UNIVERSITY OF MINNESOTA ROCHESTER

What's in your food? Investigation of nutritional properties in common household staples

Jenny Wollschlager and Micaela Haas
Center for Learning Innovation
University of Minnesota Rochester
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Learning Goals

- Interpret and compare nutrition labels
- Understand the function of different indicator solutions
- Analyze indicator solution results
- Differentiate unknown solutions based on their nutritional content

What are the four macromolecules?

- Lipids
- Proteins
- Carbohydrates
- Nucleic acids

The Unknowns

Protein Powder

Supplement Facts

Serving Size One Scoop (33.6 g)
Servings Per Container 25

Amount Per Serving		% Daily Value
Calories	130	
Total Fat	2 g	3%†
Saturated Fat	1 g	5%†
Cholesterol	80 mg	27%
Total Carbohydrate	4 g	1%†
Total Sugars	2 g	*
Protein	24 g	
Calcium	130 mg	10%
Sodium	60 mg	3%
Potassium	190 mg	4%

† Percent Daily Values are based on a 2,000 calorie diet.
* Daily Value not established.

Nondairy Creamer

Nutrition Facts

About 63 servings per container
Serving size 1 tbsp (15 mL)

Amount per serving
Calories 20

	% Daily Value
Total Fat 1 g	**1%**
Saturated Fat 0 g	**0%**
Trans Fat 0 g	
Polyunsaturated Fat 0 g	
Monounsaturated Fat 1 g	
Cholesterol 0 mg	**0%**
Sodium 5 mg	**0%**
Total Carbohydrate 2 g	**1%**
Total Sugars <1 g	
Includes <1 g Added Sugars	**2%**
Protein 0 g	

Not a significant source of dietary fiber, vitamin D, calcium, iron, and potassium.

Whole Milk

Nutrition Facts

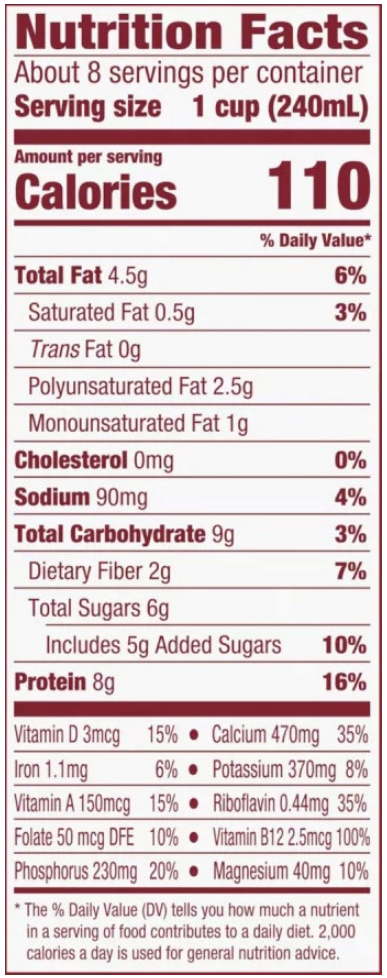
16 servings per container
Serving size 1 cup (240mL)

Amount per serving
Calories 150

	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 5g	**25%**
Trans Fat 0g	
Cholesterol 35mg	**12%**
Sodium 105mg	**5%**
Total Carbohydrate 12g	**4%**
Dietary Fiber 0g	**0%**
Total Sugars 12g	
Includes 0g Added Sugars	**0%**
Protein 8g	**16%**
Vitamin D 2.5mcg	10%
Calcium 300mg	25%
Iron 0mg	0%
Potassium 322mg	6%
Vitamin A 112mcg	12%

* The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.

Soy Milk



Nutrition Facts

About 8 servings per container
Serving size 1 cup (240mL)

Amount per serving
Calories 110

	% Daily Value*
Total Fat 4.5g	**6%**
Saturated Fat 0.5g	**3%**
Trans Fat 0g	
Polyunsaturated Fat 2.5g	
Monounsaturated Fat 1g	
Cholesterol 0mg	**0%**
Sodium 90mg	**4%**
Total Carbohydrate 9g	**3%**
Dietary Fiber 2g	**7%**
Total Sugars 6g	
Includes 5g Added Sugars	**10%**
Protein 8g	**16%**

