Using Sensory Analysis to Understand Your Product: Defining Flavor of Cheeses

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A matter of taste

- Ultimate goal for any application – ingredient or finished product
- Flavor impacts customer preference
- Flavor never goes out of style!
The bottom line

- Competitive, global and expanding market
- What are the keys to success?
  - Make what people want to buy
  - Make what people want to eat
- Deliver target flavors to customers
More than marketing

• Deliver target flavors
• To do this we need to:
  • Understand the consumer
  • Understand our product
• Sensory analysis is required
Defining flavor: provides the platform

- Enhanced product understanding
  - Influence of processing
  - Influence of aging
  - Comparisons with competitors
  - Can be linked with flavor chemistry to identify flavor sources
  - Can be linked with consumer liking
The Basic Cheese Lexicon

Basic Tastes:
- umami
- cooked
- whey
- diacetyl
- milkfat
- brothy
- sulfur
- fruity
- catty
- FFA
- nutty
- cowy
- salty
- sweet
- sour

Aromatics:
Some key questions

• How does ripening influence Cheddar cheese flavor?
• Are there regional differences in Cheddar cheese flavor?
• Are there international differences in Cheddar cheese flavor?
• Does milk pasteurization impact flavor?
• What about other cheeses?
Setting the Stage: Cheddar cheese flavor

Step 1

**MILK** —> **Fresh Cheddar Curd**

**Manufacture Steps**
- Milk type, quality and heat treatment
- Starter culture acidification
- Coagulation with rennet
- Dehydration (cutting, cooking, salting, pressing)
- Time: up to 24 h

**Flavor profile:** Simple, Salty and sour taste, low milky, whey and butty flavors

**Texture profile:** firm, elastic, no breakdown when chewed
Setting the Stage: Cheddar cheese flavor

Step 2

Fresh Cheddar Curd → Cheddar Cheese

Ripening: biochemical cascade
- glycolysis
- proteolysis
- lipolysis
Time: months - years

**Flavor profile:** very complex, wide array of flavors and intensities

**Texture profile:** Brittle/fracturable, breakdown in mouth
1. Influence of ripening

• Age does matter
• Flavor profile develops with ripening
  • “Aged” flavors appear
  • “Young” flavors decrease
• Flavor differences are more pronounced
• Dependent on the stage set in Step 1
Influence of ripening

Young milky flavors Predominate
Influence of Ripening

Aged flavors predominate
2. Are there regional differences in U.S. Cheddar cheeses?

• 20 production facilities manufacturing year-round
  • 4 Northeast
  • 7 Midwest
  • 7 Northwest
  • 2 California

• Triplicate 18 kg blocks (< 1 mo) from 3 different vats provided three times per year for two years

• Blocks aged at 7C
Cheddar cheese production facilities
Cheddar cheeses aged for 6 months

- Sulfur
- Brothy
- Nutty
- Fruity
- Umami
- Sweet
- Salty
- Sour
- Bitter
- Whey
- Milkfat
- Cooked
- Diacetyl
- FFA
- Feed
Cheddar cheeses aged for 6 months

- Stirred
- Milled
- Brothy
- Sulfur
- Nutty
- Fruity
- Umami
- Catty
- Feed
- Bitter
- Sour
- Whey
- Milkfat
- Cooked
- Diacetyl
- Salty
- Sweet

(P1 43%)

(P2 28%)
Cheddar cheeses aged for 12 months
Conclusions

• Some regional effects exist, specifically for NE and NW cheeses
• Differences in aged U.S. Cheddar cheese flavor are most strongly influenced by individual processing facility practices
• Flavor is specific to facility not region of manufacture
3. Are there international differences?
Fluid milk flavor varies.....

Flavor of milk from pasture-fed cows is different from that of TMR-fed cows. More grassy flavors in pasture-fed milk will influence cheese flavor.
Cheddar cheese flavor from different countries

U.S. PERSPECTIVE

NZ2
NZ3
NZ4
IR4
IR3
IR2
IR1

(P1 63 %)

US1
US2
US3
US4

(P2 20%)
Cheddar cheese flavor from different countries
Sensory profiles of aged domestic and international Cheddar cheeses
Sensory profiles of aged domestic and international Cheddar cheeses

Irish and UK cheeses
Cheese flavors

• Wide variety of flavor profiles across all cheeses but......
  • International Cheddars differentiated by sweet taste, caramelized, grassy, and barny flavors
  • Domestic Cheddars characterized by higher sulfur and brothy notes
4. The role of pasteurization

• Several reasons to pasteurize
• Does it impact flavor when everything else is optimal?
The role of pasteurization

• Physical/chemical effects
  • Many microorganisms inactivated
  • Some milk enzymes inactivated
  • Flavors formed from heat treatment

• Does it impact cheese flavor?
  • Yes and no
Sensory profiles of raw and pasteurized milk

- Intensity

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<th>Taste</th>
<th>Raw</th>
<th>Pasteurized</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Aromatic</td>
<td>2.5</td>
<td>1.5</td>
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<tr>
<td>Cooked/milky</td>
<td>2.0</td>
<td>1.0</td>
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<tr>
<td>Fruity</td>
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<tr>
<td>Serummy</td>
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</tr>
<tr>
<td>Sweet taste</td>
<td>2.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Cheeses

• Slight but distinct differences in flavor at 2 weeks
• Volatile compounds consistently distinct
• Faster flavor development in raw milk cheese compared to pasteurized milk
• Consistent fruity/phenolic note in raw milk cheeses
Flavor development of raw and pasteurized milk cheeses from the same milk

Intensity

4 months ripening

8 months ripening

sulfur
brothy
fruity
nutty

raw - 4  pasteurized - 4  raw - 8  pasteurized - 8
Flavor effects

• Small but distinct effects
  • Very low intensities of fruity/phenolic flavors in raw milk cheeses
  • Faster flavor development in raw milk cheese

• Not the driving or sole source of distinct or desirable Cheddar flavors
5. Consumer perception of Gouda cheeses
Trained panel profiles of Gouda flavor and texture

![Diagram showing trained panel profiles of Gouda flavor and texture.](image)

- H. Firmness
- Fracture
- Firmness
- H. Springiness
- Recovery
- Breakdown
- Cohesiveness
- Adhesiveness
- Smoothness
- Mouthcoating
- Sulfur
- Whey
- Sr. Aromatic
- Bitter
- Diacetyl
- Sour
- Grass
- Fructo
- Milkfat
- Fruity
- Malty/Nutty
- Brothy
- Sulfur
- Sour
- Sweet
- Salty
- Umami
- Bitter
- Cowy/Barny
- Mothball
- Cooked

Increasing age
Trained panel profiles of Gouda flavor and texture
Consumer liking of Goudas

N= 150 U.S. cheese consumers
Consumer preference map of Gouda cheeses

Three distinct consumer clusters

• Aged Goudas with intense caramel, nutty and brothy flavors and hard, brittle texture are preferred by one group of consumers

• Best liked Gouda by all consumers is mild with a smooth elastic texture and milky, buttery and whey flavors

• U.S. Goudas fall in this category (mild/medium) and are equally appealing to consumers
So what influences cheese flavor?

Cheese flavor is a combination of many factors that all contribute to final cheese flavor:

• Animal feed
• Milk quality
• Heat trt
• Cheesemake conditions
• Cooling and ripening conditions
Conclusions

• A defined sensory language can be linked with products and consumer to provide
  • Increased product understanding
  • Sources of flavors and flavor variability
  • Insights into the consumer
• Sensory lexicons which define dairy flavors provide the keys to research and marketing
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LEARN HOW FLAVOR RULES

csu.edu/sensory