between weight and height and is not only an excellent, but also a reliable indicator, of body fat content in the general population.

It is only a number calculated from a person's weight and height, acting as an index. It does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI is an inexpensive method of screening for weight categories that may lead to health problems.(cdc.gov/nccdphp/dnpa/BMI/...)

The following index is an indicator whether one is obese or not:

- Underweight = <18.5
- Normal weight = 18.5-24.9
- Overweight = 25-29.9
- Obesity = BMI of 30 or greater

The BMI formula

The Body Mass Index (BMI) formula was developed by Belgium statistician Adolphe Quelet(1796-1874), and was known as the Quetelet Index. BMI is also referred to as 'body mass indicator'. BMI is an internationally used measure of obesity.

Body mass index calculation is very straightforward. Calculating body mass index requires only two measurements, height & weight. Calculation of BMI is done using the metric system or in pounds and inches

Metric system

The formula for BMI is weight in kilograms divided by height in meters squared
(Weight (kg) / Height $(m)^2$)
Example: Weight = 68 kg, Height = 165 cm (1.65 m)
Calculation: $68 \div (1.65)^2 = 24.98$

Traditional System (Pounds and Inches)

The formula for BMI is weight in pounds divided by height in inches squared multiplied by 703.

(Weight (Pounds) / Height (inches $)^2$ x 703
Example: Weight = 149.6lbs (68 kgs), Height = 66 (165 inches)
Calculation: [149.6 ÷ (66)2] x 703 = 24.143

Major causes of obesity

Metabolism is a set of chemical reactions that takes place in the cells of the body which converts food into energy that can be used as power for the various activities of our body or stored for later use.

A calorie is a unit that measures how much energy a particular food provides to the body. For example a bar of chocolate has more calories than an orange and therefore provides the body with more energy. This is good since the body has more energy which can be used. But what happens when all this energy is not used? It goes into storage.

Let's take a look at an example. Just as energy is absolutely essential for our existence, fuel is required for cars to move from one point to another. We fill the tank and drive. Let's suppose we have a tank capacity of 10 gallons and traveled more than 200 miles we would have used up most of the fuel and if we were to travel another 200 miles we need to fill gas again. But if we went only about 10 miles then we still have a lot of gas stored for later use.

This is similar to what happens when we eat. Food is mass which has some amount of energy. Different foods store different amounts of energy that can be identified by their calorific value. Eating food is a process where the mass is converted to energy. The energy released is used by the body for its various functions and the excess is stored as storage mass (fat). Therefore, in this process we get 3 different scenarios –

Scenario 1: When food intake is greater than energy required, it leads to gain in weight

Scenario 2: When food intake is equal to energy required, it leads to no gain, no loss

Scenario 3: When food intake is less than energy required; it leads to loss in weight

So if weight loss is our aim then we can either consume less food or increase our energy requirement by burning it away in the form of physical exercise. Obviously if there is a weight gain it means we are eating too much or exercising too little, (assuming no other health problems).

I found this interesting comparison of calories and weight relationship to Einstein's famous equation relating energy and mass $E=mc^2$ on the website bioneural.net. Energy gained leads to weight gain. Since mass is required to release energy, energy expended is weight loss. All energy has a mass equivalence and all mass has an energy equivalence. Hence, mass cannot be created from nothing, the source of mass is energy, less energy in leads to less mass out and mass can be reduced by conversion to energy.

How much do we need to burn or eat to stay fit? The number of calories a person burns is proportional to the amount of exercise, the amount of fat and muscle, and the person's basal metabolic rate (BMR). BMR is a measure of the rate at which a person's body burns energy in the form of calories while at rest. For example a person with a lower BMR will tend to gain more weight than a person with an average BMR though the two eat the same amount of food and get the same amount of exercise.

There are several factors that affect a person's BMR. To a certain extent a person's BMR is inherited. At time various health problems can affect a person's BMR. But interestingly BMR can actually change by exercising. Exercising will not only cause a person to burn more calories but will also increase the BMR as one becomes more physically fit.

