

National FFA Organization

Dairy Foods

Career Development Event

Manual



Compiled by:
Stephanie Clark, Ph.D.
Department of Food Science and Human Nutrition
Iowa State University
Ames, IA 50010

National FFA Organization Dairy Foods Career Development Event Manual

Purpose.

This manual is designed to help Agriscience Instructors/FFA Advisors and students prepare for dairy foods CDE. The manual is divided into 4 sections, with each section covering one area of the CDE.

Section	Topic	Page
1.	Milk flavor identification	3
2.	Identification of cheeses	9
3.	Problem solving (real vs. imitation)	12
4.	Written test	14
5.	Consider Food Science in college	15

Milk Flavor Identification

The ability to identify milk flavor problems at the farm or in the food industry is highly valued. Once one can identify milk off-flavors, s/he is on the way to identifying the sources and remedying the quality issues. Descriptions of the most common off flavors that may occur in milk are included on page 6. Practice is the only way to excel at identification of milk flavors.

The FFA advisor can prepare milk samples in preparation for this area of the contest using “recipes” in Table 1. The FFA advisor must experiment with adding different amounts of the contaminants to get the desired degree of flavor. A good way of doing this is to judge the milk classes at the state contest yourself and see how the officials score the milks on intensity of flavor, then adjust your samples accordingly.

Prepare milk samples in pint or quart bottles (clean and sanitize carefully) a day before your practice session. This will allow you to have better milk samples as well as a large amount of contaminated milk to use for future sessions.

The best way to evaluate milk is to temper the milk to a temperature that is a little warmer than normal drinking temperature because volatile compounds (aromas) will be released as milk is warmed.

Follow these steps consistently (for every sample) every time you evaluate milk:

1. Take a small sample (as deep as the width of index finger) in a small cup (4 oz).
2. Grasp one hand around the bottom of the cup, which will warm the milk.
3. Place your opened palm over the top of the cup, which will trap the aromas released from the milk in the headspace below your hand.
4. Swirl the milk for about 4 turns.
5. Lift your opened palm and immediately sniff the milk aroma in the headspace

under your palm.

6. If you smell an off-aroma, mark that on your scorecard.
7. Take a big enough sip of the milk to allow it to fill your mouth but not puff your cheeks out.
8. Expectorate the sample into the same cup (assuming you won't use it again).
9. Notice any taste, aroma, or mouth-feel of the sample, which can tell you about its quality.
10. Mark down any quality defect that you notice.

At the regional contests in Iowa, the score card will look like that in Figure 5.

In the national contest, students will have to not only identify flavors, but also must include an Intensity Score for each sample (Table 2). Scores range from 1-10 on a quality basis; a score of 10 has no defect, 8-10 = good, 5-7 = fair, 2-4 = poor, 1 = unacceptable. The scores in Table 2 are suggested scores for the three intensities of flavor, however, intermediate scores can be used. It is a good idea to have the student learn the suggested scores for the contest.

Scoring

Example #1 (see Figure 1)

If #2 sample of milk has no defects, the contestant should put an "x" in the column for sample number 2 where it meets the row for no defect and put the score for intensity of flavor in the box for contestant scores. (The "o" indicates the official's selection.)

The contestant evaluated the milk correctly and put an "x" in the box for no defects, thus s/he would earn a score of "0" in the row for grade on defects (defects are valued at 2 points).

If you (the official) gave the sample an official score of 10, since it had no defects, but your student put a score of 8, you would then give him/her a score of 2 for grade difference (official score - contestant score = grade difference). In the dairy foods contest the high individual is the student with the lowest total score, therefore, the

lower the student score the better.

Example #2 (see Figure 1)

The #1 sample of milk had a strong bitter taste. The contestant thought the sample had a feed taste and put an "x" in the column for sample number 1 where it meets the row for feed and scored the sample for intensity of flavor a 6. You (the official) gave the sample an official score of 2 for bitter.

