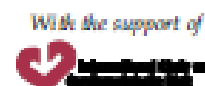


4 - Quenching Your Thirst



Healthy drink choices are as important as healthy food choices.

■ **Grade Level:**
Ages 8-12

■ **Subject Areas:**
Health, Life Science,
Mathematics

■ **Duration:**
Preparation time:
Part I: 5 minutes
Part II: 15 minutes
Activity time:
Part I: 15 minutes
Part II: 30 minutes

■ **Setting:**
Classroom

■ **Skills:**
Organize, Analyze,
Interpret, Evaluate,
Summarize, Calculate

■ **Vocabulary**
Calories (Cal), energy,
energy content, hydration,
kilojoules (kJ), nutrition,
obesity

▼ Summary

People need to drink water every-day to stay properly hydrated. All beverages we drink are a source of water, but our beverage choices also influence our daily energy intake. Drinking beverages with high energy content (Calories or kJ) may lead to intake of excess calories especially if it is not compensated by decreasing food intake, possibly contributing to obesity if activity levels are not adjusted.

Objectives

Students will:

- Recognize that some beverages have a greater energy content (Calories or kJ) than others.
- Calculate energy intake from various beverages based on energy content and amount consumed.
- Comprehend that high energy beverage choices can contribute to excess energy (Calories or kJ) intake if it is in addition to usual food intake.
- Evaluate beverage options to make the healthiest beverage choices.
- Compare and contrast the nutritional benefits and energy content of various beverages.

Materials

- Cups
- Envelopes
- Tape or rubber band
- Graduated cylinder or similar clear container
- Markers or crayons
- Paper
- Oil
- Food coloring (optional)
- Four copies of *Beverage Choices Paper Chain Template 1 Student Copy Page*

- One copy of *Beverage Choices Paper Chain Template 2 Student Copy Page*
- Four copies of the *Energy Chart Student Copy Page*

Technology Tools

- <http://projectwet.org/use-project-wet/children-water-games/hydration-game/> - Project WET hydration game that teaches you about keeping your body properly hydrated
- <http://hydrate.whomwah.com/> - download an application for your iPhone or iPod touch that allows you to track the number of glasses of water you drink per day

Making Connections

People drink beverages everyday, all of which contain water, such as milk, juice and soda without considering the number of Calories or kilojoules (kJ) they are ingesting. It becomes a problem when people do not adjust their total daily calorie intake to compensate for additional calories from beverages. Learning about balancing nutritional benefits with energy intake from various beverages provides information for people to help them making healthy choices to stay properly hydrated.

Background

The adult human body is approximately 60 percent water by weight. In order for our bodies to function correctly we must replenish the water in them regularly through drinking beverages. The amount of water our bodies need depends on gender, age, climate, activity level and health. (Jéquier, EJCN 2010).

Since water requirements vary by age and gender, it is difficult to pinpoint an amount that works for everyone. Studies in Europe generally recommend drinking 1.5 liters of water per day which corresponds to eight glasses of water.

Water, essential to a healthy life!

As a consequence of our sedentary, comfortable lifestyle and of our « toxic » dietary habits, we now experience a huge epidemic of obesity. The tragic part of this phenomenon is that our children represent the age group showing the fastest progression in the prevalence of obesity. Type 2 diabetes, a metabolic disease that is mainly the consequence of obesity, particularly of abdominal obesity, has reached epidemic proportions, and has become a major clinical and public health problem and is a huge burden to our health care systems. Indeed, type 2 diabetes, which used to be diagnosed in middle-aged individuals a few decades ago, is now striking the paediatric population.

In addition, despite good access to fresh water in our part of the world, there has been an increased consumption of sugar-sweetened beverages as a main source of hydration, particularly in children and teenagers. Studies have clearly shown that drinking sugar-sweetened beverages contributes to a passive over-consumption of calories, a factor which has been shown to increase not only the risk of obesity, but also of type 2 diabetes and even cardiovascular disease. Thus, drinking water (which contains no calories) rather than sugar-sweetened beverages would represent one simple solution to reduce the caloric intake of our children and improve their health. Meanwhile, in developing countries, eating fast food and drinking sugar-sweetened beverages is rapidly adopted by those who can afford it as a symbol of affluence, creating a health gap between the poorest and the wealthiest segments of the population. Thus, even in developing countries, the prevalence of obesity and type 2 diabetes is rapidly increasing.