Physical exercise is a simple activity to burn calories. A combination of both exercise and a diet is better than to cut down on food or engage in excessive physical exercise alone. Eating right is a healthy way of keeping fit. Eating right is watching both the calorific value and the nutrient value. Once again eating large portions of a low calorie food does not really help in checking weight loss since once again excess energy is stored. Therefore constantly being aware of calorie consumption is crucial in weight control.

Since calorie consumption is vital to control obesity it becomes extremely necessary to understand the energy in different foods. The nutrition facts on the labels of food wrappers are a good way to start and to get students into the habit of always reading the information on it. An understanding of daily percent value in a 2000 calories food serving compared to the nutrition facts on the label of food wrappers will be helpful. Students will need to figure out the amount of calories they need each day. To get a better handle on this an understanding of Body Mass Index (BMI) is important.

Understanding the Nutrition in Food

To have a better understanding of the nutrient facts on the label, and their significance, we need to understand the role that carbohydrates, proteins and fats play in body building and in checking obesity.

Most of the foods we consume have nutrients such as Carbohydrates, Protein and Fat, Vitamins, Minerals and Water. Of these, Carbohydrates, Protein and Fat are referred to as macronutrients. The energy (calories per gram) for each according to USDA is as follows protein (4 cal), carbohydrate (4 cal), fat (9 cal), vitamins (0 cal), minerals (0 cal), and water (0 cal). The recommended daily calorific intake by USDA for a 2000 calorie diet is Carbohydrate (60 to 70 percent- 300 gms), Protein (10 to 15 percent – 50 gms), and Fat (20 to 30 percent – 65 gms).

Carbohydrates

Carbohydrates, the body's main source of energy, are the major components of breads, pastas, cereals, fruits ,vegetable and beans . It is the major provider to blood sugar. Since blood sugar and insulin is related to a variety of chronic diseases it is good to choose foods that have a milder effect on blood sugar and insulin levels. This can be done by using a tool called glycemic index that measures the ease with which the body turns carbohydrates into blood sugar.

Foods with a high rating on the glycemic index are quickly turned into glucose by the enzymes in the digestive system and this glucose is immediately absorbed into the bloodstream. As a result of the rise in blood sugar the body gets a burst of energy. However this does not last long. The rise in the glucose level in the bloodstream stimulates the pancreas to secrete a great deal of insulin to process the excess glucose and put it in storage as fat. Due to the excess insulin there is a rapid drop of blood sugar to keep the body running. This lowered blood sugar produces a feeling of depression or low energy and body craves for needs more food. Carbohydrates of this nature are commonly referred to as simple carbohydrates. Sugar, honey, candies are some of them

On the other hand, carbohydrates that are low on the glycemic index are broken down more slowly leading to a gradual increase in the sugar, slower release of insulin, less storage of fat and more energy. Therefore cutting out hunger pangs. Carbohydrates of this nature are more commonly known as complex carbohydrates and are found in potatoes, pasta, whole grains and beans . Due to the slow digestion they are considered a better source of energy for the body.(Harvard Heart Letter, Dec 2002)

Fruits and vegetables are not only complex carbohydrates but also contain vitamins, minerals and are a main source of fiber. Therefore, snacking on fiber rich food such as apple, orange or carrots provides better nutrition than does a candy bar or a bag of potato chips.

Proteins

Proteins are also a source of energy. However, it is the least efficient source and is converted for fuel only if there are insufficient calories in the rest of the diet. They are made from simpler substances called amino acids. There are 22 amino acids in the protein that we eat everyday. Nine of these are essential since the body does not make them and they are required by the body to make different proteins for functioning. Therefore these have to come from the foods we eat. Both plants and animal foods contain protein. Foods that have all the essential amino acids are called high quality proteins and are usually found in animal products like meat, fish, poultry and dairy products. Foods that do not have all of the essential amino acids are called lower quality proteins. Plant foods belong to this category. People who do not eat animal products should eat a wide variety of plant protein to ensure a balance of essential amino acids.

Muscles are made of protein however, eating too much protein does not build muscle mass. Muscle mass is increased only by exercising the muscle. Any excess protein the body consumes must be either converted to urea and excreted which means more strain on the kidneys, or converted to fat and stored. Similarly too little protein will result in gradual breakdown of body protein tissues and loss of muscle tissue.

