A Field Topic

Effect of Disk Weight and Filtration Vacuum Level on Flow Time of Yellow Staining Milk Through Lintine Disks

D. K. O’TOOLE

N.S.W. Department of Agriculture, Agricultural Research Centre, Wollongbar, New South Wales, 2480 Australia

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ABSTRACT

About a pint (550 ml) of yellow staining milk was filtered using vacuum levels of 76 and 381 mm of Hg through Lintine sediment disks which weighed 65, 90, or 112 mg. The time taken for the milk to flow through the disks was longer with heavier disks and the lower vacuum level. The fat retained on the disks and the concentration of \( \beta \)-carotene in that fat increased with disk weight.

The filtration sediment test is used to assess the cleanliness of a milk supply (1,11). Sometimes during routine factory testing, milk samples pass through the disks slowly, or not at all, because of clogging (2,4,6). More often a yellow stain-like material, called yellow stain in New South Wales, is retained from the milk (3,4). The stain covers all of the disk filtering area and differs in appearance from the flecks and clots that are occasionally seen. Milk showing either or both these characteristics is considered abnormal (1,2,5).

Chumney and Kleyn (2) compared milk flow time through sediment disks as measured with the Milk Quality Gauge (MQG), and the Wisconsin Mastitis Test (WMT) score. They found that there was not a good correlation between the two. However, milk-flow time showed a better correlation with the presence of yellow stain on the disks. Explanations offered by them for the poor relationship between flow time and WMT score, were decrease in WMT score as the milk aged, and high sediment content.

However, disk weight, vacuum level used to draw the sample through the disks, and milk flow time influence the intensity of the yellow color left on disks (9). I report here an experiment showing the effect of disk weight and vacuum level on rate of milk flow through the disks. Because retained fat and \( \beta \)-carotene are known to be the source of the yellow stain (7,10), some data on fat retention and \( \beta \)-carotene concentrations in relation to disk weight are also presented.

MATERIALS AND METHODS

The milk used was from one lot of clean farm-refrigerated bulk milk which left a yellow stain on sediment disks. Lintine \( \circledast \) sediment disks (Filter Fabrics, Chicago) were sorted and weighed (9). The disks used (Table 1) were within ±1 mg of the stated weight. Since the diameter of the disks is constant, the weight is a measure of the thickness of the disks.

The sediment test was done as follows. Milk was divided into 550-ml portions in plastic bottles and heated to 40 °C in a waterbath. Disks were placed in a hand sediment gun, orifice diameter 19.5 mm, set up over a Buchner flask attached to a vacuum source and fitted with a vacuum gauge. The contents of a plastic bottle were poured into the sediment gun and vacuum applied either at 76 or 381 mm of Hg according to the gauge. The time of flow was measured from the moment vacuum was applied until the last milk passed through the disk. The funnel of the sediment gun was released and excess liquid removed from the disk by applying full available vacuum. Time of flow for each disk weight/vacuum level combination was determined in duplicate. The disks were dried overnight on the bench and the fat and \( \beta \)-carotene determined as previously described (10).

**TABLE 1. Effect of disk weight and vacuum level on flow rate, on the retention of fat, and on \( \beta \)-carotene concentration in the fat on the disk during filtration of 550 ml of yellow-staining milk.**

<table>
<thead>
<tr>
<th>Weight of disks (mg)</th>
<th>Fat on disk a</th>
<th>( \beta )-carotene on disks b</th>
<th>Time of flow (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(mg)</td>
<td>(mg/g fat)</td>
<td>76 mm Hg</td>
</tr>
<tr>
<td>65</td>
<td>4.4</td>
<td>17.4</td>
<td>31</td>
</tr>
<tr>
<td>90</td>
<td>6.2</td>
<td>20.9</td>
<td>16</td>
</tr>
<tr>
<td>112</td>
<td>28.7</td>
<td>49.6</td>
<td>NT</td>
</tr>
</tbody>
</table>

a Results from disks using 381 mm of Hg vacuum. The \( \beta \)-carotene concentration in the milk was 9.4 \( \mu \)g/g fat.

b Not tested.

RESULTS AND DISCUSSION

Results in Table 1 show that the time of flow varied with weight of the disks, i.e., thickness of disks, and vacuum level. Flow time was longer with the heavier disks, and with a lower vacuum level. The yellow stain became more intense as flow time increased.

Results show that small differences in disk weight critically affect flow time of yellow staining milk through Lintine disks. Differences in the vacuum level, i.e., the pressure applied across the disk to force the milk through, are also critical.

