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Swiss Cheese Consortium Project Report

Various Authors

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WESTERN DAIRY CENTER

Researching the Dairy Industry’s Future

Swiss Cheese Consortium

Project Report

Brewster, Ohio
June 26, 1997
Western Dairy Center
Swiss Cheese Consortium
Project Report
June, 26, 1997

ANALYTICAL

The following chemical analyses we performed on cheese samples submitted by members of the Swiss Cheese Consortium. Where available, samples of cheese with normal eye development and samples exhibiting cracks and splits were submitted and analyzed. Graphic representation of the resulting data is included in this report.

The purpose of the analytical portion of the project is to survey several samples of Swiss cheeses with and without the slit defect. A broad range of analyses were performed to determine if any chemical attributes were common among the defective cheeses.

Proximate Analysis (Robert Fife, Utah State University)
- moisture
- pH (Mike Harris, Cache Valley Dairy)
- fat
- protein in cheese
- free amino acids

Minerals (Robert Fife, Utah State University)
- calcium
- sodium
- potassium
- phosphorus
- magnesium

Texture (Robert Fife, Utah State University)
- hardness cycle 1 - maximum load to compress sample in cycle one
- hardness cycle 2 - maximum load to compress sample in cycle two
- springiness - compression distance in cycle two
- gumminess - cohesiveness times hardness cycle 1
- cohesiveness - total work done in cycle 1 divided by total work done in cycle 2
- chewiness - gumminess times springiness
Lactic Acid (Jeff Broadbent, Utah State University)
- D-lactate
- L-lactate

Lactose (Jeff Broadbent, Utah State University)

Lipase Activity (Bart Weimer, Utah State University)

Aminopeptidase Activity (Bart Weimer, Utah State University)

Capillary Electrophoresis (Bart Weimer, Marie Strickland, Utah State University)
Swiss Cheese: Calcium

Percentage (%)

Company

Swiss Cheese: Calcium

Percentage (%)

Company
Swiss Cheese: Sodium

Company

mg/Kg
Swiss Cheese: Potassium

Percentage (%)

A  A  B  B  C  C  D  D  E  F  F

Swiss Cheese: Potassium

Percentage (%)

B  B  C  C  F  A  A  D  E  F  D

Company
Swiss Cheese: Hardness Cycle 1

Company
Swiss Cheese: Hardness Cycle 2

Load (g) x 100

Company
Swiss Cheese: Cor. of Gumminess

Swiss Cheese: Cor. of Gumminess

Company
Swiss Cheese: Cohesiveness

Company
Swiss Cheese: Correlation of Cohesiveness

Company

F E D F C A D C B A B
Swiss Cheese: Chewiness

Company
L-Lactic Acid

g L-lactate/100g cheese (%)

Company
SENSORY

Members of the consortium submitted Swiss cheese samples for sensory analysis. All samples were graded and grouped by flavor type. All samples were analyzed by "electronic nose" by Dr. James Harper, at Ohio State University. A representative sample from each group was used in consumer taste panels at the following locations.

1. Ithaca, New York (John Horn. Cornell University)
2. St. Paul, Minnesota (Zata Vickers, University of Minnesota)
3. Logan, Utah (Charlotte Brennand, Utah State University)
4. San Luis Obispo, California (Cal-Poly University)

Two panels were run at Utah State University, one with adults and one with 10-11 year old children. Graphic representation of the resulting data is included in this report.

Flavor preference by location
Flavor preference by sample
Overall flavor preference by sample
New York, 158

Minnesota, 158

Utah Adult, 158

Utah Child, 158

California, 158

Flavor Score

Flavor Score

Flavor Score

Flavor Score
New York, 332

Minnesota, 332

Utah Adult, 332

Utah Child, 332

California, 332
New York, 680

Minnesota, 680

Utah Adult, 680

Utah Child, 680

California, 680
Combined, 127

Combined, 158

Combined, 332

Combined, 494

Combined, 680

Combined, 923
Combined, 127 flavor score

Combined, 158 flavor score

Combined, 332 flavor score

Combined, 494 flavor score

Combined, 680 flavor score

Combined, 923 flavor score

1 = like, 2 = neutral, 3 = dislike
New York
How often do you eat Swiss Cheese?

1 = 4 + times/month
2 = 1-3 times/month
3 = 1-2 times/month
4 = rarely or never

New York
If you don't eat Swiss cheese, why

1 = cost
2 = don't like flavor
3 = not available at home
4 = avoid high fat content of cheese
5 = other

New York
If you eat Swiss cheese, check the more common use

1 = alone or with crackers
2 = in sandwiches
3 = in cooked dishes
4 = other
Minnesota
How often do you eat Swiss cheese?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>16/99 = 16.2%</td>
<td>27/99 = 27.3%</td>
<td>34/99 = 34.4%</td>
<td>10/99 = 10.1%</td>
</tr>
</tbody>
</table>

1 = 4 or more times/month
2 = 2-3 times per/month
3 = 1-2 times/month
4 = rarely

Minnesota
If you don't eat Swiss cheese, why?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

1 = cost
2 = don't like flavor
3 = not available at home
4 = avoid high fat content of cheese
5 = other
Utah, child
How often do you eat Swiss cheese?