According to USDA the recommended daily intake of protein for an average person is determined by multiplying body weight by 0.4(0.4 grams of protein), therefore an average 150 pound man needs approximately 60 grams of protein which is about 240 calories. This amount is easily obtained in most diets that include small servings of meat, fish, eggs, milk product, beans, seeds and nuts. In the case of athletes the requirement is slightly higher. A strength athlete will need about .8grams of protein per pound of bodyweight and endurance athletes will need about 0.6 grams of protein per pound of bodyweight as more emphasis is on cardiovascular exercise than strength training.(Janice R.Hermann, Protein and the Body)

Fats

The most concentrated source of calories is fat. One gram of fat has about 9 calories which is almost 2.4 times more calories than a gram of protein or carbohydrate. Because it is a dense source of calories, the USDA recommended intake of total fats is 65 gms. There are 4 dietary fats. Cholesterol is one and the other three are forms of fatty acids namely saturated, monounsaturated and polyunsaturated.

Saturated fats are mainly found in animal products such as milk, butter, ice cream cheese, lard etc. They are also found in plant products such as coconut oil, palm oil. The term saturated fat is given since the carbon atoms contain all the hydrogen atoms they can hold and tend to be denser and more solid at room temperature. It is important to read the nutrition facts on the label to get the kind of fat being used. Both cholesterol and saturated fats have been found to be the main causes of formation of plaque on the lining of arteries and clogging of arteries, a condition called arteriosclerosis.

Unsaturated fats are of two types. Mono unsaturated fats come from vegetables such as avocados, olive, walnuts and several other nuts. These fats remain liquid at room

temperature unlike poly unsaturated fats which remain liquid at room and refrigerated temperatures. The polyunsaturated fats are found in corn, sunflower, fish and soybean oils. Since both these fats have no negative effects, it is better to have unsaturated rather than saturated fat. In certain instances unsaturated fats have been found to help remove cholesterol. Poly unsaturated might be a bit more healthful because of its effects on blood clotting and heart arrhythmias. (Harvard Health letter, September 2007)

Math in Food Labels

Every food product purchased at a store gives a gamut of information on the nutritional value of the specific food item on the food label. Most food labels follow the standard order of information. (USFDA/CFSAN: How to understand Food Labels)

- The serving size: Serving sizes are standardized to make it easier to compare similar foods. They are provided in units such as cups or pieces, along with the metric amount (grams). It is important to note that the size of the serving on the food package influences the number of calories and the nutrient amounts listed on the top part of the label
- Calories and calories from fat. This provides a measure of how much energy is obtained from this serving of food. The calorie section of the label helps manage body weight (gain, loose or maintain). Calories from fat indicate how much of the calories came from fat. For example if the calories from a Mac and cheese label had 250 calories and calories from fat are 110, then almost half the calories came from fat. So if one were to eat 2 servings then the calories will be 500 and the fat calorie will be 220
- Nutrients: The label classifies the nutrients that need to be limited(fats, cholesterol, sodium and those that could exceed the limit(vitamins and calcium)
- Percent Daily Values (%DVs) is based on a 2000 calorie diet. The %DV gives a percentage of the total daily requirement of that specific nutrient
- Footnote: This gives the recommended daily requirement in gms/mg of that specific nutrient based on a 2000 or 2500 calorie diet. This information is the same on all products. It does not change from product to product since it shows dietary advice for all Americans.

Importance of Numeracy

The above information assumes that consumers have sufficient skills to read and understand food labels. Literacy and numeracy can either help or hinder consumers from making healthy food choices. Recent studies have shown that understanding food labels is both challenging and dependent upon the literacy and numeracy skills of the consumer. Russell Rothman in his article published in the American Journal of preventive medicine demonstrated that understanding labels is correlated to literacy and numeracy skills. (Rothman et al., 2006)

The study was an attempt to examine patient's comprehension of nutrition labels and the relationship between their comprehension, literacy and numeracy skills. The study

demonstrated that the performance of a patient's understanding of food labels is highly correlated with their underlying literacy and numeracy skill.