Vitamin D 3mcg	15%	Calcium 470mg	35%
Iron 1.1mg	6%	Potassium 370mg	8%
Vitamin A 150mcg	15%	Riboflavin 0.44mg	35%
Folate 50 mcg DFE	10%	Vitamin B12 2.5mcg	100%
Phosphorus 230mg	20%	Magnesium 40mg	10%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Almond Milk

Nutrition Facts

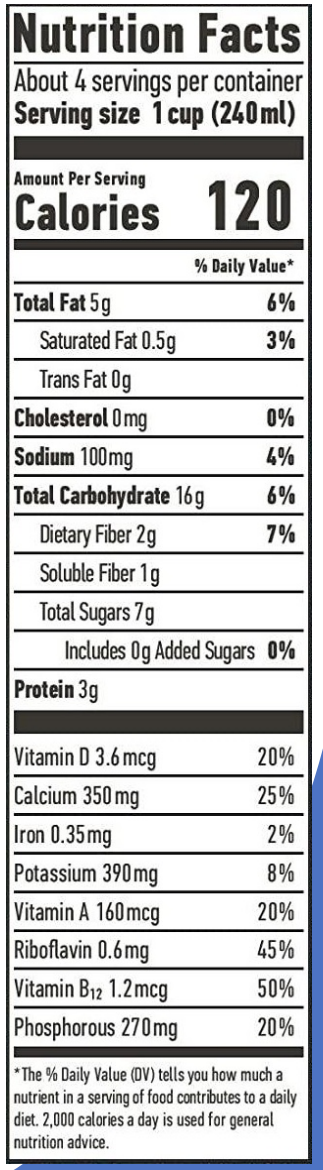
8 servings per container
Serving size 1 cup (240mL)

Amount per serving
Calories 60

	% Daily Value*
Total Fat 2.5g	**3%**
Saturated Fat 0g	**0%**
Trans Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 1.5g	
Cholesterol 0mg	**0%**
Sodium 150mg	**7%**
Total Carbohydrate 8g	**3%**
Dietary Fiber <1g	**2%**
Total Sugars 7g	
Includes 7g Added Sugars	**14%**
Protein 1g	
Vitamin D 5mcg	25%
Calcium 450mg	35%
Iron 0.7mg	4%
Potassium 170mg	4%
Vitamin A 150mcg	15%
Vitamin E 7.5mg	50%
Phosphorus 20mg	2%
Magnesium 15mg	4%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Oat Milk



Nutrition Facts

About 4 servings per container
Serving size 1 cup (240ml)