The contestant didn't identify the defect so his/her score for grade on defects would be 2. The contestant score was 6 with an official score of 2 so the grade difference score would be 4.

In these two examples the student gained 8 points. Remember, in the dairy foods contest the high individual is the student with the lowest total score.

Table 1. Recipes for production of samples for milk flavor identification.

<i>Number</i>	<i>Flavor</i>	<i>Description/Recipes/Notes</i>
Control (no defect)	Fresh milk (paperboard)	All samples today were made from whole milk (paperboard) unless indicated (plastic will be oxidized).
1	Feed	Add 3-4 Tbs "alfalfa tea" (pour boiling water over alfalfa and steep 5 min.) to 1 quart within 12 hr of tasting.
2	Acid/Sour	1 - 2 Tbs mL cultured buttermilk added to 1 quart is plenty.
3	Fruity/ Fermented	Just 1 Tbs V8 Splash Tropical juice added to 1 quart milk is enough.
4	Bitter	Bitter milk can be made with 1 tsp of a 0.25% quinine sulfate solution or a 0.25% caffeine solution.
5	Flat/Watery	AE 1% fat milk (paperboard) will taste watered down compared to whole milk (even though no water is added to it).
6	Malty	Add 1-2 tsp malted milk powder to 1 cup of milk that has been warmed in a microwave for 20 seconds and mix with clean spoon until smooth (no lumps). Pour mixture back to original quart.
7	Rancid	Add 1/4 cup grated Romano cheese to 1 cup of milk and refrigerate over night. Filter cheese out of milk (coffee filter) and combine rancid milk with original milk.
8	Light Oxidized	Buy milk in any plastic or glass container. Alternatively, add a cleaned and sanitized penny to milk, then filter out the penny before serving to students if you want to make metal-oxidized.

9	Garlic/Onion	Just 1-2 drops of garlic or onion juice will suffice to make a strong garlic/onion off flavor. Otherwise, chop some garlic, add it to a cup of milk, let sit 4 hours, filter the milk, then combine with a about a quart of normal milk.
10	Salty	For salty alone use up to 1/8 tsp salt.
11	Salty/Bitter	Salt substitute (KCl) is bitter and salty (use just 1/8 tsp).
12	Foreign	Anything that should not be in milk (but not above) is foreign: 1) add 1/4 tsp iodine sanitizer to 1 quart of milk within 6 hr of tasting; 2) add 1/2 tsp of dilute bleach solution (1 cap/gallon water); 3) add 1/4 tsp sugar (1/8 tsp if aspartame, splenda). Be creative!
8	Unclean	Mix any of the above samples together (combine) for a dirty sensation in the mouth, which may also result in an unpleasant aftertaste.

Table 2. INTENSITY SCORES for off flavors in milk.

Off Flavor	Scores		
	S	D	P
Acid	3	1	-
Bitter	5	3	1
Feed	9	8	5
Flat/watery	9	8	7
Foreign	5	3	1
Garlic/Onion	5	3	1
Malty	5	3	1
Oxidized	6	4	1
Rancid	4	1	-
Salty	8	6	4
Unclean	3	1	-

s - slight d - definite p - pronounced where a dash is entered, a product with that intensity is unsalable

Figure 1. Example score sheet partially filled out by student in national contest.

Defects	Sample Number										Total Grades	
	1	2	3	4	5	6	7	8	9	10		
Contestants score	6	8										
Official Score	2	10										
Grade Difference	4	2										6
Grade on Defects	2	0										2

1. Bitter	o
2. Feed	x
3. Flat-watery	
4. Foreign	
5. Garlic/Onion	
6. High Acid	
7. Malty	
8. Metallic/Oxidized	
9. Rancid	
10. Salty	
11. Unclean	
12. No defect	xo

COMMON OFF FLAVORS IN MILK

ABSORBED: **Barny--**

The odor/taste of a poorly maintained barn is transmitted to milk by cows inhaling air laden with volatile compounds characteristic of a barnyard. Ventilation is important for high quality milk.

