A Research Note

Evaluating Cheese-like Emulsions from Animal Blood Proteins and Whey Solids

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ABSTRACT

Animal blood globin powder and blood plasma concentrate prepared from cattle blood, were incorporated, along with modified whey solids, hydrolyzed cereal solids, butter, cellulose gum and water into heat processed cheese-like emulsions. Globin protein in the emulsion ranged from 12.2 to 16.4% while the plasma protein range was from 1.8 to 6.2%. The ingredients were blended while the pH was being raised to pH 6.8 and the mixtures were processed at 116 C for 15 min. Texture profile parameters of hardness, springiness and cohesiveness were evaluated. Increased globin protein concentration decreased springiness and cohesiveness. Hardness apparently was maximal at an approximate globin/plasma protein ratio of 5:1.

Two important reservoirs of protein which are not fully used at present are blood from slaughtered animals and whey from cheese manufacture. While many people in this country have an aversion to eating foods containing blood, progress is being made in producing animal blood protein isolates suitable for incorporation into foods (5,7,10). Even more progress has been made in recovering and utilizing cheese whey (8,9) especially in the forms of whey solids and whey proteins.

A variety of cheese analogs have been investigated based on hydrolyzed cereal solids, protein and vegetables fat (3). Use of whey solids in cheese-like products has been sparsely investigated (1,11).

The purpose of this research was to produce and evaluate cheese-like products formulated from animal blood protein/whey blends.

MATERIALS AND METHODS

Whole beef blood collected during slaughter with salt and citrate to prevent hemolysis and coagulation was separated into plasma and cell fractions with a cream separator. Plasma was desalted and concentrated to 17% protein by circulation through cellulose hollow fibers (Bio-Rad Laboratories, Richmond, CA).

After removal of heme from hemoglobin by acidified acetone, the precipitated globin hydrochloride was collected on a Buchner funnel, dissolved in water, precipitated at pH 6.8, washed at that pH to remove residual acetone, redissolved at low pH and spray-dried. The resulting white fluffy powder contained 85% protein (by Kjeldahl), 6% moisture (vacuum oven) and 8% ash. The blood proteins were mixed with modified whey solids (ENR-RO™, Stauffer Chemical Co.), hydrolyzed cereal solids (MOR-REX™, CPC International), and other ingredients at low blender speed while the pH was adjusted to 6.8 with 12 N NaOH, then high speed blended for 10 min. The emulsions (100 g) were poured into 250-ml beakers, heat processed (116 C, 15 min) in a pressure cooker to set the structure and to develop color. Compositional data are in Table 1.

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Globin protein</td>
<td>12.2-17.0</td>
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<tr>
<td>Plasma proteins</td>
<td>2.8-6.2</td>
</tr>
<tr>
<td>ENR-RO™ whey solids</td>
<td>5.0</td>
</tr>
<tr>
<td>MOR-REX™ hydrolyzed cereal solids</td>
<td>8.5</td>
</tr>
<tr>
<td>Butter</td>
<td>8.5</td>
</tr>
<tr>
<td>Cellulose gum</td>
<td>0.8</td>
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</tbody>
</table>

Composition of processed products

| Protein | 14.5-18.1 |
| Fat     | 5.9-7.5   |
| Ash     | 4.1-6.7   |
| Moisture| 54.7-64.3 |

The General Foods Texture Profile Analysis (2) was done using the Instron Universal Testing Instrument Model TM-M, Instron Corp., Canton, MA) on replicated 1 cm x 1 cm cylindrical portions of the finished product. Shama and Sherman (6) have demonstrated a high correlation between sensory panel scores for the texture parameter "hardness" of cheese and data from this instrument. The parameters of springiness and cohesiveness were also considered applicable to this type of product.

RESULTS AND DISCUSSION

It was apparent from preliminary investigations (4) that a combination of plasma and globin was necessary for the formation of cheese-like textures with heating. Emulsions formulated at high plasma levels in the absence of globin were extremely tough and rubbery while emulsions containing globin without plasma protein were more liquid. Increased levels of hydrolyzed cereal solids tended to decrease hardness while increased levels of whey solids decreased springiness and cohesiveness.

Graduated levels of globin and of plasma proteins...
were used with fixed levels of other ingredients. The effect of the ratio of globin/plasma protein on the texture of the heat processed products is presented in Fig. 1. Data presented are the means of duplicate trials. The hardness value reached a maximum at an approximate globin/plasma ratio of 5:1. Higher levels of globin in the blend drastically lowered the hardness rating. Springiness and cohesiveness values generally decreased with an increase in the globin/plasma protein ratio to greater than 4:1.

The texture of the cheese-like products did not correlate well to commercial cheese examined in the laboratory. For example, the processed emulsion formulated at 5:1 globin/plasma ratio was similar in hardness to processed cheese while the springiness was similar to cream cheese. The cohesiveness of this product was intermediate to processed and cream cheese. Interactions between globin and plasma protein with respect to moisture and texture parameters need to be investigated further before cheese-like characteristics can be predicted with confidence.

REFERENCES