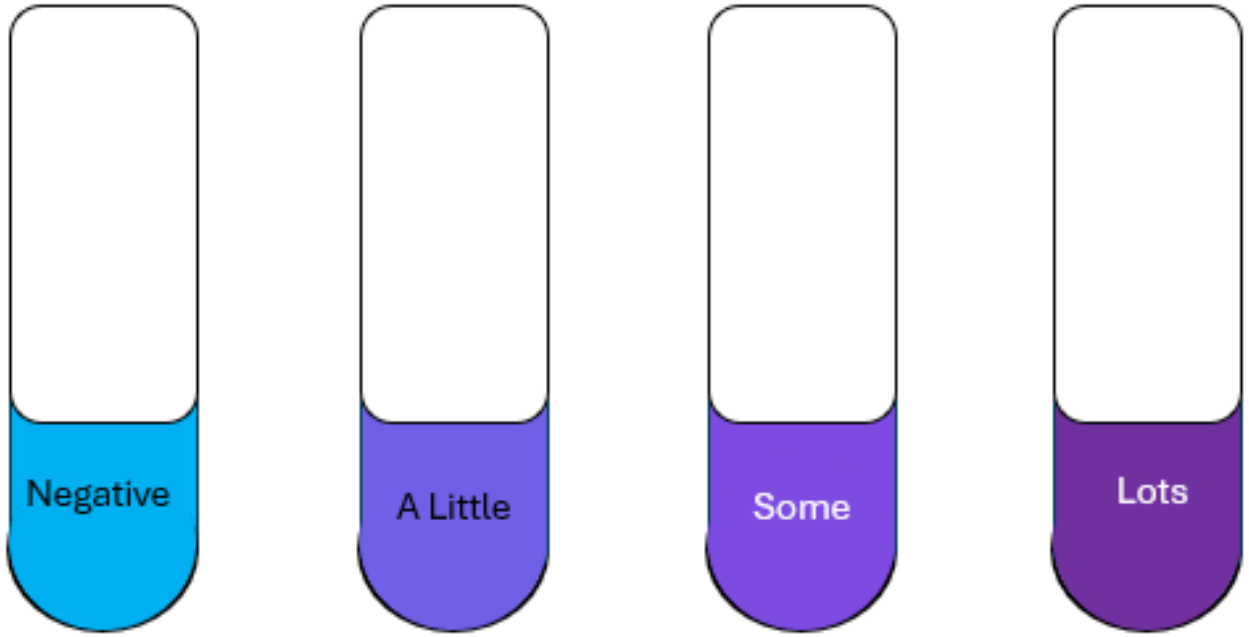
Amount Per Serving
Calories 120

	% Daily Value*
Total Fat 5g	**6%**
Saturated Fat 0.5g	**3%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 100mg	**4%**
Total Carbohydrate 16g	**6%**
Dietary Fiber 2g	**7%**
Soluble Fiber 1g	
Total Sugars 7g	
Includes 0g Added Sugars	**0%**
Protein 3g	
Vitamin D 3.6mcg	20%
Calcium 350mg	25%
Iron 0.35mg	2%
Potassium 390mg	8%
Vitamin A 160mcg	20%
Riboflavin 0.6mg	45%
Vitamin B_{12} 1.2mcg	50%
Phosphorous 270mg	20%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Biuret and Protein concentration

- The amount of protein present will result in different purple colors.
- Blue is negative and bold purple is positive. Blueish purple is some protein.
- Putting these tubes into a gradient can help a lot.
- Remember most of the solutions are white and some have a light brown tint. Both of these will have some effect on the color change.



Starch and Lugol’s

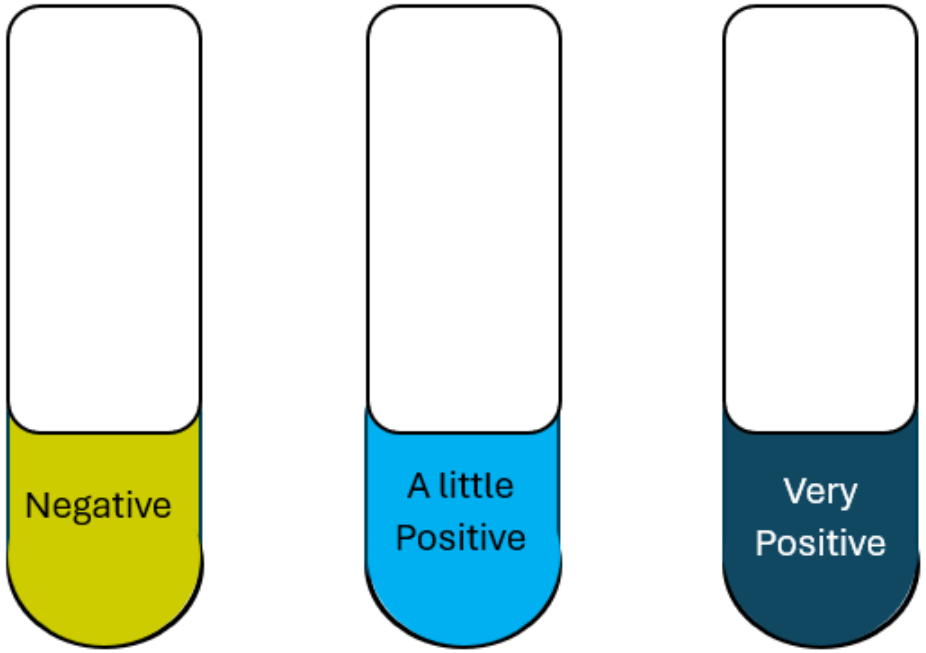
What are starches?

What are simple sugars?