The study had 234 Patients respond to a Nutrition Label Survey questionnaire. Of the 234 patients only 200 (85%) completed the study. 68% had some college education and 77% had a minimum of 9^{th} grade level literacy skill. However the numeracy skill for 63% of patient's was less than 9^{th} grade level. Though 69% of the NLS questions were answered correctly only 32% of patients could correctly calculate the amount of carbohydrates in a 20-oz bottle of soda that had 2.5 servings in the bottle and only 22% of patients could determine the amount of net carbohydrates in 2 slices of low-carb bread. Besides this it was found that patients were confused by the complex information on the nutrition label or used the information in the percent daily value column incorrectly. It was also found that patient's with less than 9^{th} grade literacy skills performed worse on the NLS than patients with higher literacy skills. Similarly, patients with less than 9^{th} grade numeracy skills performed worse than those with higher numeracy skills. In particular, it was noted that though there was a nonlinear relationship between literacy and NLS performance, there was a strong linear relationship between numeracy skill and NLS performance. One of the conclusions from the study was patient's with high literacy skills could also have difficulties in interpreting food labels.

In another article Ellen Peters, along-with other researchers, examined the concepts of numeracy, the need for numeric skills in health care decisions and best practices in presenting numeric health information. The article was based on previous studies and surveys relating numeracy and comprehension of various information. It cites a study where 26 percent of the surveyed patients were unable to understand information about when an appointment was scheduled. Also another study where 16 percent of educated people incorrectly answered straightforward questions about risk magnitudes. In yet another study based on the National Adult Literacy Survey, almost half of the general population has difficulty with relatively simple numeric tasks such as calculating the difference between regular price and sales price, or estimating the cost per ounce of a grocery item (Ellen Peters et al., 2007).

The alarming statistics above necessitated the researchers of the article to identify skills needed to understand the various health scenarios in order to make health decisions. An area where numeric skills are essential are when patients have to evaluate the risks and benefits of health options themselves. The study showed that it was essential to indicate risk descriptors numerically. However, this was disadvantageous to less-numerate patients as they could not accurately determine the benefits. Another area was in following complex health regimens. Finally, less numerate patients were more likely to weigh short-term costs and benefits than to consider benefit from long term, probabilistic rewards later.

The article also clearly showed the need for presenting numeric health information in a format which requires less cognitive effort. This was again based on previous studies and experiments which showed respondents who were given only relevant

information were able to choose higher quality hospital than those to whom too much information was given

In both studies numeracy played a pivotal role in making important decision for healthy lifestyles and could even be a barrier for patients to obtain high quality care.

So what is innumeracy? It has been defined in several ways. Very simply it is the inability to understand numbers. However, John Allen Paulos in his book Innumeracy defines "innumeracy" as "an inability to deal comfortably with the fundamental notions of number and chance"(Paulos 1988)

I want students not just learn math but to be comfortable with it and say math's cool. It is my desire to make the subject endearing rather than intimidating. Many of the students I teach are under the myth that one needs to be gifted to do math. Yes to be a mathematician is one thing but to understand everyday math is not something abstract, or unattainable. Learning math does not deal with just numbers it deals with a whole lot of other skills too, in the process the brain is trained to think analytically and logically. Because it teaches other skills it has its application in many sectors of the economy. Today we live in an age where there is no dearth of information, rather it's an explosion. The problem is no longer accessing the information, but knowing what to choose and how to process it. Most of the news that comes to us has numbers with it. Strip the numbers from the news then there is no accurate information; everything is relative left to the imagination of the audience. So significant is the role of numbers that we have come to a point where if we do not understand it then we fall far behind the rest of the world.

There is no field today that does not deal with numbers. A country's economy is judged only in numbers, Elections, Hollywood, fashion industry, health industry, and food industry. The success of any company, its rating is all in terms of numbers. Salary, taxes, bills, mortgages, insurance, prescription medicines and food labels are all examples of numbers in everyday life.

Objectives

Students will draw a relationship between the various variables defining obesity. Categorize BMI and correlate BMI with other factors such as waist size, shoe size and sleep and identify positive correlation or no correlation. From the collected data they will draw the line of best fit and get the equation of a line using combination of variables such as BMI and waist size. Interpret and analyze the graphs and draw inferences from the graph.