Cowy--

An unpleasant medicinal odor and/or chemical aftertaste results from an accumulation of ketone bodies in the milk; a sign of physiological malfunction in cows (acetonemia/ketosis).

Feed--

Aromatic compounds in feed are transmitted to milk. Time between feeding and milking should be greater 30 minutes.

Garlic/Onion--

The same concepts hold as for the feed defect, above. The flavor derives from wild onions.

BACTERIAL: **Acid/Sour--**

Acid is a basic taste and may be experienced as a tingling sensation on the sides of the tongue. Sour may include an associated aromatic component. Lactic acid bacteria convert lactose to lactic acid at warm temperatures. Immediate cooling below 4.4°C/40°F will minimize development. Pasteurization kills lactic acid bacteria, but will not improve the flavor of milk if the defect is already present. This defect is uncommon since refrigeration and pasteurization are regularly used.

Bitter/Unclean--

Bitter is a basic taste and yields a somewhat numbing sensation on the back of the tongue. Psychrotrophic bacteria (grow at 7°C/45°F) may cause bitterness, especially during extended storage. Bitterness results from protein degradation (proteolysis) to bitter peptides and amino acids. Weeds in cows' diet may also impart bitterness.

Fruity/Fermented--

The fruity/fermented aroma may be like apples, sauerkraut, pineapples, strawberries... The defect results from growth of psychrotrophic bacteria (e.g. *Pseudomonas fragi*), production of ethanol, and enzymatic action upon lipids during extended storage.

Malty--

The malty aroma resembles Grape Nuts® cereal. The flavor may be associated with acid taste. The defect likely results from contact with improperly sanitized equipment during production and/or temperature abuse. (Growth of *Lactococcus lactis* ssp. *Maltigenes* is enhanced at 18°C/65°F.)

CHEMICAL:

Cooked--

A somewhat nutty, custard-like aroma and sweet taste may be notable in cooked milk. This is not a serious defect, and it is quite common. The defect results from heating milk above standard pasteurization temperatures. Sulfide compounds may arise with excessive heating (ultra-high temperature pasteurization), imparting a smell reminiscent of burned hair or feathers.

Oxidized, Light Induced--

Milk oxidized by light may smell mildly like cooked cabbage, burnt hair, wet cardboard, or wet paper. Sunlight/UV light exposure leads to breakdown of sulfur-containing proteins or lipid oxidation (autoxidation). This is a common defect today, particularly sold in glass and clear plastic milk containers.

Oxidized, Metal Induced--

Oxidation of unsaturated fatty acids occurs after contact with copper or other metals and some types of feeds. Aldehydes and ketones are formed. The sensation dries your tongue and is reminiscent of light oxidized but with an aroma/flavor of a copper penny.

Rancid (hydrolytic)--

The rancid aroma may resemble Parmesan, Romano, or Blue cheese, and the flavor lingers. Rancidity results from hydrolysis of fatty acids by the enzyme lipase. Aromatic free fatty acids include butyric, caproic, caprylic, and capric acids. Lipase is inactivated by pasteurization. However, the surface area of fat globules are increased by homogenization. Therefore, homogenization of raw milk without pasteurization or contamination of pasteurized milk with raw milk may lead to rancidity. Overly rapid cooling or excessive agitation before pasteurization can also yield rancidity (This may also be considered bacterial since bacterial lipases may hydrolyze fatty acids.)

Salty--

Salty is a basic taste experienced on the front and sides of the tongue. The defect may be present in the milk of cows with mastitis or in late lactation. This defect is rare in milk because most milk is pooled.

DELINQUENCY:

Flat--

Flat milk lacks creamy aroma or full-bodied flavor. This defect results from contamination of milk with water.