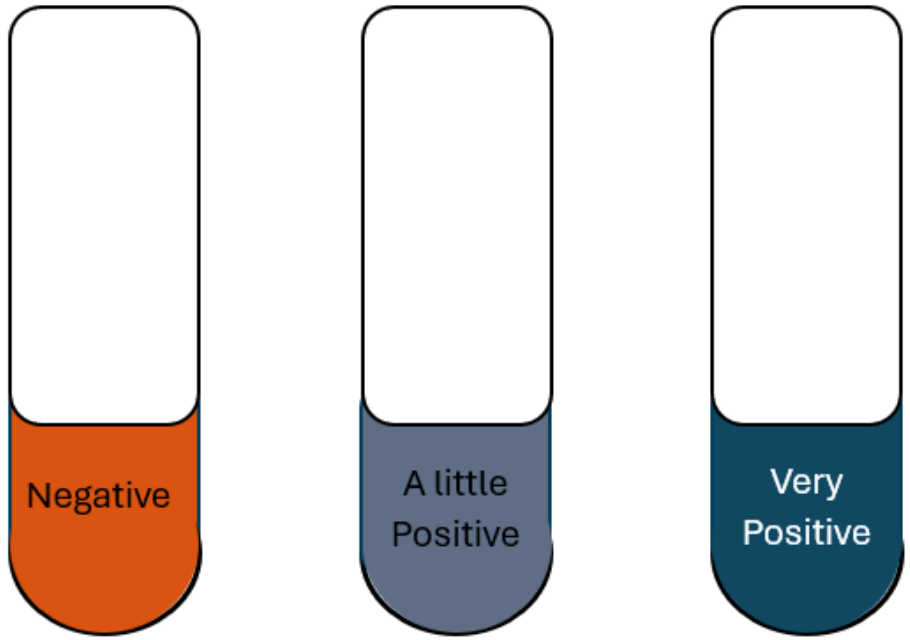
Will simple sugars give a positive starch response?

Lugol’s - Iodide potassium iodide

1 Drop of Indicator Solution



2-3 Drops of Indicator Solution



Please note that there are varying degrees of color change for each test.
The final color can depend on the solution components as well

Reducing Sugars

- Reducing sugars contain a hemiacetal

  An –OH bound to a carbon that also has an O-R

  This specific structure allows the sugar to be a reducing agent (donate electrons to another molecule) for a metal

  Copper in Benedict's solution becomes reduced.

- All simple sugars are reducing except sucrose
- So, Benedict's tests for simple sugars, except sucrose.

Reducing sugars

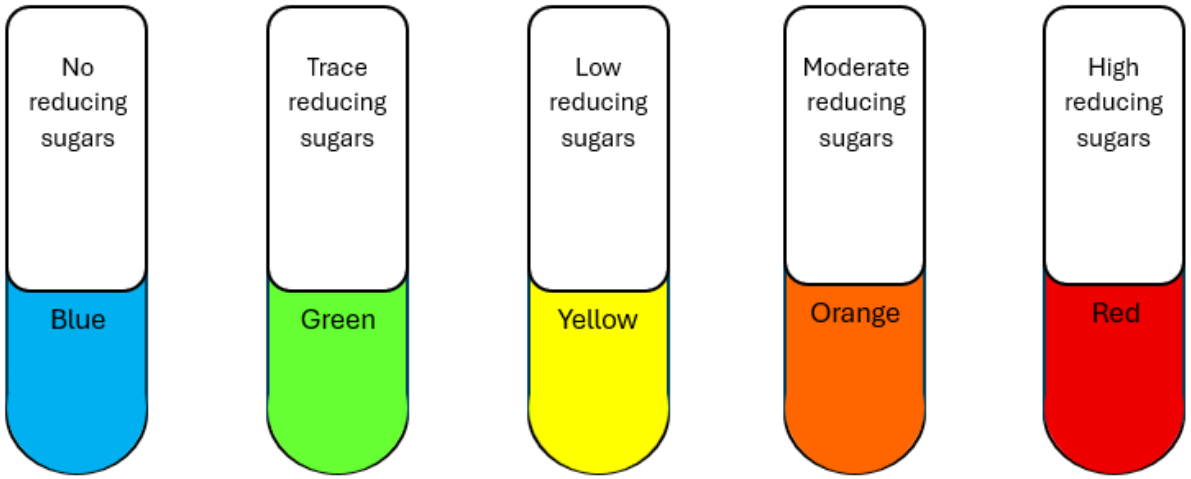
- It matters if they are present and how much is present
- Scenario:

  You tested two solutions using Benedict's test. One turns orange, the other turns green.