They will familiarize themselves with the nutrition values on various food labels and work with various portion sizes and calculate the percentages and ratios.
Students will apply these to their own daily calorific intake and measure for themselves their calorie intake and nutritional math and nutrition. Students need to discover for

themselves the effects of calorie intake and body exercise. Awareness is necessar to make right food choices for a healthier life style. To make connections while reading the nutrition facts on labels, students will learn to calculate the % daily value and convert it to calories, then apply to themselves their required intake of calories after calculating their own BMI.

Standards

The lesson in this unit is designed for high school math which incorporates Data collection and statistical methods, Percentages , Ratios and proportions. Students will apply statistical concepts in a real world application. The procedure of data collection, tabulation, analysis and interpretation will be made more relevant

The unit will fulfill the Pennsylvania Academic Standards for Math and Science and Technology listed in the appendix

Strategies

Collect data from at least 20 other students/adults of all size ranges and calculate the BMI of each and categorize as obese, fit or underweight. Get the regression line equation. Verify it on the graphing calculator – TI 83

Students will collect at least 10 different food wrappers and tabulate the calories against carbs, proteins and fats.

Journal entries for 3 weeks - Maintain a journal of the food consumed during the different times of the day. Calculate the calories consumed for each day. Keep track of physical activity done during the day. Anmalyze for weight balance - is there a trend towards obesity? Plan their own meal and a meal for a 5 year old.

Cooperative learning: Students will be engaged in groups while collecting the data and working on the regression line thereby learning other skills besides academics such group dynamics. This approach also encourages peer learning and sharing.

Brainstorming/ Group Discussion: This is something they will use after they have finished an activity and analyze the activity done to draw inferences – Foods that could replace fast foods and high calorie foods. Discuss correlation between waist size and BMI, draw inferences from the data. This activity promotes critical thinking and increases reasoning skills.

Math / Health Glossary: Students gain immensely in keeping track of the words and concepts they learn. It acts also as a quick reference when they are in doubt about a formula, definition or concept.

Classroom Activities

Lesson Plan 1

Title: Obesity and Body Mass Index

Duration: 2 class periods (45 min)

Objective:

Students will calculate their Body Mass Index. They will learn to relate BMI with Obesity and find if their BMI lies in the healthy range using the obesity chart.
Students will calculate the BMI in systems - Metric system and pounds.
They will graphically interpret data (BMI) from other students
Analyze the data- find the mean, median, mode and standard deviation of the class.

Materials:
Inch / cm tape
Weighing scale
Graph sheet
Calculators

Vocabulary: Obesity, Body Mass Index (BMI), mean, median, mode,
Standard Deviation, correlation

Procedure:
Part 1
Students will measure their height and weight in inches and pounds, waist size in inches.
Calculate the Body Mass Index using the formula $BMI = (Mass/ Height^2) \times 703$
In the next step they will convert the height to meters and weight to kilograms and calculate the Body Mass Index using the formula $BMI = (Mass/ Height^2)$.
Students will discover the BMI turns out to be the same in both systems.
Using the 3 norms: underweight=< 18.5, normal weight =18.5 -24.9 and overweight = 25-29.9 Obesity = BMI of 30 or greater, they will categorize if they are underweight, normal weight, overweight.
The data and the BMI will be recorded individually and collectively, so that each student has a copy of the data for the entire class.

Part 2
Using the BMI of the entire class they will calculate the measures of central tendency (mean, median and mode) and the measures of dispersion (variance and standard deviation).

Make an analysis of the mean bmi of the class and how much is the deviation from the mean.
Draw a scatter plot relating BMI with waist size, draw the line of regression and then obtain the equation for the line of best fit and find the correlation.

Part 3
Using the same data, students will calculate the percentage of the class in all 4 categories underweight, normal, overweight and obese

Assignment:
Get on the 'net and read the articles on the given websites on obesity and BMI.
Compare the class obesity percentage (which they will consider as a sampling) with the obesity percentage in general among adolescents in the United States and write a report

Lesson Plan 2

Title: The math in Nutrition facts on Food Labels

Duration: 3 class periods (45 minutes)

Objective: At the end of the lesson students will be able to…
- Interpret the nutrition facts on food labels
- Compare food portions to serving sizes on the food labels
- Calculate percentage daily value for different calorie diets
- Use the label's nutrition facts to make healthy food choices
- Calculate their individual caloric intake to maintain a certain weight using Harris-Benedict equation

