Tomato-Flavored Beverage and Onion-Flavored Chip Dip
Made from Cottage Cheese Whey

B. J. DEMOTT, A. B. HELMS, and O. G. SANDERS

Department of Food Technology and Science
The University of Tennessee, Knoxville, Tennessee 37901

(Received for publication January 28, 1977)

ABSTRACT

Whey from cottage cheese made by the short-set culture method was used to make tomato-flavored drink by addition of 6% dried tomato-spice flavoring material, and was found by 10 panelists to have a pleasing taste. Heat treatment of cottage cheese whey at 93 to 99 C resulted in a precipitate containing over 9% total solids. This precipitate was further concentrated by centrifugation or filtration through a cotton cloth. The precipitates were blended with xanthan gum and onion-flavoring to produce a chip dip.

Use of whey for food has been the object of much research effort recently. Emphasis on this subject has been largely due to pollution abatement regulations, increased cheese production, economic conditions, and future needs for food to ease a world food shortage.

Cottage cheese whey has been used as a beverage base (2,3) and in other food products, primarily bakery items (5). Cottage cheese whey, depending on the manufacturing process, generally contains about 0.8% protein which can be concentrated by heat treatment. The degree of concentration depends upon the type of heat treatment applied. USDA workers (6) have recovered about 60% of the whey protein by exposing cottage cheese whey to temperatures near or slightly above boiling, and further purifying the protein for use in macaroni. Webb and Whittier (7) describe several methods for recovering the whey protein.

The present study was undertaken to examine the use of tomato flavored whey as a beverage; to develop a simple procedure applicable for protein recovery from cottage cheese whey; and to investigate use of the protein precipitate in the manufacture of a chip dip.

MATERIALS AND METHODS

Cottage cheese whey used in these studies was from two different cheese manufacturers, both of whom used the short-set culture method for making cottage cheese. The xanthan gum used was provided by the Kelco Co., Chicago, and sold under the trade name, Keltrol. The spices used were supplied by the Baltimore Spice Co., Baltimore, Maryland.

Tomato-flavored beverage

Five and four-tenths percent or 6% dried tomato spice flavoring material was added to cottage cheese whey taken from the vat at draining time. The mixture was allowed to remain at 4 C overnight and examined by 10 adults who were asked to state if the product had possibilities for further developmental work, and if it were different from tomato juice which was supplied for comparison. The objective was to determine the compatibility of the flavors.

Protein precipitation and collection procedure

To determine the quantity of precipitate resulting from various heat treatments, 25 ml of cottage cheese whey in graduated test tubes were immersed in hot water at the temperatures shown in Table 1. After allowing the treated samples to remain undisturbed for 2 h, tubes were gently rotated to encourage curd particles clinging to the tube walls to precipitate. The volume of the precipitate was recorded and the supernatant fluid was discarded. The precipitate was poured from one container to another, and a homogenous sample taken for analysis. The total solids concentration of the precipitate resulting from each heat treatment was determined by drying at 60 C in a vacuum oven overnight at 380 torr (15" vacuum).

To determine whether the precipitate might be concentrated by centrifugal force, the precipitates resulting from heat treatment of whey were centrifuged for 40 min at room temperature in a 8-inch radius Babcock centrifuge (40 x g), and the resulting sediment analyzed.

Whey was treated in a steam cabinet for various lengths of time, and the precipitate removed by allowing the fluid to pass through a cotton hackaback (huck) towel of about 130 thread count. The precipitate was then analyzed for moisture content and examined organoleptically for mealiness using the terms: none, slight, and pronounced. Eight adults, four males and four females, were supplied with samples in 12-ounce cartons and made their judgements in the laboratory.

Preparation of chip dip

Cottage cheese whey treated in a steam cabinet for 40 min was allowed to cool and the supernatant fluid was discarded. After storage at 4 C for 2 days, the precipitate containing 10.88% solids was heated to 60 C, and to one portion, as it was being stirred slowly in a blender, was added 1.2% xanthan gum, and to a second portion 1.4% of the gum. The speed of the blender was increased until thickening occurred, at which point 3% of onion dip seasoning was added. The finished products containing 13.07 and 13.30% solids were then stored at 4 C and examined the following 2 days by a taste panel.