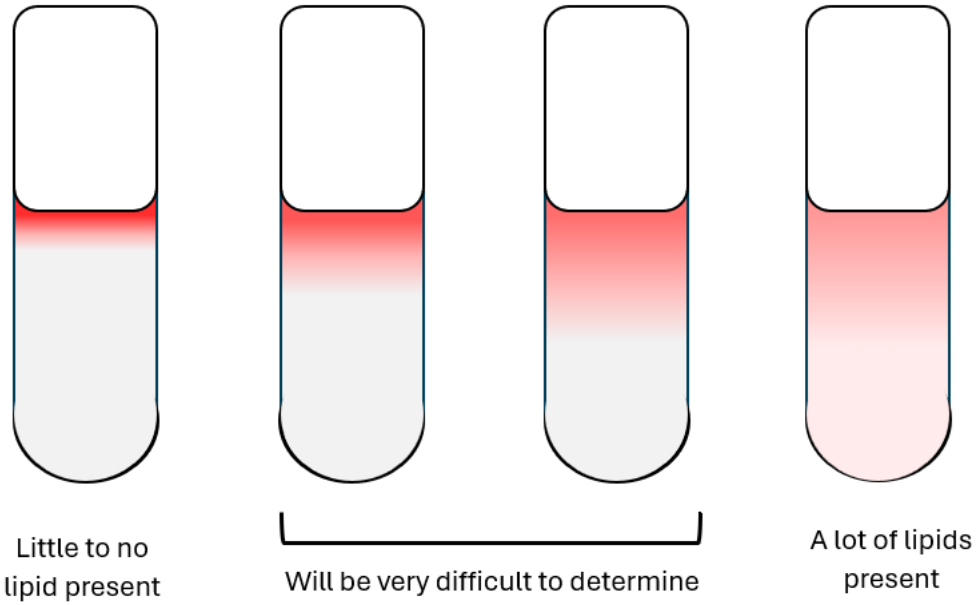
  The total sugars in each solution was 5 grams/serving.

  One solution had only lactose, the other had mostly sucrose, with a trace amount of glucose and fructose.

  Which solution turned orange, and which turned green?



Sudan Red



- Sudan red easily combines with lipids
- To speed up the process of diffusion, we will swirl the tubes, a little at a time

  Do not mixing vigorously
- Depending on technique, you can get different results from neighbors, so this is the most variable test.
- Very low or very high amounts of lipids should give clear results, but anything in between may be hard to distinguish
- Please feel free to verify your results with us if you are concerned

Prelab Table

Everything you need is in the lab background

* For nondairy creamer, round up. If there is less than 0.5 grams of added sugar, it does not need to be reported [20], so <1 g means there's more than 0.5 grams of added sugar per serving. To make the math easy, round up.

	Whole Milk	Non-Dairy Creamer (CoffeeMate)	Protein Shake (made from protein powder)	Soy Milk	Almond Milk	Oat Milk
Volume per serving						
Servings in a cup (multiplier)						
Total Fat (g) in 1 cup						
Is starch present?						
Total Protein (g) in 1 cup						
Total sugars in 1 cup*						
Type of simple sugars present						

	Whole Milk	Non-Dairy Creamer (CoffeeMate)	Protein Shake (made from protein powder)	Soy Milk	Almond Milk	Oat Milk
Volume per serving	1 cup	1 tbsp	1 scoop	1 cup	1 cup	1 cup
Servings in a cup (multiplier)	1	16	1	1	1	1
Total Fat (g) in 1 cup	8 grams	16 grams	2 grams	4.5 grams	2.5 grams	5 grams
Is starch present?	None	None	None	Some present	None	Lots
Total Protein (g) in 1 cup	8 grams	0 grams	24 grams	8 grams	1 gram	3 grams
Total sugars in 1 cup	12 grams	16 grams	2 grams	6 grams	7 gram	7 grams
Types of simple sugars present	Lactose	Glucose	Lactose	Mostly sucrose A little maltose	Sucrose only	Glucose and Maltose

Biuret reagent

- Corrosive to skin
- Hazard level - danger

Lugol's (Iodine-potassium iodide)

- Toxic
  - Reproduction
  - Aquatic
- Hazard level – danger

Sudan red

- Toxic
- Flammable
- Hazard level - danger

Benedict's Solution

- Eye irritation
- Toxic to aquatic life
- Hazard level - warning/caution

Lab safety – Wear your safety goggles and gloves

Pay special attention to chemical collection. Some of these chemicals CANNOT MIX

Liquid Waste Collection

- Lugol's and Biuret
  - **Empty into the liquid waste beaker (labeled Lugol's and Biuret)**
  - **Rinse the test tubes at your table with the squirt bottle and dispose of the liquid in the Lugol's and Biuret waste beaker**
  - **If anything remains after rinsing, use a little water and the test tube brushes to clean them a little more thoroughly.**
  - Put them back on the racks **to dry**
- Sudan red
  - **Secure the falcon tube top to the full falcon tubes**
  - **Put the full falcon tubes in the waste collection bag on the counter labeled Sudan red.**
- Benedict's
  - **Leave the 1.5 mL tops secured**
  - **Put in the waste collection bag on the counter labeled Benedict's**
- Sudan red cannot mix with any of the other indicators! Benedict's cannot mix with any of the other indicators! They are reactive with Lugol's and Biuret. DO NOT MIX THEM.