Materials: variety of food packages with labeling (cereals, cookies, fruits, yogurt, and veggies- carrots)
Calculator

Vocabulary: Serving size, Nutrients, Calories, total fat, Saturated fat, Cholesterol, Sodium, total Carbohydrate, Dietary Fiber, Sugars, Protein, Vitamin A, Vitamin C, Calcium, Iron, Percent Daily value, Daily value, Basal Metabolic Rate

Procedure: Introduce the above vocabulary, its significance and relevance

Part 1

Based on a 2000 calorie diet these are the daily value requirements

Table 1 (DV)

Fat	65 g
saturated fat	20 g

Cholesterol	300 mg
total carbohydrate	300 g
Fiber	25 g
Sodium	2,400 mg
Protein	50 g
Vitamin A	5,000 IU
Vitamin C	60 mg
Calcium	1,000 mg
Iron	18 mg

Calories: *Table 2*

Fat	9 calories per gram
Carbohydrate	4 calories per gram
Protein	4 calories per gram

Using the information in table 1 and 2 students and the 2 formulas, students will complete the worksheet

Weight = % Daily Value/ 100 x Daily value (refer table 1)
%Daily Value (%DV) = weight/ Daily Value x 100
Calories = weight x calories per gram (refer table 2)

Food item: ----------
Servings: ---------- Portion/size/measure : ----------

	Weight in g, mg	%DV	Calories
Total Fat			
Sat fat			
Trans fat			
Cholesterol			
Sodium			
Total Carbohydrate			
Dietary Fiber			
Protein			
Vitamin A			
Vitamin C			
Calcium			
Iron			

The above worksheet will be done for different servings (1/2, 1, 2 and 3.5) for different food items and for different inputs - weight or %dv

Calculate the Daily value for a 2900 calorie diet
(Use this guideline: 30 % cal from fat, 10 % cal from sat. fat, 60% cal from carbohydrates and 10% cal from protein)

Part 2

Using the Harris – Benedict equation calculate the recommended daily caloric intake to maintain a certain weight.

I will use the worksheets found on these websites

https://info.uwaterloo.ca/infofs/nutrition_information/health_challenge/health_challenge3/pdfs/week2/CalorieCounterWorksheet.pdf

http://ific.org/publications/other/tnflles2.cfm?renderforprint=1

Using the above worksheet, make changes to get the caloric intake for i) a lesser weight and ii) an increase in the activity factor. Then compare the 2 differences

Lesson Plan 3

Demonstration of the calorimeter and getting the calorie of different foods.

Identify individually the calorific need for each day. If your weight is normal, it needs to be maintained, if you are underweight / overweight / obese alter the formula to get the required calories for the required weight and to have a healthy BMI.

Plan a day's menu which includes breakfast, lunch, dinner and 2 snacks to meet your daily calorific need. The food you choose should have the required nutrients and the %dv

Note: If you have health problems consult your doctor before you use your menu plan
Every meal should have the specified amount of carbohydrates, protein and not more than the specified amount of fat.
Use the website to find out the calories for the specific food and

Annotated Bibliography

Books

Preventing Childhood Obesity: Health in the Balance
Jeffrey P. Koplan, Catharyn T. Liverman, and Vivica A. Kraak, *Editors*, Committee on Prevention of Obesity in Children and Youth
This book examines the nature, extent and consequences of obesity among children and youth in America. The book looks into the social, environmental, medical and dietary factors that are responsible for the high prevalence. It also identifies interventions and offers recommendations to reduce future occurrence.

The China Study
Dr. T. Colin Campbell and Thomas M. Campbell II.
The book is based on the largest comprehensive study on the relationship between diet and the risk of developing diseases. It is the result of a 20 year partnership of Cornell University, Oxford University and the Chinese Academy of Preventive Medicine and has produced 8000 statistical associations between various dietary factors and diseases.

Innumeracy by John Allen Paulos (1988)
In this book John Allen Paulos defines innumeracy and the importance in reading and interpreting numerical information. He gives examples on how we misinterpret and muddle things up when it come to dealing with numbers and of how it is outrageous when decisions are made based on faulty interpretation.