Foreign--

The foreign term is used when milk had an odor or flavor not associated with milk (depends on causative agent). The defect may result from contamination of milk with chemical sanitizers, detergents, medications, etc.

Identification of cheeses

The contestant will be asked to identify 10 samples of cheese and mark his/her answers with an "x" in the appropriate box on the card (Figure 2). For each incorrect answer the contestant has two points added to their score.

The only way to prepare for this aspect of the contest is to taste a variety of cheeses that are included in the contest. Descriptions of the cheeses are included on page 9 to assist you in differentiating the cheeses.

Scoring

As an aid to a better understanding of the scoring method used, two samples are scored on the card in Figure 2. An x indicates contestant's mark; o indicates official's mark.

The panelist gained 2 points (not desired) due to a mistaken identity.

Figure 1. Scorecard used for the identification of cheeses.

	Varieties	1	2	3	4	5	6	7	8	9	10
Identification of Cheeses	Grade on Identification	2	0								2
	1. Blue										
	2. Brick										
	3. Brie/Camembert										
	4. Cheddar (mild)		o								
(Incorrect Identification 2 points each)	5. Cheddar (sharp)		x								
	6. Colby										
	7. Cream/Neufchatel										
	8. Edam/Gouda										
	9. Monterey (Jack)										
	10. Mozzarella/Pizza			xo							
	11. Munster										
	12. Processed American										
	13. Provolone										
	14. Swiss										

The following list of cheeses and their descriptions may help you prepare for the cheese identification contest:

Blue: The body and texture is semisoft, pasty, and sometimes crumbly. Flavor pronounced. White interior and is marbled or streaked with blue veins of mold. It has a tangy, peppery flavor. Do not taste if you can visually identify this cheese.

Brick: The body and texture is semisoft, to medium firm, elastic and has numerous small mechanical openings. Softer than Cheddar cheese. It has a mildly pungent and sweet taste. Light yellow or creamy yellow in color.

Brie: The body and texture is soft and smooth when ripened. Has a creamy yellow interior with an edible thin, brown white crust. It has a mild to pungent flavor.

Mild

Cheddar: The body and texture is smooth and firm with small mechanical openings. The color is light yellow to orange. Distinct nutty (toasted peanuts) aroma and flavor. Some varieties are white in color.

Sharp

Cheddar: The body and texture is smooth and waxy with some mechanical openings. Cheddar is white to medium-yellow orange. Sharp nut-like flavor to a peppery somewhat sour flavor in very sharp cheddar.

Colby: The body and texture is softer and more open than cheddar cheese. It is characterized by numerous irregular shaped openings. White to medium-yellow orange. Flavor is milder and mellower taste than Cheddar.

Cream: This soft unripened, non-aged variety has a mild, bland, slightly acid flavor. The body and texture is very soft and smooth. White to light cream color.

Edam

Gouda: The body and texture is semisoft to firm or mealy. Creamy yellow or medium-yellow orange interior and may or may not have a red wax covering, Cannonball or oval shaped. They have a mellow, nut like flavor and may exhibit a salty after taste.

Monterey

Jack: Contains more moisture and is softer than colby. The body and texture is soft to semisoft and has small openings evenly dispersed through out the

cheese. White to light cream in color. It has a mild to mellow flavor.

Mozzarella: "Pizza cheese" which has a semisoft body and texture that is slightly plastic. Creamy white color. Mozzarella is unripened, not aged and has a mild delicate flavor.

Muenster: The body and texture is semisoft and has small openings throughout the cheese. Muenster has a creamy white interior with a yellow-orange-tan surface. It also has a mild to mellow flavor with a slight limburger odor since the cheese is traditionally surface-ripened.

Processed

American: The body and texture is semisoft and smooth. Color ranges from light to medium yellow. It is made from a blend of other cheeses and generally has a waxy appearance and sweet to bland taste.