The International Chair on Cardiometabolic Risk (ICCR) is a multidisciplinary academic organisation comprised of worldwide renowned experts in the field of cardiovascular medicine. The main objective of the Chair is to educate about the consequences of our poor lifestyle habits leading to abdominal obesity, the most dangerous form of overweight/obesity. Among the solutions to this epidemic, our scientists have generated evidence that regular physical activity/exercise and a healthy diet could have a major impact on the health status of sedentary and abdominally obese individuals.

Drinking fresh water is an important component of a healthy lifestyle. Let's hope that this precious resource will be better protected and managed in the future. To achieve this ultimate goal, education is key and, at the ICCR, we are looking forward to do our part. Water is not only essential to life, it is essential to health!



Jean-Pierre Després, Ph.D.

Scientific director

International Chair on Cardiometabolic Risk

Université Laval, Québec, CANADA



Drinking 1.5 liters (1500 ml) of water per day is a recommended daily average for a sedentary adult living in temperate climate.

All beverages contain water. Although we could stay hydrated by drinking eight glasses of water per day, many people choose to drink other beverages, such as soda, juice, milk, coffee and tea to satisfy some of their hydration needs. These beverages and others contain water and other ingredients. Further, energy content varies among beverages.

Calories and kilojoules.

In many parts of the world, people are familiar with seeing Calories on nutrition labels. However, in other regions the use of the kilojoule (kJ) is the standard measure of energy in food. In this activity we will reference both units of measurement. The technical definition of a calorie (not capitalized) is the amount of heat required to raise the temperature of one gram of water one degree Celsius. A kilocalorie, or Calorie (capitalized) as it relates to food energy, is equal to 1000 calories; the heat required to raise one kilogram of water one degree Celsius. One Calorie (kilocalorie) is equal to 4.18 kJ. The Joule is the only unit of energy defined in the international system of scientific units (SI) and is defined as the work done by a force of one Newton (N) moving an object

one meter in the direction of the force. The base units of a Joule are $\text{kg m}^2 \text{s}^{-2}$. A kilojoule is 1000 times this amount of energy.

Our bodies burn the kJ we take in to give us the energy to function in our daily lives. The number of kJ each person needs to take in per day varies based on factors such as height, weight, gender and activity level. The following chart provides a rough guide to the daily recommendations of Calories and kilojoules for gender and age based on healthy body weights.

Depending on beverage choices, energy intake from beverages can contribute considerably to the daily energy intake of a person. In developed countries people are consuming many more Calories or kJ than needed in their diets partly due to their beverage choices, possibly without even realizing it. A major problem is that people often do not decrease their food intake to compensate for the additional energy intake from their beverage choices. In both the United States and Mexico over 20 percent of a person's daily energy intake comes from beverages, showing a significant increase over the last decade. Excess energy intake can lead to obesity, which in turn can lead to health problems such as hypertension (high blood pressure), diabetes and heart disease.

When considering healthy beverage choices it is important to consider both what we drink and how much. When determining energy content for a beverage, it is important to consider both the energy content per serving, and also the number of servings consumed. Information necessary to calculate the actual number of kJ consumed can be found on the nutrition label for each beverage. In certain countries companies are required to include information about the energy content and suggested serving size in clear view on the packaging of a product. The key is to understand that the actual amount of energy consumed depends on the amount of the beverage consumed. For example, a half-liter bottle of soda (500 ml) may contain two servings (one serving = 250ml), but a person is likely to consume the entire bottle. If each serving contains 102 Cal (427 kJ), the actual amount of energy consumed is 204 Cal (854 kJ) if the entire beverage is consumed. In general: $[\# \text{ of Cal (or kJ) per serving}] \times [\text{number of servings consumed}] = \text{actual number of Cal (or kJ) consumed}$.

Energy content is important, but is not the only factor to keep in mind when making healthy choices about beverages. Different kinds of beverages offer different nutritional value. Beverage choices vary by location, economic situation and culture. Furthermore some beverages are a source of nutrients, as in the case of 100% juices and low-fat milk. Because it is important to balance our beverage and food choices based on nutritional and Caloric/kJ intake, drinking water is an excellent choice as the first source of hydration to satisfy our water needs without consuming excess calories.