1. 4+ times/month
2. 2-3 times/month
3. 1-2 times/month
4. Rarely or never

Frequency
Utah, adult
How often do you eat Swiss cheese?

1=4+ times /month
2=2-3 times /er month
3=1-2 times per month
4=rarely or never
California

How often do you eat Swiss Cheese

1=4 or more times/month
2=1-3 times/month
3=1-2 times/month
4=rarely of never
<table>
<thead>
<tr>
<th></th>
<th>127</th>
<th>158</th>
<th>332</th>
<th>494</th>
<th>680</th>
<th>923</th>
</tr>
</thead>
<tbody>
<tr>
<td>texture is too grainy, but taste is good</td>
<td>great</td>
<td>taste is very bland</td>
<td>bland</td>
<td>cheese is chewy</td>
<td>texture is grainy</td>
<td></td>
</tr>
<tr>
<td>kind of sharp</td>
<td>good blend of sharpness and blandness</td>
<td>bland</td>
<td>between 494 &amp; 127 on sharpness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gross flavor, makes me feel a little sick</td>
<td>the texture was good but it was not such a great flavor</td>
<td>pretty good but it is also oily</td>
<td>seems a little oily with a little strange texture</td>
<td>it's alright</td>
<td>good, I like it this texture</td>
<td></td>
</tr>
<tr>
<td>I liked this one because it had the best flavor</td>
<td></td>
<td>soft</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>horrible</td>
<td></td>
<td>soft, bland</td>
<td>flavors, almost chalky</td>
<td>dry, crumbly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good flavor</td>
<td>bland</td>
<td>bland (very)</td>
<td>good</td>
<td>still too bland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bad</td>
<td></td>
<td>good</td>
<td></td>
<td>dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grainy texture, kind of oily</td>
<td>too sweet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>too strong</td>
<td>bland, sticky</td>
<td>didn't taste like anything</td>
<td>sweet, yuck!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flavor less strong</td>
<td>Not enough flavor</td>
<td>not enough flavor</td>
<td>off taste</td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flavor less strong</td>
<td>flavor less strong</td>
<td>taste was stronger</td>
<td>not much flavor</td>
<td>flavor less strong</td>
<td>taste was very strong and gross</td>
<td></td>
</tr>
<tr>
<td>yummy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry, off flavor</td>
<td>soft texture, very mild flavor</td>
<td>no flavor, texture</td>
<td>pretty good</td>
<td>rubbery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry, off flavor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment</td>
<td>1st Taste</td>
<td>2nd Taste</td>
<td>Overall Flavor</td>
<td>Flavor Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------</td>
<td>-----------</td>
<td>----------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tastes the best</td>
<td>good</td>
<td>no taste</td>
<td>good</td>
<td>very good, good flavor, smooth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>very good</td>
<td>good</td>
<td>good</td>
<td>very good</td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>too strong</td>
<td>rubbery</td>
<td>rubbery</td>
<td>no taste</td>
<td>flavor, strange, almost dry, texture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not much flavor</td>
<td>nice sharp flavor</td>
<td>not much flavor</td>
<td>not much flavor</td>
<td>cheese sat out too long, began to sweat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sharp smell</td>
<td>smooth</td>
<td>no real flavor</td>
<td>waxie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>very odd</td>
<td>bland</td>
<td>bland</td>
<td>tasteless</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat dry</td>
<td>not very sharp</td>
<td>rubbery</td>
<td>very bland</td>
<td>bland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>terrible! too strong, bad texture</td>
<td>slightly bitter</td>
<td>not very strong</td>
<td>great texture</td>
<td>too oily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>very similar to 923</td>
<td>texture was too soft</td>
<td>not enough flavor, tastes like wax</td>
<td>no taste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>slightly off flavor</td>
<td>soft texture</td>
<td>seemed weak, kind of rubbery</td>
<td>buttery aftertaste, rubbery, good odor</td>
<td>that's how I like it, good flavor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry</td>
<td>good</td>
<td>not good at all</td>
<td>no taste to it at all</td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry flavor</td>
<td>dry</td>
<td>bland</td>
<td>bland</td>
<td>yuck!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hard</td>
<td>soft, a bit salty</td>
<td>no flavor, bland</td>
<td>bland</td>
<td>funny taste, sour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>it was too hard</td>
<td>good!</td>
<td>was very good!</td>
<td>didn't have flavor</td>