Teacher References

US Centers for Disease Control and Prevention
www.cdc.gov/nchs/pressroom/07newsreleases/obesity.htm: The National Center for Health Statistics is a public resource for all health information. It has various statistical information to help in determining various actions and policies regarding health issues

Journal of the American Medical association, April 5, 2006 - cdc.gov/nchs

Obesity Among Adults in the United States— No Statistically Significant Change Since 2003-2004 , Cynthia L. Ogden, Ph.D.; Margaret D. Carroll, M.S.P.H.; Margaret A. McDowell, M.P.H.,RD; and Katherine M. Flegal, Ph.D., Division of Health and Nutrition Examination Surveys , November 28, 2007, www.cdc.gov/nchs/data/databriefs/db01.pdf

David J. Gunnell, Stephen J. Frankel, Kiran Nanchal, Tim J Peters and George Davey Smith, "childhood obesity and adult cardiovascular mortality: a 57 year follow-up study based on the Boyd Orr cohort", American journal of Clinical Nutrition, 1988

Ellen Peters, Judith Hibbard,Paul Slovic and Nathan Dieckmann, "Numeracy skill And The Communication, Comprehension, And use of Risk-Benefit Information", Health affairs, May/Jun 2007, Vol 26, Number 3

Carbohydrates and health: Not that simple...or that complex. Harvard Heart Letter, Dec 2002, Vol. 13 Issue 4, p3, 2p; (AN 7887707)

Janice R.Hermann,Ph.d..,RD/LD,Nutrition Education specialist, Protein and the Body, Oklahoma State University)

Harvard Health letter, Time to fatten up our diets, vol 32 – Number 11, September 2007

Kubik MY, Lytle LA, Hannan PJ, et al.
The association of the school food environment with dietary behaviors of young adolescents. Am J Public Health. 2003;93(7):1168-1173.

US Centers for Disease Control and Prevention. Physical activity levels among children aged 9 – 13 years -United States, 2002.MMWR Weekly. 2003;52(33):785-788.

http://jama.ama-assn.org/cgi/reprint/298/16/1876
Improving Child Survival Through Environmental and Nutritional Interventions
The Importance of Targeting Interventions Toward the Poor

Student References

http://www.rwjf.org/files/research/obesityfs.pdf
This website gives comprehensive information on what research tells us about obesity. It gives statistics, health consequences and the nutrition for children. Also talks about what school could do to improve children's nutrition

http://www.obesityresearch.org/cgi/content/full/8/2/160
Obesity is the official journal of the Obesity Society. It is a journal which helps one increase their knowledge on obesity. A number of commentaries, reviews, public health and medical developments are published

www.fitday.com
Various calculators and tools which will interest students as they play with it. To calculate calorie count and body BMI

http://www.sciam.com/article.cfm?id=how-do-food-manufacturers&topicID=4&catID=3
http://www.foodproductdesign.com/articles/466/466_0696QA.html
The above 2 websites talks about how food manufacturers calculate the calorie count of packaged foods.

www.kidshealth.org/parent/general/body_basics/metabolism.html
Talks about the basics of general health and nutrition.

www.sportsdoctor.com/chg/n8.html
Gives a comprehensive view on different nutrition facts and food value. A good site for athletes to get more information on eating the right food

www.whfoods.com/eathealthy.php
A website which list different healthy foods

www.mypyramid.gov/pyramid/index.html
United States Department of Agriculture, food pyramid all related facts

www.cfsan.fda.gov
United States food and Drug Administration, Center for food safety and applied nutrition

Appendix content Standard

2.1 Computation and Estimation
2.2 Basic functions (+, -, ×, ÷), Reasonableness of answers, Calculators
2.3 Measurement and Estimation

Types of measurement (e.g., length, time)
Units and tools of measurement,

2.4 Mathematical Reasoning and Connections
Using inductive and deductive reasoning

2.5 Mathematical Problem Solving and Communication
Problem solving strategies
Representing problems in various ways
Interpreting results

2.6 Statistics and Data Analysis
Collecting and reporting Data (e.g., charts, graphs)
Analyzing data

2.8 Algebra and Functions
Equations
Patterns and functions