Age Group	Gender	Calories	Kilojoules
4-8 years old	MALE	1400 - 1800	5852 - 7524
	FEMALE	1200 - 1600	5016 - 6688
9-13 years old	MALE	1800 - 2200	7524 - 9196
	FEMALE	1600 - 2000	6688 - 8360
14-18 years old	MALE	2200 - 2600	9196 - 10868
	FEMALE	1800 - 2200	7524 - 9196

Source: Gidding, Samuel, et al. 2005.

Note: Kilojoule numbers were reached by multiplying Calories by 4.18.

Procedure

Warm Up

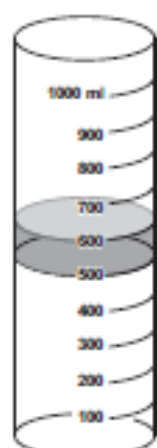
How do we measure energy?

Calories (Cal) and kilojoules (kJ) are the units we use to measure the amount of energy in food and drinks. Our bodies need energy in the form of Calories or kJ as fuel to function. The amount of energy each of us needs to take in each day varies.

Most people think about energy (Cal or kJ) coming into our body from the foods we eat. Many people do not focus on energy coming into their bodies from beverages. Over the past several decades, researchers have documented an increase in people's daily energy intake from beverages. An excess of energy (Caloric and kJ) intake can lead to obesity, the condition of increased body weight due to excess fat accumulation, which can lead to serious health problems. Simply stated, if you consume more calories (whether they come from food or beverages) than your body needs, those calories will be stored as fat and you will experience weight gain. This can happen over a short period of time or over many years. The important thing is to recognize the total amount of calories you are consuming from food and beverages and to either reduce your calorie and kJ intake or to increase your activity level.

You will need a graduated cylinder or narrow vertical container such as a water bottle or glass but note that glasses that widen at the top DO NOT work well in this demonstration. Fill the cylinder with five equal parts that fill the container approximately halfway and mark that line with marker, tape or a rubber band. Explain that this amount of water represents typical daily energy intake from food. Now, explain that there is evidence that people from some parts of the world are consum-

ing enough extra energy from beverages to add 20 percent more energy to the total amount they take in (Popkin et al. 2006). Add an additional one equal part of oil to the cylinder to visibly show the different



liquids and their relative volumes. Ask the students to compare the volume of the liquid before and after. Could the extra energy intake from beverages lead to obesity? (Yes, the amount

of fluid in the "body" represented by the cylinder increased noticeably). Alternatively, the demonstration can be done by drawing a chart that represents five equal parts and adding to that an additional equal part to represent 20 percent more energy. Finish the discussion by relating this idea to actual numbers of Cal or kJ. If a person consumes 2000 calories (8374 kJ) per day from food, but also drinks 2.5 cans of soda throughout the day they are actually taking in almost 2400 calories (10,048 kJ) per day—approximately 20 percent more than just based on calorie intake from food.

The Activity

Part I

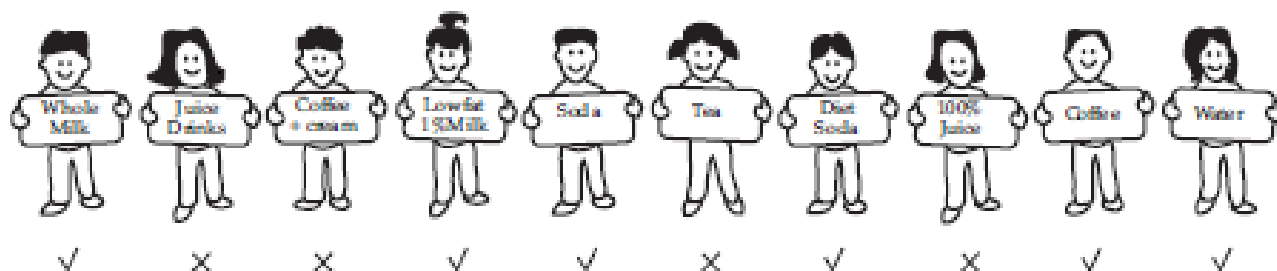
1. Explain to students that drinking water does not contribute to our energy intake. Drinking water contains zero calorie. Other drinks contain varying amounts of calorie per serving. To be aware of how many calories or kJ are consumed through food and drink, it is important to be aware of how much energy different kinds of foods and drinks contain.