The increase in fat content on disks as disk weight increased would explain the clogging of disks and its subsequent effect on flow time. Retention of fat globules on Lintine disks is the cause of yellow stain (7,10). When yellow-stained disks are examined microscopically, small fat globules are seen spread over the fibers of the disks (8).

Results of analyses for \( \beta \)-carotene indicate that there is a selective build-up of this substance on the disks. The concentration in the milk
was 9.4 µg/g of fat, but on the disks it was as high as 49.6 µg/g of fat. This is in agreement with a previous report (10).

If flow time through Lintine disks is to be used to assess whether a milk supply is abnormal, the variation in disk thickness, and the pressure differential used to force the milk through the disks, must be carefully controlled. It has been shown (9) that disks can vary in weight from 58 to 195 mg, indicating a wide variation in thickness. Thus randomly selected disks would be of no use for measuring flow time. I suggest that a satisfactory pressure differential would be that equivalent to 381 mm of Hg vacuum, i.e., a vacuum level of 15 inches of Hg.

Report of the 3-A Sanitary Standards Symbol
Administrative Council

There were two meetings of the Council held during this year; one took place in Denver, Colorado on October 25 & 26, 1977, and the second was held on June 6, 1978 in Chicago, Illinois.

Present members of the Council are: Dr. W. S. Clark, Jr., Chairman; Mr. P. K. Girton, Vice-Chairman; Mr. E. O. Wright, Secretary-Treasurer; Mr. P. J. Dolan, Asst. Secretary-Treasurer; Mr. D. G. Colony, Dr. H. V. Atherton, Mr. O. M. Osten, Mr. D. D. Fry.

The Council is now up to full strength. Dr. Henry Atherton was approved by the I.A.M.F. E.S. to replace Dr. K. G. Weckel on the Council. Dr. George Muck resigned because of his work load in other areas and David Fry was appointed by D.I.C. to replace him on the Council.

Several non-compliance reports were considered by the Council during the year. The Council publishes a list of holders of 3-A Symbol Council authorizations every six months in the Journal of Food Protection. There were several new applications received and processed during the past year.

Following are a few of the Council's activities during the year:

1. Reflecting a procedures change, the Council, when listing an authorization on the published list, will show the manufacturer of that equipment if other than the company holding the authorization.
2. Guidance has been given to the Poultry and Egg Institute of America in their consideration of developing an E-3-A Symbol Council for their organization.
3. The Trustees have reviewed the booklet "Sanitation in Dairy Equipment" and have recommended changes to be made in revising the publication for distribution this fall.
4. A booth in cooperation with D.F.I.S.A. was planned and will be on exhibit at Anaheim, California during Food and Dairy Expo '78, November 5-9, 1978.
5. There were 172 Symbol holders a year ago and there are 173 this year. Each year we lose a few but we always end up with approximately 170 holders of the 3-A Symbol.

During the past year standards for centrifugal and positive rotary pumps for milk and milk products (No. 02-07) were amended and incorporated into a new No. 02-08. A new standard for pressure and level sensing devices was published and distributed (No. 37-00).

The Symbol Council wishes to thank all sanitarians, fieldmen, dairy processors, equipment manufacturers, and the 3-A Standards Committees for their cooperation and assistance in making this a successful year.

Respectfully submitted,
Earl O. Wright
Secretary-Treasurer
3-A Sanitary Standards
Administrative Council

O'TOOLE

ACKNOWLEDGMENT

I thank Mr. D. J. Firth for his assistance with chemical analyses.

REFERENCES


Coming Events

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Aug. 13-17--WORKSHOP ON EDUCATIVE PROCESSES IN FOOD MICROBIOLOGY. Sponsored by the Joint American Society for Microbiology/Institute for Food Technologists Committee on Food Microbiology Education. Quadra Resort, Hill City, MN. Contact: E. A. Zottola, Dept. of Food Science and Nutrition, 1334 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Aug. 29-31--FOURTH INTERNATIONAL IUPAC SYMPOSIUM ON MYCOTOXINS AND PHYCOTOXINS. Co-sponsored by World Health Organization and Swiss Society for Analytical and Applied Chemistry. Lausanne, Switzerland. For participation and poster presentation, contact: Prof. P. Krogh, Dept. of Veterinary Microbiology, School of Veterinary Medicine, Purdue University, West Lafayette, IN 47907 or Prof. D. Reymond, IUPAC, Case postale 88, 1814 La Tour de Peilz, Switzerland.

Sept. 18-20--WESTPACK. Convention Center, Anaheim, CA.