Consumers Can Detect Light-Induced Flavor in Milk

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ABSTRACT
Two-thousand consumers were surveyed at three county fairs in Vermont to determine their taste preference for samples of good milk and milk with light-induced flavor defect. More than 73% of the people surveyed preferred the good milk sample. More females than males could taste a difference between the two samples, had a preference for one sample, and preferred the good sample. The data suggest strongly that it is in the best interests of the dairy industry to prevent light-induced flavor of milk.

In the United States approximately 93% of the dairy products sold are purchased at stores. The dairy cases are attractive and well-lighted with fluorescent tubes. Milk is packaged predominantly in opaque, plastic-coated paper or translucent, blow-molded plastic containers. Dairy scientists have known for many years that when light comes in contact with milk is initiates a series of reactions that leads to a flavor defect, sometimes called light-induced flavor. Researchers have found more recently that a large percentage of milk packaged in blow-molded containers and purchased at stores has a light-induced flavor. This could be one reason why consumers are drinking less pasteurized-homogenized milk.

Light-induced flavor in milk has been studied by many researchers and several good review articles have been written (1,3,5,6). However, data have not been published on consumer reactions to this flavor defect.

Last summer R. P. Rogers accepted the assignment for the Vermont Department of Agriculture to organize an exhibit for several County Fairs. As part of the Dairy Division exhibit, we discussed the possibility of testing consumer reactions to a milk sample with light-induced flavor. Administrators in both The State Department of Agriculture and University of Vermont Agricultural Experiment Station agreed that this was an excellent opportunity to test if consumers considered a light-induced flavor disagreeable.

MATERIALS AND METHODS

Milk
Pasteurized-homogenized milk was obtained from the University Dairy Plant. It was pasteurized at 75.5 °C for 15 sec, homogenized at 60°C and 2,500 psi, and packaged in 6-gallon bag-in-box dispensers.

Preparation of samples
Blow-molded, translucent, plastic gallon containers were filled with pasteurized-homogenized milk from a 6-gallon bag-in-box dispenser, capped, placed in a walk-in cooler at 4.5 °C, and subjected to 400 footcandles of fluorescent light for 48 h. For several years, milk samples with light-induced flavor have been prepared the same way for state and regional Future Farmers of America judging contests. The 8-ft double-tube lamp (Sylvania F96T12-CW tubes) was mounted on its side and the samples placed next to the lamp. Light-intensity was measured with a General Electric color- and angle-corrected light meter with a 10x multiplier attachment. Control samples in 6-gallon bag-in-box containers were taken from the same milk supply and stored in the same walk-in cooler as the light-treated samples.

On the morning of each fair a 6-gallon bag-in-box dispenser was filled with light-treated milk from six blow-molded, plastic gallon containers. At the fair, the two 6-gallon bag-in-box dispensers of milk samples (control and light-treated) were placed in a milk dispenser cabinet that was cooled to 4.5 °C. An experienced flavor judge tasted the two samples at each fair and did not find a flavor defect in the control samples but did find a typical and definite light-induced flavor in the samples treated under fluorescent light.

Design of survey
Responses from a heterogeneous population were collected at three county fairs that represented the southern (Rutland), central (Chittenden), and northern (Orleans) geographical areas of Vermont. Data were collected over a 4-day period, 1 day at the northern and southern fairs and 2 days at the central fair. (The central fair was only 5 miles from the university.)

The dispenser cabinet was placed at the front of the Department of Agriculture exhibit. A poster was attached to the dispenser cabinet where it could be read easily by people as they passed the booth. Printed on the poster was "Free Milk" and "Please Taste These Two Milks.

Approximately 1 ounce of milk sample was poured into coded, 3½-ounce Dixie cups. A random letter and two numbers were marked on the bottom of each cup. Sample codes were changed each day.

Ideas for a simple set of questions were found in a publication by Larmond (4). Consumers who volunteered to taste the two milk samples were asked the following questions: (a) Can you taste a difference between the two samples? (b) If you can taste a difference, do you prefer one sample over the other? (c) If you prefer a sample, which sample do you prefer?
you prefer? As part of the Department of Agriculture exhibit, free
samples of Vermont cheeses were given away. This promotion helped
draw people to the booths.

When a consumer tasted the samples and responded to the
questions, data were also recorded for sex and age. Consumers were
divided into two groups, young and adult, based upon personal
observation and judgment of the age of the tasters by the investigators
manning the fair booths. Young people were classified as college age
and younger, while adults were over 25 years of age. These subjective
categories were selected because they were easiest to judge by
observation. Data were statistically analyzed by examination of
difference in proportions (2).

RESULTS AND DISCUSSION

Two thousand willing respondents for this survey were
composed of a heterogeneous population from three
geographical areas of Vermont. We know only their sex,
approximate age, and the fact that they drink milk.

Responses to the questions asked each consumer are
summarized in Table 1. A comparison of values for each
fair show some variation, but the trend is the same for
the three fairs. For consumers who could taste a differ­
ence between the two samples of milk and had a prefer­
ence, more than three-fourths of them preferred the good
milk sample. These data suggest strongly that it is in
the best interests of the dairy industry to prevent
mass production of milk is data tabulated for milk judging contests. And
it must be kept in mind that the contestants in these
contests were trained to identify flavor defect. In the
Milk Quality and Dairy Foods contest at the Eastern
States Exposition in 1975 and 1976, only 29% of the
Future Farmers of America contestants from the
Northeastern States identified correctly the milk sample
that had a definite, light-induced flavor. (Milk samples
with light-induced flavor were prepared the same way as
those samples for this fair survey.) But all the contestants
indicated that the light-induced samples had a flavor
defect. These facts indicate that even trained individuals
can have difficulty identifying the milk flavor defect
correctly, but they do know when a flavor defect exists.
They are obviously trained to be more discriminating
than the general consumer.

Of the 2,000 people surveyed, 73.2% preferred the
good sample. These data suggest strongly that it is in
the best interests of the dairy industry to prevent
light-induced flavor of milk.

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Table 1. Mean percent responses of consumers at Vermont fairs
who tasted good milk and milk with light-induced flavor defect

<table>
<thead>
<tr>
<th>Answers to questions</th>
<th>Southb</th>
<th>Centralc</th>
<th>Northd</th>
<th>All fairsd</th>
</tr>
</thead>
<tbody>
<tr>
<td>No difference</td>
<td>8.4</td>
<td>4.0</td>
<td>5.2</td>
<td>4.8</td>
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<tr>
<td>No preference</td>
<td>5.0</td>
<td>4.0</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Preferred light-induced</td>
<td>20.7</td>
<td>19.6</td>
<td>22.2</td>
<td>20.3</td>
</tr>
<tr>
<td>Preferred good</td>
<td>65.9</td>
<td>75.4</td>
<td>71.3</td>
<td>73.2</td>
</tr>
</tbody>
</table>

aThree questions were asked to each consumer: (a) Can you taste a
difference between the 2 samples? (b) If you can taste a difference, do
you prefer one sample over the other? and (c) If you prefer a sample, which
sample do you prefer?

b945 consumer responses.
c1,332 consumer responses.
d369 consumer responses.

d2,000 consumer responses.