2. In this activity, 10 volunteers will represent a 200 ml serving of 10 types of beverages. The class will have to predict how many Cal or kJ are found in 200 ml of each type of beverage and compare. Choose 10 volunteers from the class to stand in the front of the room. Using the beverages listed on the Energy Content of Various Beverages Resource Page label the outside of 10 envelopes with the type of beverage they represent (water, soda, 100% juice, juice drinks (e.g., fruit punch), whole milk, diet drinks, 1% milk, coffee with cream, coffee, tea). Cut the Energy Content of Various Beverages Resource Page into strips and place the strips inside the sealed envelope that corresponds to the correct beverage.

3. Ask the volunteers to try to line up in order from the drink with the lowest energy content to the drink with the highest energy content. Encourage other students to provide input and direct the movement of volunteers until most students agree about the order in which they stand. Discuss why the students chose the order they did. Without giving away the final answers, consult the Energy Content of Various Beverages Chart to determine which of the volunteers is in the proper order for their beverage energy level.

4. Notify the class which students are in the correct order. Allow the students who are in the correct order to stay in place, and ask the other beverage students to rearrange in order to find their correct positions. Repeat this process until all ten are in the correct position.

5. Complete the exercise with an unveiling ceremony: Instruct the volunteers to open their envelopes, one at a time starting with water, and read aloud the amount of calories and kilojoules associated with their beverage. Are the students surprised at the correct order and how



much energy each beverage contains? Note: For the purposes of this exercise, these energy amounts per beverage are average amounts within a range identified in the table below (United States Department of Agriculture).

Part II

1. Arrange four beverage stations around the classroom. Each station should represent water, 1% milk, 100% juice and soda. At each station place an empty cup labeled with one of the four beverage choices (water, 1% milk, 100% juice and soda) to designate the different beverage stations. Use the Student Copy Pages-Beverage Choices Paper Chain Templates 1 and 2 to create strips of paper that will represent each beverage choice. Four copies of Template 1 and one copy of Template 2 will

Energy Content of Various Beverages

Type of Beverage	Serving Size	Energy Content	
Whole Milk	200 ml	124 Cal	518 kJ
100% Juice*	200 ml	102 Cal	426 kJ
Juice Drinks (such as fruit punch)*	200 ml	98 Cal	410 kJ
Lowfat 1% Milk	200 ml	87 Cal	364 kJ
Soda (Avg.)*	200 ml	80 Cal	334 kJ
Coffee with 30ml of cream or half and half	200 ml	41 Cal	171 kJ
Diet Soda	200 ml	4 Cal	17 kJ
Tea (plain)	200 ml	3 Cal	8 kJ
Coffee (plain)	200 ml	2 Cal	8 kJ
Water	200 ml	0 Cal	0 kJ

**Different flavors of soda and juice contain different numbers of calories. Energy content may vary slightly by brand. (Adapted from Source: "What's in the foods you eat Search Tool." United States Department of Agriculture. <http://www.ars.usda.gov/Services/docs.htm?docid=17082> [accessed July 9, 2010]. Calculated with 200 ml = 6.76 oz.)*

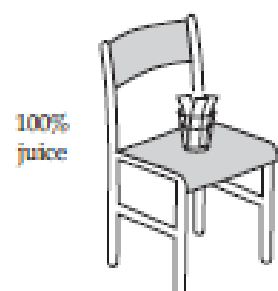
ensure enough strips of paper for four groups of students. Be sure to cut enough strips for the entire class. Place the appropriate strips of paper

in their respective labeled cups at each station.

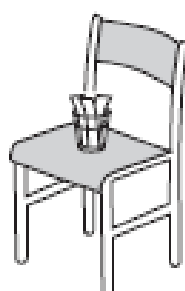
2. Have students divide into four groups and assign each, A, B, C, or D. Each group will follow the day of a typical student as they make beverage choices.

3. Explain that on most days these sample students each consume about 2000 Calories (8374 kJ) from food. They will now see how many additional Cal or kJ are consumed depending on their different beverage choices.