Organoleptic evaluation

The panel consisted of 28 untrained men and women from food-oriented departments and their judgements were made in a room especially designed for sensory evaluation. The triangular-degree of difference test was used (1). Samples were supplied in small paper cups. Three samples, two of which were duplicates, were offered to the panel members who scored all samples on a nine point hedonic scale where a score of one was equal to "like extremely" and a score of nine was "dislike extremely." On Day 1, the sample containing 1.4% xanthan...
gum was offered in duplicate and on Day 2 the sample containing 1.2% xanthan gum was offered in duplicate. The panel members were not told that any two samples were identical. The second day potato chips were available as a carrier inasmuch as this is the manner in which most dip is consumed. The data were analyzed statistically by analysis of variance and Duncan’s multiple range test.

Precipitates concentrated to 16.18 and 14.87% total solids by means of filtration through a towel were standardized to 14.75% total solids by the addition of cottage cheese whey. Xanthan gum and onion flavoring were added to these mixtures which were then stirred in a blender until thickening occurred. After storage at 4 C overnight, samples were examined for flavor and texture by a panel of seven judges.

### RESULTS AND DISCUSSION

The tomato-flavored whey drink and two commercial brands of canned tomato juice were tasted informally in the laboratory by 10 untrained panelists. The samples were tested for difference and overall acceptability. In general, the panelists could distinguish a difference between tomato juice and the tomato-flavored whey, and found the latter to have a pleasing flavor and good texture. Among the suggestions for improvements received from panel members was that of adding a red color to the whey drink. Consequently, artificial food coloring (McCormick and Co., Inc., Baltimore) was later added to the whey drink to make it resemble more closely the color of tomato juice. The whey drink contained 12.0% solids and the two brands of tomato juice contained 5.9 and 5.2% solids. The quoted price of the tomato flavoring was $1.25 per pound. Assuming the whey at no cost, the ingredient cost was about 16 cents per 1000 grams of beverage.

The quantity of precipitate obtained from cottage cheese whey heated at temperatures ranging from 77 to 99 C for periods ranging from 10 to 40 min is shown in Table 1. The duration of the heat treatment had less effect than the temperature at which it was heated. Heat treatment of 93 and 99 C gave approximately the same quantity of precipitate at all heat durations studied. The total solids concentration of the gravity-separated precipitate from different heat treatments, shown in Table 2, indicated that duration is of minor importance as related to the solids concentrations.

Data in Table 3 show that centrifugation (40 × g) of the gravity-separated precipitate will reduce its volume to less than one-fourth its original, triple the protein concentration, and increase the solids concentration over 50%. The heat treatment given to the whey caused about 73% of the protein to precipitate by gravity. The concentration by centrifugal force resulted in the precipitation of 52% of the protein in the original whey.

### TABLE 1. Influence of temperature and duration of heat treatment upon volume of precipitate from cottage cheese whey

<table>
<thead>
<tr>
<th>Trial</th>
<th>Temperature (°C)</th>
<th>Temperature</th>
<th>Duration of heat treatment, min</th>
<th>(mL ppt/100 mL whey)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>88</td>
<td>16a</td>
<td>10</td>
<td>2.18</td>
</tr>
<tr>
<td>II</td>
<td>77</td>
<td>0</td>
<td>15</td>
<td>2.18</td>
</tr>
<tr>
<td>III</td>
<td>88</td>
<td>16</td>
<td>20</td>
<td>2.18</td>
</tr>
<tr>
<td>IV</td>
<td>99</td>
<td>22</td>
<td>40</td>
<td>2.18</td>
</tr>
</tbody>
</table>

### TABLE 2. Influence of heat treatment of cottage cheese whey upon the concentration of the gravity-separated precipitate

<table>
<thead>
<tr>
<th>Treatment (°C)</th>
<th>Minutes</th>
<th>Total solids (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>40</td>
<td>9.78</td>
</tr>
<tr>
<td>93</td>
<td>10</td>
<td>9.77</td>
</tr>
<tr>
<td>93</td>
<td>40</td>
<td>9.82</td>
</tr>
<tr>
<td>99</td>
<td>10</td>
<td>9.26</td>
</tr>
<tr>
<td>99</td>
<td>40</td>
<td>9.31</td>
</tr>
</tbody>
</table>

### TABLE 3. Influence of centrifugation (40 × g) upon composition of precipitate obtained by heat treating cottage cheese whey at 99 C for 40 minutes