Time to solve the puzzle

- All four protocols are in the lab handouts
- You can complete them in any order
- Controls
- As you move through this lab, make sure to use BOTH the prelab results and the color change in your analysis.

  For example, if only two milks have starch, you shouldn't be concluding that 5 have starch

  For example, if a milk has 1 gram of protein, you shouldn't be concluding that it has a lot of protein.
- The prelab table is like your hint sheet. It's going to tell you what you're looking for.
- It may be helpful to convert the color changes into relative amounts (to the best of your ability)

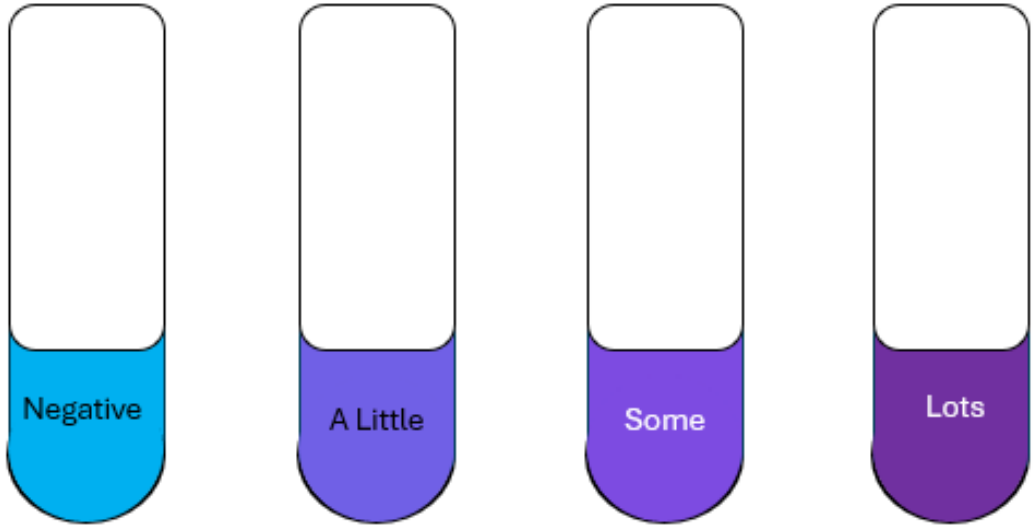
  Protein - none, a little, a lot, most

  Starch - none, a little, a lot

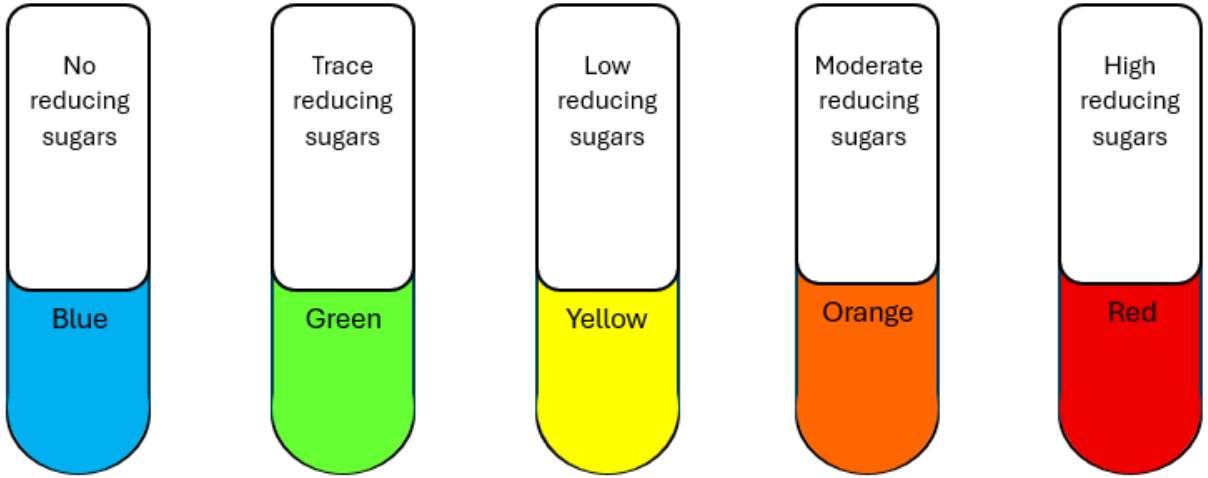
  Fat - least, some, alot, most

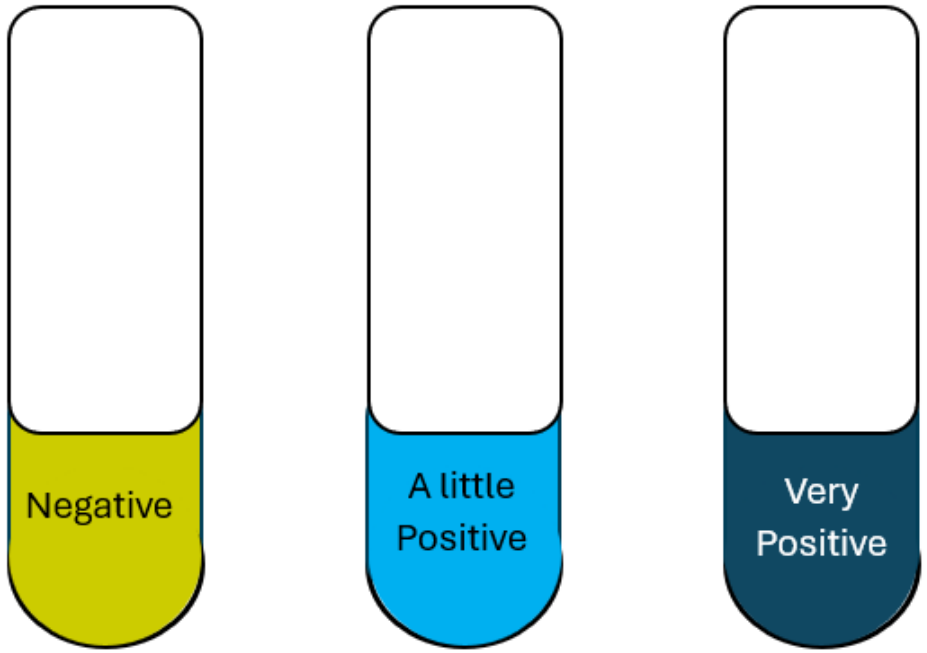
  Reducing sugars - undetectable, trace, low, moderate, high

Biuret

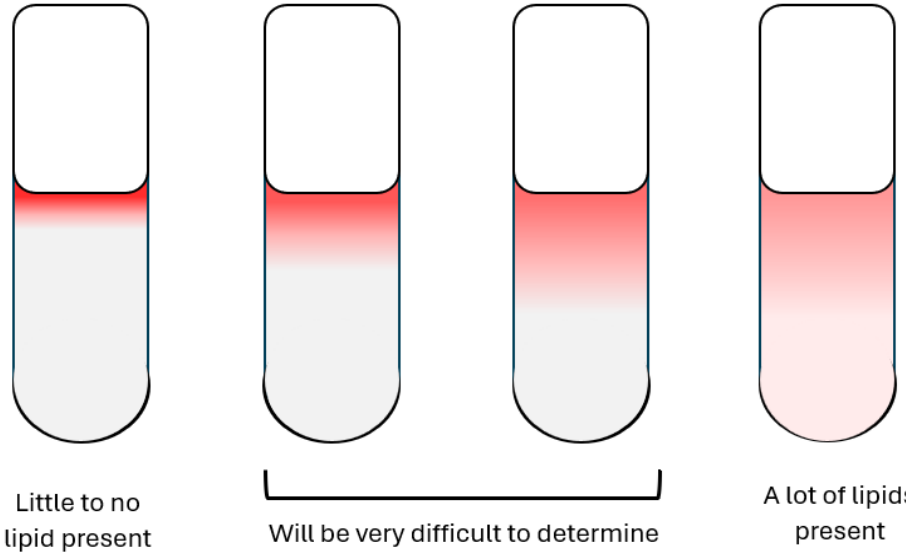


Benedict's





Lugol's



Sudan Red

Discussion of Results

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