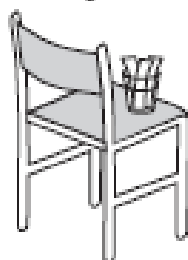
4. Recreate the Beverage Choices Table - Teacher Copy Page on the board at the front of the room. Inform the students that each beverage serving is 200 ml and that, for the purpose of this activity, all of the groups are consuming a total of 1.6 liters (1600ml) each (slightly above



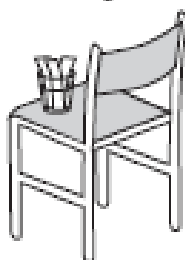
100% juice



Soda



Water



1% milk

Beverage choices

	Group A	Group B	Group C	Group D
With breakfast	1% milk	100% juice	1% milk	1% milk
After recess	water	water	water	water
With snack	100% juice	100% juice	soda	100% juice
With lunch	water	soda	100% juice	water
With snack	water	100% juice	soda	1% milk
After school	1% milk	water	100% juice	1% milk
With dinner	water	1% milk	100% juice	water
Before bed	water	1% milk	100% juice	water
Totals	1600 ml	1600 ml	1600 ml	1600 ml

Note: serving size is 200 ml – each group is consuming 1600 ml (1.6 liters) total (if each serving size is 200 ml, the total amount consumed is equal to 1.6L for each group and not the recommended daily intake of 1.5 liters of water.)

the recommended daily intake of 1.5 liters of water).

5. Have the groups follow the choices on the board and go from station to station to find out the energy content for each beverage they drink. Have each group select one piece of paper from the cup that represents their groups' beverage choice. Students may also color their strips of paper.

6. After each group has collected their eight beverages ask them to tape the pieces together to create a long strip of paper. We will call this the beverage chain. Display the chains at the front of the rooms for visual effect.

7. Instruct the students to calculate the total number of Calories or kJ that their group consumed. They can use the Energy Content Resource Page to create a results table. Calculations can also be done as a whole class depending on the math skills of the students.

8. When the total energy consumed has been calculated for all of the groups, analyze the differences in total energy for each group. Ask the students the following questions:

- Which group had the longest paper beverage chain? Which group had the shortest?
- Which group consumed the most Cal or kJ from their beverage

choice? (C)

- Who made the most healthy beverage choices as far as energy content? (A)
- How can the students improve their beverage choices? (They could try to reduce their food energy intake slightly or replace some of their beverage choices with water)
- Do you have to drink only water to avoid obesity? (No, but replacing high energy non nutritious beverages with water certainly helps. You can enjoy some high energy beverages occasionally and in moderation and stay healthy. You can also decrease energy intake from food to compensate for consuming high energy beverages. Another option is to increase your activity level, but that increase may need to be significant and deliberate.)
- What might be the consequences if the groups continue to make similar beverage choices every day into the future? (A and D may gain a little weight over time because they are adding some extra energy into their diet, whereas groups B and C have the potential to gain more weight and possibly face obesity from the excess energy these drink choices are adding to their diet).
- Are the groups drinking enough fluid to stay properly hydrated (yes)?

▼ Wrap Up

Although an important consideration, energy content is not the only factor in determining what makes a beverage a healthy choice. Different beverages contain different ingredients - for example: minerals, vitamins, fat, caffeine, carbohydrates (including sugars) and protein. Determining which beverage choices are right for you should take more than energy content into account.

	Group A		Group B		Group C		Group D	
With breakfast	87 Cal	364 kJ	102 Cal	426 kJ	87 Cal	364 kJ	87 Cal	364 kJ
After recess	0 Cal	0 kJ	0 Cal	0 kJ	0 Cal	0 kJ	0 Cal	0 kJ
With snack	102 Cal	426 kJ	102 Cal	426 kJ	80 Cal	334 kJ	102 Cal	426 kJ
With lunch	0 Cal	0 kJ	80 Cal	334 kJ	102 Cal	426 kJ	0 Cal	0 kJ
With snack	0 Cal	0 kJ	102 Cal	426 kJ	80 Cal	334 kJ	87 Cal	364 kJ
After school	87 Cal	364 kJ	0 Cal	0 kJ	102 Cal	426 kJ	87 Cal	364 kJ
With dinner	0 Cal	0 kJ	87 Cal	364 kJ	102 Cal	426 kJ	0 Cal	0 kJ
Before bed	0 Cal	0 kJ	87 Cal	364 kJ	102 Cal	426 kJ	0 Cal	0 kJ
Totals	276 Cal	1154 kJ	560 Cal	2340 kJ	655 Cal	2738 kJ	363 Cal	1518 kJ

Hydration and nutrition are both important factors in determining healthy beverage choices. Discuss with students their perception of a healthy beverage. How healthy are the following beverages: juice, milk, soda, coffee and tea? Why? Encourage them to bring their knowledge of these drinks into the conversation. For example, we learned that juice contains more energy than soda. Does that mean soda is a healthier choice? Why or why not?

