Salt content in yellow cheese as result of **brining** and the effect on salt distribution and **textural properties** during cheese **ripening**

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**Introduction and purpose**

Brining in saturated NaCl-solution to reach the desired salt content is common dairy practice for Danish semi-hard yellow cheese types (Samsoe, Danbo, etc.) in order to target microbial control, cheese flavor and texture of the final product. The typical brining time is 24-28 h followed by ripening for ~7-12 weeks.

The purpose of the study is to evaluate:  
- how brining time affects texture and NaCl content of cheese  
- the development in cheese salt distribution and texture during ripening  
- the difference in cheese texture of two different chymosin types.

![Figure 1](image1.png)  
**Figure 1.** Hardness and elasticity of yellow semi-hard Danish cheese analyzed by uniaxial compression of combinations of brining time and ripening time (all cheeses are produced with bovine chymosin), n=16.

**Results**

Cheese salt content ranged from <0.15 - 1.9 g/100g when brining from 0h - 24h, respectively (Table 1).

A positive significant effect of brining time and a negative effect of ripening time on cheese hardness was seen. Reduced brining time gave highly elastic cheeses (high Hencky strain) (Figure 1).

![Figure 2](image2.png)  
**Figure 2.** Distribution of NaCl in yellow semi-hard cheese as function of brining time and ripening at edge and at center of the cheese.

![Figure 3](image3.png)  
**Figure 3.** Texture-to-salt relation in yellow semi-hard Danish cheese for ripening times of 2, 7, and 12 weeks as axial stress and Hencky strain.

A large gradient in salt concentration between edge and center in young cheese was levelled out by increasing ripening time (Figure 2).

The 'texture-to-salt' relationship correlated exponentially between cheese hardness (axial stress) and salt concentration (average r = 0.71), and linearly between compresibility (Hencky strain) and salt concentration (average r = -0.49), which became more pronounced with ripening time (Figure 3).

Different chymosin types affected the cheese texture, where camel chymosin resulted in harder cheese texture at reduced salt content compared to bovine chymosin (Table 1).

**Conclusions**

Salt distribution in brined semi-hard cheese depends on ripening time and correlates positively to cheese hardness and negatively to cheese compressibility.

Selection of chymosin type is a possible way to counterbalance textural impacts in salt-reduced semi-hard yellow cheeses.

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**Table 1.** Effect of brining time of cheese for two chymosin types on 12 week ripened yellow semi-hard Danish cheese salt content (%), cheese hardness given as stress at fracture (kPa), and cheese elasticity given as Hencky strain at fracture (-).

<table>
<thead>
<tr>
<th>Chymosin Type</th>
<th>Brining time, h</th>
<th>&lt;0.15</th>
<th>1.11</th>
<th>1.42</th>
<th>1.90</th>
<th>1.77</th>
<th>1.46</th>
<th>1.79</th>
<th>&lt;0.01</th>
</tr>
</thead>
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<tr>
<td>Bovine (CHYMAX PLUS)</td>
<td>0.0</td>
<td>1.31</td>
<td>1.25</td>
<td>1.08</td>
<td>1.33</td>
<td>1.25</td>
<td>1.05</td>
<td>&lt;0.05</td>
<td></td>
</tr>
<tr>
<td>Camel (CHYMAX 44)</td>
<td></td>
<td></td>
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**Table 2.** Effect of brining time of cheese on 12 week ripened yellow semi-hard Danish cheese salt content (%), cheese hardness given as stress at fracture (kPa), and cheese elasticity given as Hencky strain at fracture (-).

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