Provolone: A light creamy interior with a light brown (if smoked) or golden yellow surface. Provolone's texture is similar to Mozzarella, but the flavor is more sharp, often with a salty, rancid or even smoky tang. It is made in a variety of shapes including pear, bowl, and sausage. The body and texture is firm and smooth.

Swiss: The body and texture is firm and smooth with small to large round eyes (gas holes) distributed throughout the cheese. It is a unique strong, sweet, nutlike flavor and is light yellow in color. Some Swiss does not have big eyes, so you may need to taste to identify. To rest your taste buds, you do not have to taste Swiss if you can visually identify it.

**Problem-Solving:
Real vs. Imitation (Dairy vs. Non-dairy)**

The problem-solving portion of the dairy foods contest challenges team members' ability to distinguish between real and artificial dairy foods/products. Participants should use all of the senses to determine if the product is dairy or non-dairy.

The Real vs. Imitation CDE (scorecard included in Figure 3) will be conducted at the same time as the Milk Flavor Identification and the Cheese Identification (Figure 4) CDEs. You have 35 minutes total, so you must manage your time carefully to finish all sections of the contest.

The best way to practice is to eat a variety of dairy foods and pay attention to the aroma and flavor, body/texture and mouthfeel. Read food labels to see which products contain dairy ingredients. Soon you will learn to notice how the aroma, flavor, texture and mouthfeel of dairy products differ from non-dairy imitations.

Some examples include, but are not limited to:

<i>Real</i>	<i>Imitation</i>
Butter	Margarine
Whipped cream	Non-dairy whipped topping
Half & half	Coffee whitener
Various cheeses	Non-dairy cheeses
Milk	Soy or Rice milk
Ranch salad dressing	Mayonnaise
Cheese crackers	
Milk chocolate	

Figure 3.

IDENTIFICATION OF REAL OR IMITATION DAIRY PRODUCTS

Contestant Name _____

Score___ /50_

Contestant Number _____

Chapter Name _____

Identify the sample and if it is a Real or Imitation Dairy Product (or dairy ingredient) by clearly marking (X) the correct box.

SAMPLE NUMBER	Is it?	
	REAL	IMITATION
1		
2		
3		
4		
5		

5 points for each correct response (leaving the correct space empty is a correct response).

Figure 4. CHEESE IDENTIFICATION Score Card

Contestant Name _____ Score _____ /100
 Contestant Number _____
 Chapter Name _____

Directions: Mark an "X" in the box opposite the cheese variety observed.

TYPE:	SAMPLE NUMBER									
	1	2	3	4	5	6	7	8	9	10
Blue										
Brick										
Brie/Camembert										
Cheddar (mild)										
Cheddar (sharp)										
Colby										
Cream/Neufchatel										
Gouda/Edam										
Monterey Jack										
Mozzarella										
Muenster										
American										
Provolone										
Swiss										

5 points for each correct response in a column.

Figure 5. MILK FLAVOR IDENTIFICATION Score Card

Contestant Name _____

Score ____ /100

Contestant Number _____

Chapter Name _____

INSTRUCTIONS: Evaluate the milk in the coded containers. Pour a small amount into a sampling cup for tasting. Identify the defect by placing a X in the box.

Defects	1	2	3	4	5	6	7	8	9	10
Acid										
Bitter										
Feed										
Flat/Watery										
Foreign										
Garlic/Onion										
Malty										
Oxidized										
Rancid										
Salty										
No Defect										

5 points for each correct response in a column.

Dairy Products Written Test

The written test is designed to evaluate your general knowledge about dairy products. Questions may be pulled from dairy books and trade publications as well as from previous national contest examinations. The best way to prepare for this test is to read about dairy foods in dairy books and trade publications. There is some information about dairy products on the internet, but you need to be selective (focus on .gov and .edu websites) because there is a lot of misleading information out there.

The regional test in Iowa (Calmar) contains 40 multiple-choice questions and you have 35 minutes to complete the test. The national test contains 50 multiple-choice questions and you have 35 minutes to complete the test.