You should explain clearly the nutritional value of milk and fruit juice that are often drunk at the breakfast.

Assessment

Have students:

- Recognize that excess energy consumed through beverages can lead to obesity (Warm Up)
- Compare the energy content of various beverages (Part I)
- Calculate energy intake from various quantities of different beverages (Part II & III)
- Incorporate healthy changes into their hydration regimen (Part III, Wrap Up)
- Identify which beverages are nutritious

Extensions

Instruct students to create a daily beverage menu for themselves based on what they have learned about making healthy beverage choices. Remind them that they need to be sure that they are consuming at least 1.5 liters (eight glasses) of water, while also making a healthy choice. Challenge them to follow this menu to improve upon making healthy beverage choices.

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Type of Beverage	Serving Size	Energy Content	
Whole Milk	200 ml	124 Cal	518 kJ
100% Juice*	200 ml	102 Cal	426 kJ
Juice Drinks (such as fruit punch)*	200 ml	98 Cal	410 kJ
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Soda (Avg.)*	200 ml	80 Cal	334 kJ
Coffee with 30ml of cream or half and half	200 ml	41 Cal	171 kJ
Diet Soda	200 ml	4 Cal	17 kJ
Tea (plain)	200 ml	3 Cal	8 kJ
Coffee (plain)	200 ml	2 Cal	8 kJ
Water	200 ml	0 Cal	0 kJ

*Different flavors of soda and juice contain different numbers of calories. Energy content may vary slightly by brand.
(Adapted from Source: "What's in the foods you eat? Search Tool." United States Department of Agriculture.)



	Group A	Group B	Group C	Group D
With breakfast	1% milk	100% juice	1% milk	1% milk
After recess	water	water	water	water
With snack	100% juice	100% juice	soda	100% juice
With lunch	water	soda	100% juice	water
With snack	water	100% juice	soda	1% milk
After School	1% milk	water	100% juice	1% milk
With dinner	water	1% milk	100% juice	water
Before bed	water	1% milk	100% juice	water
Total	1600 ml	1600 ml	1600 ml	1600 ml

ENERGY CONTENT - RESOURCE PAGE

	Group A		Group B		Group C		Group D	
With breakfast	87 Cal	364 kJ	102 Cal	426 kJ	87 Cal	364 kJ	87 Cal	364 kJ
After recess	0 Cal	0 kJ	0 Cal	0 kJ	0 Cal	0 kJ	0 Cal	0 kJ
With snack	102 Cal	426 kJ	102 Cal	426 kJ	80 Cal	334 kJ	102 Cal	426 kJ
With lunch	0 Cal	0 kJ	80 Cal	334 kJ	102 Cal	426 kJ	0 Cal	0 kJ
With snack	0 Cal	0 kJ	102 Cal	426 kJ	80 Cal	334 kJ	87 Cal	364 kJ
After school	87 Cal	364 kJ	0 Cal	0 kJ	102 Cal	426 kJ	87 Cal	364 kJ
With dinner	0 Cal	0 kJ	87 Cal	364 kJ	102 Cal	426 kJ	0 Cal	0 kJ
Before bed	0 Cal	0 kJ	87 Cal	364 kJ	102 Cal	426 kJ	0 Cal	0 kJ
Totals	276 Cal	1154 kJ	560 Cal	2340 kJ	655 Cal	2738 kJ	363 Cal	1518 kJ



Group: _____	Beverage Choice	Serving Size (ml)	Energy Content (Cal/kJ)
With breakfast			
After recess			
With snack			
With lunch			
With snack			
After School			
With dinner			
Before bed			
Totals			



100% Juice

100% Juice

Water

Water

Water

1% milk

1% milk

Soda**Soda****Soda****100% Juice**