<table>
<thead>
<tr>
<th>Volume (mL)</th>
<th>Original precipitate</th>
<th>Precipitate after centrifugation</th>
</tr>
</thead>
<tbody>
<tr>
<td>181.5a</td>
<td>9.62b</td>
<td>43.5</td>
</tr>
<tr>
<td>Total solids (%)</td>
<td>24.4c</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 4. Influence of duration of heat treatment at 99 C of cottage cheese whey upon texture of resulting precipitate

<table>
<thead>
<tr>
<th>Length of time in steam bath (min)</th>
<th>Average texture score*</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.8a</td>
</tr>
<tr>
<td>10</td>
<td>1.9a</td>
</tr>
<tr>
<td>15</td>
<td>1.5a</td>
</tr>
<tr>
<td>20</td>
<td>2.6b</td>
</tr>
<tr>
<td>25</td>
<td>2.3b</td>
</tr>
<tr>
<td>30</td>
<td>2.5b</td>
</tr>
<tr>
<td>35</td>
<td>2.3bc</td>
</tr>
<tr>
<td>40</td>
<td>1.9ac</td>
</tr>
</tbody>
</table>

Scoring system: 1 = No mealiness, 2 = Slight mealiness, 3 = Pronounced mealiness.

*Eight judges. Numbers followed by the same letter are not statistically different (P > .05).
amount to use was in the range of 1.2 to 1.4%. The chip
taste panel scores, shown in Table 5, indicate that
the amount of gum (1.2% or 1.4%) probably is not an
important factor, inasmuch as the scores were not
significantly different. The general acceptability as
described by the panel was between the "neither like nor
dislike" and "like slightly". The criticisms were
primarily related to a weak body.
Cottage cheese whey precipitates which were concen-
trated by filtration through a towel were made into a dip
in a manner similar to that used on the gravity-separated
precipitate. The composition and organoleptic evalua-
tion by the judges are shown in Table 6. A smaller
quantity of xanthan gum was necessary in these samples
than in the gravity-separated precipitate. The body and
texture defect most frequently noted was mealiness. The
onion flavoring appeared to improve body and texture as
well as flavor.
The results of these trials show that cottage cheese
whey can be used to make a very satisfactory
tomato-flavored drink, or the solids can be denatured by
a simple heat treatment, concentrated by centrifugation
of filtration, and used to manufacture a dip-like product
containing no fat.

### Table 5. Acceptability of a chip dip made from cottage cheese whey (average scores of 28 panelists on each sampling day)

<table>
<thead>
<tr>
<th>Sampling periods</th>
<th>Percent of xanthan gum added</th>
<th>1.4</th>
<th>1.2</th>
<th>1.4</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td>4.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.61&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Day 11</td>
<td></td>
<td>4.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.61&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Scoring system: 1 = like extremely, 2 = like very much, 3 = like
moderately, 4 = like slightly, 5 = neither like nor dislike, 6 = dislike
slightly, 7 = dislike moderately, 8 = dislike very much, 9 = dislike
extremely. Sample scores noted by the same letter within each sampling day are
not significantly different (P > .05) from each other.

### Table 6. Influence of composition of chip dip upon its texture and flavor, average of seven judges

<table>
<thead>
<tr>
<th>Sample composition</th>
<th>Moisture</th>
<th>Xanthan gum</th>
<th>Onion flavoring</th>
<th>Texture</th>
<th>Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>83.82</td>
<td>81.21</td>
<td>0.05</td>
<td>3.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Final</td>
<td>85.13</td>
<td>81.60</td>
<td>0.05</td>
<td>3.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>83.82</td>
<td>80.50</td>
<td>0.05</td>
<td>4.0</td>
<td>2.1</td>
</tr>
</tbody>
</table>

<sup>a</sup>Scoring system: 1 = like very much, 2 = like moderately, 3 = like
slightly, 4 = dislike slightly, 5 = dislike moderately, 6 = dislike very
much.

### REFERENCES
sory testing methods. ASTM Special Technical Publication No. 434.
3. Demott, B. J. 1975. Acceptability of flavored drinks made with
cottage cheese whey produced by the direct acidification process. J.
Milk Food Technol. 38:691-692.
Dept. Agric. Publication 1284.
 nomic Research Service. DS-361, p. 35-41.
N. C. Aceto. 1975. The heat coagulation of cottage cheese whey
proteins and their incorporation into macaroni. Proceedings Whey
AVI Publishing Company, Wesport, Conn.