

CHEESE FAMILIES

Information provided by:
 Professor Arthur R. Hill
 Dept. of Food Science,
 University of Guelph, Canada
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<http://www.foodsci.uoguelph.ca/dairyedu/cheese2.html>

The objectives of cheese making are: (1) To obtain the optimum cheese composition with respect to moisture, acidity (pH), fat, protein and minerals (especially calcium); (2) Establish the correct structure of the cheese at the microscopic level; and (3) Ripen to perfection. Objectives (1) and (2) are achieved by varying initial make procedures and it is then possible to achieve objective (3). Most of these variations in initial make procedures are different means to control the rate and extent of acid development, and the rate and extent of moisture release.

Family 1. Acid-coagulated Fresh Cheese

Varieties	Cottage, Quark and Cream
Coagulation	The distinguishing characteristic of these varieties is that coagulation is achieved by acidification to pH 4.6 - 4.8, with little or no coagulating enzyme. Acidification is normally by lactic acid producing cultures. Most other American and European cheese varieties also use lactic acid producing cultures, but gelation is induced by a coagulating enzyme at pH 6.5 - 6.7, before much acid development has taken place.
pH Control	After cutting at pH 4.6 - 4.8, the curd is cooked to 52 C which is sufficient to inactivate the culture and prevent further acid development. Acidity is also reduced by washing the curd before salting.
Curd moisture (%)	Curd moisture is reduced by syneresis during cooking but remains high, 60 - 70%, in the finished cheese.
Curing	Fresh cheese as the name implies is consumed fresh and has a shelf life of only 2 - 3 weeks.

Family 2. Rennet-coagulated Fresh Cheese

Varieties	Queso Blanco, Queso Fresco, Italian fresh cheese, Halloumi
Coagulation	The distinguishing characteristic of rennet coagulated fresh cheese is that little or no culture is used. Coagulation is, therefore, entirely by rennet at the natural pH of milk.
pH Control	The pH is determined by the amount of culture. If no culture is used, the pH remains in the range of 6.5-6.7. In some Queso Blanco varieties a small amount of culture is used to reduce the pH to about 5.8 which reduces the growth of both spoilage (increases shelf life) and pathogenic (increases food safety) microorganisms. Further acidification is inhibited by cooling and salting. Too much acidification below pH<5.8 will produce a meltable cheese which is unsuitable for frying.
Curd moisture (%)	Curd moisture may be reduced by syneresis during cooking and limited acidification, but is still 50 - 70% in the finished cheese. Some varieties exhibit syneresis after packaging.
Curing	Consumed fresh and has a shelf life of only 2 - 4 weeks.

Family 3. Heat-Acid Precipitated Cheese

Varieties	Ricotta (Italy), Channa and Paneer (India), some varieties of Latin American white cheese.
Coagulation	Coagulation is accomplished by direct acidification of heated milk. High heat treatment of milk (temperatures greater than 75C) causes denaturation of the whey proteins. Subsequent acidification of the hot milk coagulates both casein and whey proteins, so that most of the milk protein is recovered in the cheese.
pH Control	The final acidity (pH) is determined by the amount of acid added. Final pH is normally in the range of 5.3 - 5.8. Any organic acid can be used, but lactic and citric acids are most common.
Curd moisture (%)	Moisture can be reduced by holding the curd in the hot curd-whey mixture after coagulation, and by draining and pressing procedures. Moisture is generally high (55 - 80%) due to the high water holding capacity of whey proteins.
Curing	Heat-acid precipitated varieties are normally consumed fresh. An exception is Mizithra, a type of ricotta cheese which is cured, dried, and consumed as a grating cheese. It is also possible in some cases to hot pack heat-acid varieties to obtain extended shelf life. High concentrations of whey proteins decrease cheese meltability and account for the excellent cooking properties of heat-acid precipitated cheese.

Family 4. Soft-Ripened Cheese	
Varieties	Fetta, Camembert, Brie, Blue
Coagulation	Coagulation is primarily rennet (enzymatic) with three important differences relative to cooked and pressed varieties (Families 5-7). (1) The amount of lactic acid bacteria inoculum is large and the ripening period before renneting is extended. The result is that acidification has considerable influence on the development of curd structure during setting and demineralization of the curd is decreased. (2) Cutting is delayed (i.e., setting time increased) to further encourage acidification and demineralization before cutting. (3) Cutting is accomplished with large knives or just broken up with paddles to minimize moisture and fines losses before filling the forms.
pH Control	The distinguishing feature of these cheese is that the curd is placed in the forms while still sweet and let stand in a warm room for several hours. Acidification (i.e. conversion of lactose to lactic acid) continues until the accumulation of lactic acid inhibits culture growth. Acid development is also influenced by the time and amount of salting. The pH is normally about 4.3 - 4.6 on the day following manufacture and in the case of Feta remains low during curing, The pH of mould ripened varieties increases during curing (i.e., acidity decreases), especially Camembert and Brie.
Curd moisture (%)	Syneresis is induced by acid development after forming and by brine salting. Moisture content is typically 45 - 60%.
Curing	2 - 8 weeks.
Family 5. Semi-hard Washed Cheese	
Varieties	This is the largest and most diverse group of cheese including Gouda, Edam, Colby, Brick, Montasio, Oka, Muenster and many others.
Coagulation	See family 4
pH Control	The distinguishing feature of these cheese is the practice of washing to remove lactose. Part or all of the whey is removed and replaced with water to leach lactose from the curd. The objective is to limit the amount of lactose to a level which permits sufficient lactic acid development to produce a minimum pH of 5.0 - 5.2, but not enough to ferment and produce cheese pH less than 5.0.
Curd moisture (%)	The amount of syneresis is controlled mainly by the temperature and time of cooking and by the temperature of the wash water. Higher temperatures during cooking or washing cause the curd to contract and expel moisture. Also, important are the rate of acid development and salting treatments. Washed curd cheese typically have moisture contents of 40 - 50%. With few exceptions, such as, part skim Mozzarella, production of a rennet coagulated cheese with a moisture content of 40% or greater requires a washing treatment to remove the substrate for lactic acid fermentation, i.e., lactose.
Curing	2 weeks - 9 months.
Family 6. Hard Cheese: Low temperature	
Varieties	Cheddar types and Pasta Filata. types. Cheddar and Pasta Filata manufacture are similar in the early stages. Pasta filata varieties are distinct in that they are worked and stretched in hot water and brine salted. Cheddar types are salted before hooping and pressing.
Coagulation	See family 4
pH Control	The distinguishing feature of these cheese is that acid development is mainly controlled by the amount of syneresis. As with semi-hard cheese, the objective is to obtain a minimum pH of 5.0 - 5.2 within 1 - 3 days after manufacture. Lactose content is substantially reduced by fermentation with associated moisture loss during cheddaring and vat salting.
Curd moisture (%)	Moisture is controlled by cooking temperature and time, stirring out after draining, cheddaring, amount of culture, and salting treatments. Typical moisture content is 35 - 39% for Cheddar types and up to 52% for Pasta Filata types.
Curing	1 - 36 months.
Family 7. Hard Cheese: High Temperature	
Varieties	Romano, Parmesan, Swiss
Coagulation	See family 4
pH Control	Type of culture, time-temperature profile during pressing until cooling, lactose removed by syneresis. Little acid development before draining.
Curd moisture (%)	Rapid syneresis induced by high renneting temperature and high cooking temperature.
Curing	1 - 36 months