Milk has 6 basic constituents. The exact percentage of each item can vary depending upon an individual cow’s genetic makeup, her stage of lactation, her age, her diet, and her health status. But as an average, here are the major components of milk and their percentages:

- water (87%)
- carbohydrates in the form of lactose (4.8%)
- fat (4%)
- protein (3.4%)
- vitamins and minerals, (0.8%)

The specific protein genes a cow inherits can impact the quality and the quantity of her milk. These genes can also affect the way the milk is processed into products like cheese. Since there are 3 different genetic tests available for bovine milk protein genes, some people genetically test their cows as a tool in determining management strategies.

Three genetic tests are available for bovine milk proteins:

- Beta Casein A1/A2 genes
- Kappa Casein A/B genes
- Beta Lactoglobulin A/B genes

There are two main types of milk proteins:

- Casein proteins
- Whey proteins.

**Casein Proteins: Beta Caseins and Kappa Caseins**

- Casein proteins comprise 82% of all milk proteins.
- Bovine milk is 3% Casein proteins.
- There are two important casein proteins genes: Beta Casein genes and Kappa Caseins genes.
• **Beta Caseins** are 1% of the total composition of milk. The two most common Beta casein variants are the A1 gene and A2 gene.
  - A1 – the majority of dairy animals in the United States have this variant
  - A2 – studies are ongoing to ascertain if this variant has specific health benefits
  - A cow that has only one of these variants (A1A1 or A2A2) will only produce that protein in their milk.
  - If a cow has both proteins (A1A2), she will produce both proteins in her milk.

• **Kappa Caseins** are 0.35% of the total composition of milk. The two most common Kappa casein gene variants are the A gene and the B gene.
  - A – associated with higher milk production by volume
  - B – associated with higher protein and casein content in milk
  - B is favored for cheese production
  - Relative to cheese production:
    - AA is the least favorable gene combination
    - AB is moderately favored
    - BB is the most favored

**Whey Protein: Beta Lactoglobulin**

- Whey proteins comprise 18% of all milk proteins.
- Bovine milk is 0.65% whey proteins.

- **Beta Lactoglobulin**, the major whey protein gene, has two common variants:
  - A – associated with higher milk production by volume and higher whey protein content in milk
  - B – associated with higher casein content and fat content in milk
  - B is favored for cheese production
  - Relative to cheese production:
    - AA is the least favorable gene combination
    - AB is moderately favored
    - BB is the most favored