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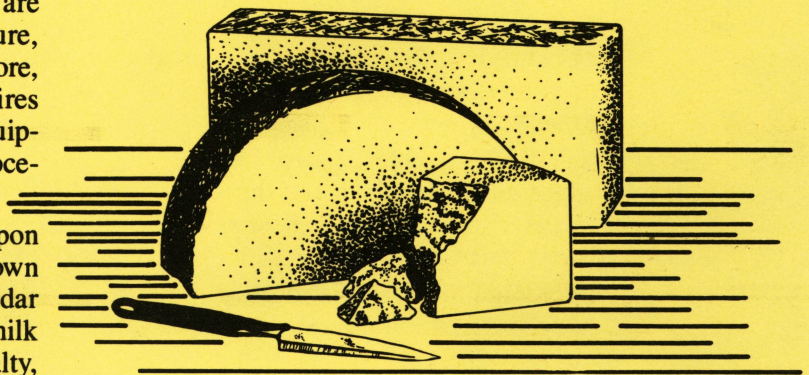
Dairy Product Quality

Cheddar Cheese

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Cheddar cheese is a product of fermentation and undergoes constant changes during storage. Its characteristic flavor, body, texture, color and curing qualities are influenced by milk quality, manufacturing procedure, temperature of storage and length of storage. Therefore, to manufacture high quality Cheddar cheese requires the use of high quality milk, clean and sanitary equipment, active starter, standardized manufacturing procedures and controlled temperature storage.

Characteristic Cheddar cheese flavor depends upon a group of compounds resulting from the breakdown of fat, protein and lactose in proper balance. Cheddar cheese flavor defects that are directly related to milk quality are: acid, bitter, feed, flat, fruity, lipase, malty, old milk, sour, sulfide, utensil, weedy, whey-taint, yeasty, onion and barny. Terms used to describe flavors are difficult to define, but the following explanation of terms is used by the industry:



Acid Sharp and puckery to the taste, characteristic of lactic acid.

Bitter Distasteful, similar to taste of quinine.

Feed Feed flavors of milk carried through into cheese.

Flat Insipid, practically devoid of any characteristic cheese flavor.

Fruity A sweet, fruit-like flavor resembling apples.

Lipase A flavor suggestive of rancidity or butyric acid, sometimes associated with bitterness.

Malty A distinctive, harsh flavor suggestive of malt.

Old milk Lacks freshness.

Sour An acidly pungent flavor resembling vinegar.

Sulfide An objectional flavor of hydrogen sulfide similar to the flavor of water with a high sulfur content.

Utensil A flavor that is suggestive of improper or inadequate washing and sterilizing of milking machines, utensils or factory equipment.

Weedy A flavor due to the use of milk which possesses a common weedy flavor, present in cheese when cows have eaten weedy hay or grazed on common weed-infested pasture.

Whey-taint A slightly acid flavor and odor characteristic of fermented whey.

Yeasty A flavor indicating yeasty fermentation.

Onion A flavor recognized by the peculiar taste and aroma suggestive of its name.

Barny A flavor characteristic of the odor of a cow stable.

Body and texture defects of Cheddar cheese related to milk quality are: corky, crumbly, mealy, pasty, pinny, gassy, short, slitty, sweet holes and weak. Industry uses the following explanations of these terms.

| | |
|-------------|--|
| Corky | Hard, tough, over-firm cheese which does not readily break down when rubbed between the thumb and fingers. |
| Crumbly | Loosely-knit and tends to fall apart when rubbed between the thumb and fingers. |
| Mealy | Short body, does not mold well and looks and feels like corn meal when rubbed between the thumb and fingers. |
| Pasty | Usually weak body; when the cheese is rubbed between the thumb and fingers, it becomes sticky and smeary. |
| Pinny | Numerous very small gas holes. |
| Gassy | Gas holes of various sizes and may be scattered. |
| Short | No elasticity to the plug; when rubbed between the thumb and fingers, it tends toward mealiness. |
| Slitty | Narrow elongated slits generally associated with a cheese that is gassy or yeasty; sometimes referred to as "fish-eyes." |
| Sweet holes | Spherical gas holes, glossy in appearance; usually about the size of BB shots; also referred to as shot or Swiss holes. |
| Weak | Requires little pressure to crush, is soft but not necessarily sticky like a pasty cheese. |

Milk Quality Factors

Milk quality factors that affect Cheddar cheese quality include high bacteria count, high somatic cell count, high acid degree value and antibiotic residues.

