



# Food Science/ Healthy Living:

## Project: Protein – Egg Foam Soufflés

### Supplies:

- 2 Tbsp. all-purpose flour
- ¼ tsp. salt
- 2/3 cup milk
- 1 Tbsp. butter
- ¼ cup shredded cheddar cheese *or* ¼ cup chopped vegetables of your choice
- 2 large eggs, whites and yolks separated

**Time: 1 hour**

### What to Do:

1. Preheat the oven to 350°F or plan on placing the prepared soufflé in the microwave for 3 minutes.
2. Blend flour and salt together in a saucepan. Gradually add cold milk and stir until the flour is evenly dispersed.
3. Place the sauce over heat and bring to a quick boil with constant stirring. Boil for 1 minute, until the sauce is thick. Remove from heat.
4. Add butter and shredded cheese to the hot sauce. Stir until the cheese has melted.
5. Add the unbeaten egg yolks to the sauce. Stir until blended.
6. Beat the egg whites until they begin to form stiff peaks. Record your “before baking” observations in Table 1.
7. Combine the sauce and the beaten egg whites in a bowl. Fold the mixture with a spatula until all the ingredients are blended.
8. Lightly butter the bottom of a small baking dish. Pour in the soufflé mixture. Set the dish in a pan of warm water. Note that the water should be the same depth as the soufflé in the baking dish.
9. Place the soufflé in the preheated oven and bake until a knife inserted in the center comes out clean. If a microwave is used, microwave the soufflé for 3 minutes.
10. Record your observations of the finished soufflé in Table 1.

### Reflect:

Table 1. Foam Formation Before and After Baking

	Appearance	Texture	Volume	Tenderness
Before Baking				
After Baking				

1. How did the soufflé change after baking?
2. What does a clean knife mean when testing to see if the soufflé is fully baked?
3. To what stage should you beat your egg whites for a soufflé?

**Reflect (cont.):**

The traditional soufflé consists of a sauce blended with beaten egg yolks and leavened by stiffly beaten egg whites. Many types of soufflés are possible, including ones that include cheese, seafood, or vegetables. These types of soufflés are typically served hot. Dessert soufflés have sugar and other ingredients, such as chocolate or fruit. Dessert soufflés are often served cold or frozen.

The process of making an egg foam involves trapping air into egg whites as they are beaten with a whisk to yield a light, airy mixture. Ovalbumin (the major protein in the white) is easily denatured by both heat and mechanical action. The whisking of air into the egg whites denatures the proteins, causing them to coagulate. This causes the foam to stiffen and the air bubbles to stabilize.

The foam should be transferred into a greased, ovenproof soufflé dish. A soufflé dish has a special design. Its straight sides and circular shape facilitate the soufflé's rising. The soufflé dish is placed into a large pan of water that steams when it gets hot.

**Apply:**

There are four stages of egg white foam:

1. *Foamy*: Foam is unstable and has a large air-cell volume. It is transparent, and the bubbles merge if the beating is halted. Cream of tartar (an acid) is added at this stage to coagulate the proteins around the air cells.
2. *Soft rounded peaks*: The air cells subdivide in size and are whiter. The volume of the foam increases. Sugar is added at this stage.
3. *Stiff pointed peaks*: The foam has many small air cells. The volume of the foam increases. Egg protein coagulates around the small air cells. At this point, the foam is ready for most food applications and can be used for hard meringues.
4. *Dry peak foam*: The foam is now brittle and inelastic. The foam loses volume as the air cells break and the proteins become denatured. Water escapes the foam and it takes on a lumpy, over-coagulated, and curdled appearance.

**Background:**

Eggs can be part of a nutritious and healthy diet and aren't just for breakfast! One large egg contains 70 calories, 6 grams of protein, all 9 essential amino acids and 250 mg of choline. Choline helps promote normal cell activity, liver function and the transportation of nutrients throughout the body.

**Ancient egg production**

History indicates that wild fowl were domesticated as early as 3200 BC in India. Europeans have had domesticated hens since 600 BC. It is believed that Columbus brought laying hens to the America's on his second trip!

**Modern day egg production**

Each of the roughly 300 million laying birds in the U.S. produces from 250 to 300 eggs a year. In total, the U.S. produces about 75 billion eggs a year, about 10% of the world supply. Consumers use about 60% of the eggs produced, while about 9% are used by the foodservice industry. The rest are turned into egg products which are used mostly by foodservice operators (restaurants) and by food manufacturers to make foods like mayonnaise and cake mixes.