EFFECT OF VARIOUS BINDERS ON SAUSAGE EMULSIONS

L. J. BRATZLER

MICHIGAN STATE UNIVERSITY

As your section chairman very well knows, this discussion should be given by a former member of this Conference, Dr. E. Harold Rongey, Swift Research Laboratories, who strived mightily in this area for completion of his Ph.D. thesis problem. All data that may be presented are the results of his efforts and should be so recognized.

The meat industry is and has been noted for using descriptive names that tend to give an impression that may lack somewhat in truthful representation. For example, California "hams", "country" sausage, and "prime" ribs of beef are just a few of the glowing terms used to lure a few ill-informed purchasers. The same misrepresentation has taken place in the sausage processing industry. Except for the holding or absorbancy of either ice or water, binders have very little function. The phosphates and perhaps sodium caseinate may be exceptions but a better descriptive term of the binders might be "extenders" or "fillers". While the institutional feeding industry does not list extended items on the menu, they are known as such in recipe formulations and preparation areas. A product that enhances the emulsifying capacity or stability of a sausage emulsification should be called a binder, while all others could very well be labeled as fillers, tap water absorbers, seasoning adjuncts, etc.

The sausage maker of today is expected to produce a superior product at a profit to his company. Any added attribute such as color stability, flavor, nutritive qualities, yield, peelability, palatability, display life, and consumer preference are much desired by the selling and advertising facets of the company. Linear programming in deciding how much and what meat ingredients can be used to an advantage has contributed to the industry but the benefits are limited by the necessity of establishing limits that are based on art and experience rather than on scientific research. It is apparent that processing conditions such as temperature, time, etc. are as important, if not more important, than small variations in ingredient variation. I am certain that Mr. Swift has indicated that normal meat ingredients properly handled have a super-abundance of binding qualities. Therefore, dried milk solids, various flours, and other fillers or extenders are not necessary to achieve the desired binding characteristic.

In order to present an idea as to the effect that various binders and meat have on the palatability and processing characteristics of bologna, I shall briefly discuss the study we undertook in cooperation with the Beltsville group. The factors studied were: % nonfat dried milk (NFDM), soya grits, high and low fat, low binding meat, and phosphates as shown in Table 1.

Twenty-five pound batches were made and formulated according to Table 2. It will be noted that ice was added on a pound for pound basis when NFDM was added. Sugar was omitted from those batches having 10% or more
NFDM because of the lactose content of this ingredient. Commercial processing procedures were employed, with various weights and data taken to evaluate differences. A paper giving more details will be published in Food Technology if and when the manuscript is made acceptable to that journal's standards.

In discussing the results, it should be kept in mind that "regular binding" was considered as being skeletal beef and pork, whereas "low binding" was the substitution of 50% pork hearts for 50% of the pork trimming component.

The major results might be discussed under the various categories that may be associated with bologna.

1. Out of cook yields, Increasing NFDM from 0 to 20% and the addition of phosphates showed that increased yields were obtained. However, significance (P < .01) was observed only in 3.5% over the control (0%). Conversely, 7 day cooler shrinkage decreased as % NFDM was increased. When different types of meat was considered, the high fat, and regular binding formulations gave a greater cooking yield.

Table 1.

Comparison I

| % - NFDM | 0 Control | 3.5 | 10 | 15 | 20 |

Comparison II

| % - NFDM | 0 Control | 3.5 | 10 |

regular binding | regular binding
low fat | low fat
high fat | high fat
low binding | low binding

Comparison III

| Phosphate (4.7 oz./100 lb. meat) |

regular binding | regular binding | regular binding | regular binding
low fat | low fat | low fat | low fat
high fat | high fat | high fat | high fat
low binding | low binding | low binding | low binding
Table 2. Formulations* of bologna, Comparison I

<table>
<thead>
<tr>
<th>Batch formulation</th>
<th>Control</th>
<th>3.5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork</td>
<td>10.0 lbs.</td>
<td>9.15</td>
<td>7.7</td>
<td>6.5</td>
<td>5.2</td>
</tr>
<tr>
<td>Beef</td>
<td>10.0 lbs.</td>
<td>9.15</td>
<td>7.7</td>
<td>6.5</td>
<td>5.2</td>
</tr>
<tr>
<td>Ice</td>
<td>5.0 lbs.</td>
<td>5.85</td>
<td>7.3</td>
<td>8.5</td>
<td>9.8</td>
</tr>
<tr>
<td>N F D M</td>
<td>---</td>
<td>0.85</td>
<td>2.3</td>
<td>3.5</td>
<td>4.8</td>
</tr>
<tr>
<td>Spice</td>
<td>45.5 g.</td>
<td>43.5</td>
<td>40.2</td>
<td>37.5</td>
<td>34.5</td>
</tr>
<tr>
<td>Sugar</td>
<td>56.7 g.</td>
<td>32.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>136.0 g.</td>
<td>130.3</td>
<td>120.4</td>
<td>112.2</td>
<td>103.4</td>
</tr>
<tr>
<td>Nitrite</td>
<td>1.4 g.</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Nitrate</td>
<td>1.4 g.</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Ascorbate</td>
<td>4.0 g.</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Beef, pork, ice and NFDM in pounds, balance in grams.

2. Chemical Composition. As expected, there was an inverse relationship between fat and moisture content. Low fat and low binding formulations produced bologna with the highest protein content. Percent fat was more affected by meat treatments and NFDM than any other component. As NFDM and meat leanness was increased, fat decreased in the final product. As to protein content, this was affected mainly by the fat present in the meats used.

5. Color. Munsell rennotations showed that increasing NFDM and fat meats decreased Value, or increased lightness in the product. Ten percent soya grits produced a yellowish cast or tinge to the product.

4. Tensile strength. Phosphates, 3.5 or 10.0% NFDM, as well as soya grits, increased this objective measurement.

5. pH. Phosphates and soya grits produced the greatest increase in pH, while increased NFDM also showed a lesser increase in this respect.

6. Flavor preference. Bologna with either 3.5 or 10% NFDM were always at least equal to or slightly preferred over the control - or all meat, product. Differences in juiciness and tenderness were not pronounced, although the higher fat formulations were considered more juicy. Incorporation of 10% soya grits produced a flavor typical of that protein product, while phosphates produced a slightly tougher product.
It had always been my impression that nothing surpassed an "all meat" bologna. We found that the optimum NFDM would range somewhere between 3.5 and 10%. Evidently, the establishment of the 3.5% limit by the MID was based on some judgment - a personal guess - a compromise or on some information that is not apparent or discoverable in the available literature. In our own State, Michigan, pork hearts or any meats other than skeletal, are not "allowed" in Grade I sausage. Without a doubt, fresh pork hearts would be preferable to some of the "reworks" or "returns" that are now used. Perhaps content regulation is more feasible than correct labeling, but maybe Senator Hart will succeed in blazing an honest labeling trail. In closing, I would like to make a plea to call a spade a spade and not refer to a filler as a binder.

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MR. SAFFLE: Thank you, Jim.

In listening to the paper and also knowing Prof. Bratzler, it sounded like he was coming through there all the time.

One of the big areas, of course, in the sausage industry is the matter of peeling performance, and it is something in which there is no information available in research literature. We became interested in this at Georgia, and when John Carpenter came down to do his Ph.D. work he was interested in peeling performance, and so together with him and one other graduate student and myself we conducted a study on peeling performance.

I think that John Carpenter will be seen around the Meat Conferences a great deal in the years to come, and I now call on John Carpenter.