High Bacteria Count

Milk with a high number of bacteria per ml is often responsible for off flavors and the gassy texture in Cheddar cheese. The most serious flavor defect in cheese originating from milk with high numbers of bacteria is sulfide. The slightest sulfide flavor in Cheddar cheese results in the cheese being downgraded to either USDA grade "B" or "C". Absolutely no sulfide flavor is allowed in either grade "AA" or "A". Early gas formation may be caused by coliforms in the milk supply. Later formation of gas may be due to spore-forming organisms surviving pasteurization treatment. These bacteria get into the milk during and after milking. They come from the soil or dirt on the udders, hands of the milkers, unclean milking machines, particles of feed, bedding and manure.

Cooling milk rapidly on the farm and maintaining it at a low temperature creates an environment that is favorable for the growth of another group of bacteria, the psychrotrophs. These bacteria are capable of producing proteolytic enzymes that cause the milk protein to be changed. This change in protein causes a reduction in the yield of cheese per pound of milk and also causes a bitter flavor to develop in the finished cheese.

High Somatic Cell Count

High numbers of somatic cells in milk are caused by adding milk from infected udders to the milk supply. The legal limit in Idaho is 1,000,000 somatic cells per ml. However, milk having only 500,000 per ml will reduce cheese yield by 1 percent and increase the moisture content by 1 percent. The finished cheese made from such milk will have a weak body and develop a bitter flavor.

High Acid Degree Value (Rancidity)

The acid degree value of milk is increased when milk is obtained from cows in late lactation or when milk is cooled, then warmed to 80 or 90°F and cooled again to 40 or 50°F. Excessive agitation with foaming of raw milk will also cause an increase in the acid degree value. Excessive agitation may be caused by an air leak in the milking system, partially filled milk lines or "starving" the centrifugal milk transfer pump. Holding milk for long periods of time at low temperatures favors the growth of organisms that cause rancidity.

Cheddar cheese made from unpasteurized milk with high acid degree value will have rancid and unclean flavors. Cheddar cheese made from pasteurized milk with high acid degree value milk will have bitter and unclean flavors. When Cheddar cheese is manufactured from high acid degree value milk, fat loss in the whey is higher than normal. An illegal cheese with less than 50 percent fat in the dry matter may result.

Antibiotic Residues

Antibiotic residues get into the milk supply from cows that have been treated with antibiotics to cure, control or prevent infections. Udder infusion is not the only source of antibiotics in milk. Intramuscular injection of lactating cows with an antibiotic, for any reason, will result in an antibiotic residue in the milk.

Milk with low concentrations of antibiotics will cause slow acid development during the Cheddar cheese manufacturing process and will favor growth of gas formers in the curd. The finished cheese will have a weak body and slightly higher moisture content, and may develop a bitter flavor.

Grading Cheese

Since Cheddar cheese is a product of fermentation and is constantly undergoing changes, it must be grad-

Table 1. Classification of flavor according to degree of curing.

| Identification of flavor characteristics | AA | | | A | | | B | | | C | | |
|--|------------------|--------------|---------------|------------------|--------------|---------------|------------------|--------------|---------------|------------------|--------------|---------------|
| | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged |
| Feed | VS* | VS | VS | S | S | S | D | D | D | P | P | P |
| Acid | - | - | - | VS | S | S | S | D | D | D | P | P |
| Flat | - | - | - | - | - | S | S | S | S | D | D | D |
| Bitter | - | - | - | - | VS | S | S | D | D | D | P | P |
| Fruity | - | - | - | - | - | - | S | D | D | D | P | P |
| Utensil | - | - | - | - | - | - | S | D | D | D | P | P |
| Metallic | - | - | - | - | - | - | - | - | - | S | D | D |
| Sour | - | - | - | - | - | - | - | - | - | S | D | D |
| Whey-taint | - | - | - | - | - | - | S | D | D | D | P | P |
| Yeasty | - | - | - | - | - | - | S | S | S | D | D | D |
| Malty | - | - | - | - | - | - | S | S | S | D | D | D |
| Old milk | - | - | - | - | - | - | S | S | S | D | D | D |
| Weedy | - | - | - | - | - | - | S | S | S | D | D | D |
| Onion | - | - | - | - | - | - | VS | VS | VS | S | S | S |
| Barny | - | - | - | - | - | - | S | S | S | D | D | D |
| Lipase | - | - | - | - | - | - | S | S | S | D | D | D |
| Sulfide | - | - | - | - | - | - | - | - | S | - | S | D |