Some example questions are included below (answers are in bold):

1. Made by removal of about 60% of milk's water, _____ milk must contain at least 6.5% milk fat at least 23% total milk solids by weight.
 - a. Nonfat dry
 - b. Cultured
 - c. Sweetened condensed
 - d. Evaporated**
2. Class I milk commands the highest price in the market and includes _____.
 - a. Dry milk and butter
 - b. Cultured products
 - c. Fluid milk products**
 - d. Cheese products
3. According to the Food and Nutrition Board of the National Academy of Sciences, all people need at least _____ mg of calcium per day.
 - a. 100
 - b. 500
 - c. 1,000**
 - d. 5,000
4. For every 100 pounds (cwt) of milk marketed, _____ cents are assessed for dairy promotion and research programs as authorized by the check-off legislation.
 - a. 10**
 - b. 15
 - c. 20

- d. 25
5. About _____ of the calcium available in the food supply is provided by milk and milk products.
- 25
 - 55
 - 75**
 - 85
6. New Zealand produces approximately _____ percent of the world's milk.
- 2**
 - 8
 - 20
 - 28
7. A CMT test that forms a strong gel that tends to adhere to the paddle and forms a distinct central peak would have leukocyte count of _____ cells/mL.
- Below 200,000
 - 250,000-5,000,000
 - 400,000 - 3,000,000
 - Over 5,000,000**
8. This off-flavor in milk results from breakdown of fats. The aroma resembles butyric acid or a male goaty and leaves a "soapy" flavor in the mouth.
- Rancid (hydrolytic)**
 - Oxidized (oxidative)
 - Acid/Sour
 - Malty
9. This off-flavor in milk results from breakdown of fats into free radicals. A "papery" or "cardboard" flavor is noted in the mouth.
- Rancid (hydrolytic)
 - Oxidized (oxidative)**
 - Acid/Sour
 - Malty
10. This off-flavor in milk results from fermentation of lactose at warm temperatures if milk is not properly cooled/refrigerated prior to pasteurization.
- Rancid (hydrolytic)
 - Oxidized (oxidative)
 - Acid/Sour**
 - Malty
11. To effectively sanitize a teat and maintain milk quality, how long must a teat prep be left on the teat to be effective?
- 20 seconds
 - 30 seconds**

- c. 45 seconds
 - d. 1 minute
12. Photoperiod, or supplemental lighting has been shown to improve milk production. To be effective, how long should cows be in the dark?
- a. **6 to 8 hours**
 - b. 10 to 12 hours
 - c. 14 to 16 hours
 - d. 18 to 20 hours

Do you enjoy the Dairy Foods CDE?

Do you love food, science, and being creative...?

Consider a major in Food Science in college!

What is Food Science?

The study of the food properties, including factors that affect flavor, nutrition, shelf-life and safety. The Department of Food Science and Human Nutrition at ISU offers five undergraduate majors, three bachelors/masters combined programs, and four minors. Undergraduate students in any of these majors have the opportunity to participate in learning communities, study abroad, research with faculty, service learning, summer internships, and club activities.

Extracurricular activities that help prepare you for Food Science:

- FFA
- 4-H
- AgScience programs
- Key Club
- Debate Team
- Team building and leadership programs
- Home Economics or Culinary

What kinds of jobs do our graduates go into?

- Food Product Development
- Quality Control/Quality Assurance

Sensory Analysis
Consultant
Business Management
Technical or Laboratory
Academic (technician, instructor or professor)
Food Production (food/beverage processor)
Sales and/or Marketing
Government Inspection or Food Safety Officer
Manufacturer/supplier (ingredients, packaging, or equipment)

For more information about Food Science at Iowa State University, see our website:
<http://www.fshn.hs.iastate.edu/>

For more information about Food Science in general, see the Institute of Food Technologists website: <http://www.ift.org/cms/?pid=1000023>