<td>wasn't like at all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>texture was too grainy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>good flavor</td>
<td>no flavor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A little dry, more flavor than 494, a little salty, best flavor</td>
<td>a little like whey</td>
<td>more flavor than 494, best texture, 2nd best flavor</td>
<td>not much flavor</td>
<td>a little like whey</td>
<td>a little like whey</td>
<td></td>
</tr>
<tr>
<td>the smell is bad to me</td>
<td>little more flavor, not bad</td>
<td>still not much flavor</td>
<td>no flavor</td>
<td>a little firmer than I like</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bad after taste</td>
<td></td>
<td></td>
<td>no flavor</td>
<td>little more flavor, not bad</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>it is sour and yucky</td>
<td>this is better</td>
<td>ok</td>
<td>it is bitter and yucky</td>
<td>yuck!</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>---------</td>
<td>------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>yum!</td>
<td>it is sour and yucky</td>
<td>this is better</td>
<td>ok</td>
<td>it is bitter and yucky</td>
<td>yuck!</td>
<td></td>
</tr>
<tr>
<td>texture was strange</td>
<td>no taste</td>
<td>poor flavor, sticky</td>
<td>bland</td>
<td>lingering unclear flavor</td>
<td>ok, but weak on flavor</td>
<td></td>
</tr>
<tr>
<td>strong taste</td>
<td>soft texture</td>
<td>texture was slimy</td>
<td>no taste, soggy</td>
<td>fair texture but little taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tastes a little salty</td>
<td>smooth-good</td>
<td>a little too soft, but like the taste</td>
<td>doesn't really taste</td>
<td>kind of dried out texture but still ok</td>
<td></td>
<td></td>
</tr>
<tr>
<td>doesn't taste good</td>
<td>taste ok</td>
<td>too mushy, taste bad</td>
<td>ok</td>
<td>ok</td>
<td>not good</td>
<td></td>
</tr>
<tr>
<td>a bit aged!!</td>
<td>acidic aftertaste</td>
<td>eyes properly formed, proper strength, low acid aged!!</td>
<td>too milk and bland!</td>
<td>no mouthfeel, i.e., after taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good</td>
<td>good</td>
<td>no taste</td>
<td>bland, stretchy</td>
<td>very, very strong weird taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lots of flavor, texture is smooth</td>
<td>smoother than the first smoother taste</td>
<td>smooth texture, I did not like flavor</td>
<td>hardly any flavor</td>
<td>not as much flavor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not good, quite bad</td>
<td>very good</td>
<td>ok</td>
<td>no flavor</td>
<td>I did not like the flavor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I did not like this</td>
<td>very good</td>
<td>ok</td>
<td>ok</td>
<td>too strong</td>
<td></td>
<td></td>
</tr>
<tr>
<td>too dry</td>
<td>getting better</td>
<td>the aftertaste is too strong</td>
<td>doesn't taste like Swiss</td>
<td>this was worse than 158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bites you back</td>
<td>very good</td>
<td>gross, too mushy</td>
<td>little flavor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>very good!</td>
<td>not much taste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>not much taste</td>
<td>not much taste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>too soft</td>
<td>too soft, bland</td>
<td>yucky, not very good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>too much like 158</td>
<td>not bad, but bland</td>
<td>no flavor</td>
<td>very tasty</td>
<td>not at all appealing</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>I might buy this one</td>
<td>this didn’t taste good at all</td>
<td>very flavorful</td>
<td>this one was ok</td>
<td>tastes wonderful, I would buy it</td>
<td>I don’t like this one!</td>
<td></td>
</tr>
<tr>
<td></td>
<td>good, combination of flavor and texture</td>
<td>good texture but no flavor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bad flavor, strong</td>
<td>good</td>
<td>no flavor</td>
<td>good, not strong</td>
<td>bland</td>
<td>too hard</td>
<td></td>
</tr>
<tr>
<td>really strong</td>
<td></td>
<td></td>
<td>was kind of bland</td>
<td>texture was dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>very good flavor, strong</td>
<td>nice flavor</td>
<td>flavor ok, slightly soft</td>
<td>no flavor too soft</td>
<td>nice flavor, good bite</td>
<td>off flavor</td>
<td></td>
</tr>
<tr>
<td>I don’t like Swiss</td>
<td>good, sharp flavor</td>
<td>bland</td>
<td>very smooth texture, mild flavor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It has a horrible after taste</td>
<td></td>
<td>ugh!</td>
<td>kind of bland</td>
<td>it has hardly any flavor until you’ve chewed it for a while.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>too mild</td>
<td>not much taste</td>
<td>bland sort of</td>
<td>taste ok</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>rubbery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>