* VS = Very slight — Detected only upon very critical examination.
 S = Slight — Detected only upon critical examination.
 D = Definite — Not intense, but detectable.
 P = Pronounced — So intense as to be easily identified.

Table 2. Classification of body and texture according to degree of curing.

| Identification of body and texture characteristics | AA | | | A | | | B | | | C | | |
|--|------------------|--------------|---------------|------------------|--------------|---------------|------------------|--------------|---------------|------------------|--------------|---------------|
| | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged | Fresh or current | Medium cured | Cured or aged |
| Curdy | D | S | - | D | S | - | D | S | - | D | S | - |
| Coarse | - | - | - | - | - | - | S | S | - | D | D | - |
| Open | VS | S | S | S | S | S | D | D | D | P | P | P |
| Sweet holes | - | VS | VS | S | S | S | D | D | D | P | P | P |
| Short | - | - | - | - | S | S | S | D | D | D | P | P |
| Mealy | - | - | - | - | S | S | S | D | D | D | P | P |
| Weak | - | - | - | - | S | S | S | D | D | D | P | P |
| Pasty | - | - | - | - | - | S | S | D | D | D | P | P |
| Crumbly | - | - | - | - | - | S | S | D | D | D | P | P |
| Gassy | - | - | - | - | - | - | S | S | S | D | D | D |
| Slitty | - | - | - | - | - | - | S | S | S | D | D | D |
| Corky | - | - | - | - | - | - | S | S | - | D | D | - |
| Pinny | - | - | - | - | - | - | - | - | - | D | D | D |

* VS = Very slight — Detected only upon very critical examination.
 S = Slight — Detected only upon critical examination.
 D = Definite — Not intense, but detectable.
 P = Pronounced — So intense as to be easily identified.

ed according to its degree of curing. Tables 1 and 2, from the Agriculture Marketing Service, U.S. Department of Agriculture, indicate the extent of a flavor, body and texture defect permitted for various grades of Cheddar cheese.

To permit proper examination of flavor, body and texture, the temperature of the cheese should be about 45°F. The temperature of the examining room should not be less than 60°F.

The explanation of terms (very slight, slight, etc.) used in the tables is the best the industry has. The terms are subject to individual interpretation and are not precise, but no analytical methods are available for routine use to provide objective values for measurement of cheese flavors. USDA has developed a kit of plastic tiles simulating body and texture characteristics of Cheddar cheese to promote standardized grading. Official USDA cheese graders are trained and must be certified.

Conclusions

The milk producer can do a great deal to assure production of high-quality cheese by shipping high-quality milk to the cheese manufacturing plant. Production of high-quality milk can be achieved by following these recommended practices:

1. Keep cows clean by providing ample bedding and maintaining a well-drained cow yard/feeding area.
2. Thoroughly clean and dry udders and teats before milking. Clipping the udder makes this cleaning easier.
3. Clean and sanitize milking equipment after **each** milking.
4. Clean and sanitize the bulk tank after **each** milk pick-up.
5. Cool milk to 40°F within 2 hours after milking is completed and **never** permit the milk temperature to get above 45°F before pick-up.
6. Withhold milk from **all four quarters** of cows treated with antibiotics whether treated by mammary infusion or intramuscular injection (follow label instructions).
7. Withhold milk from mastitic cows. Monitor the herd for somatic cell count and withhold milk from all cows that shed 500,000 or more somatic cells/ml of milk.



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