Quality and Yield of Chihuahua Cheese Produced from Dairy Cattle Supplemented with Enriched Apple Byproduct

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Abstract: Solid State Fermented Apple Pomace (AP-SSF) enriched with non-nitrogen protein has been studied as alternative ingredient for feeding dairy cattle. The aim of the present study was to evaluate, the effects of AP-SSF dairy cattle supplementation on yield, sensorial properties and foodborne pathogens on Chihuahua cheese. About 2 groups (treatment and control) of 10 cows were used on a Latin square design (2×2). Treatment animals were AP-SSF supplemented (5% as fed basis) in 2 periods of 20 days rotating with the control group (conventional diet). About 6 samples of milk within each period were used to elaborated Chihuahua cheese. Foodborne pathogens and sensorial properties were analyzed after 8 and 10 days of cheese elaboration, respectively. No effects were observed (p>0.05) on microbiological cultures of Salmonella sp., Streptococcus sp., Staphylococcus sp. and total coliforms after 8 days of cheese elaboration. Sensory properties were affected (p<0.05) by AP-SSF supplementation, improving preferred sample, appearance, flavor and texture also, it was better overall qualified. Results suggest that AP-SSF improve sensorial properties of Chihuahua cheese. Moreover, yield and foodborne load was within international dairy federation standards.

Key words: Apple pomace, cheese, solid state fermentation, foodborne pathogens, sensorial properties, Mexico

INTRODUCTION

Cheese origin is controversial, it is estimated that the first cheese was elaborated at 3000 AC years. Nevertheless, moxity of both milk and cheese was address until the 50 BC years. Since then cheese producers have been working on increase yield and sensorial properties of cheese and decrease risk of foodborne pathogens. The most important are Salmonella sp., Staphylococcus sp., Streptococcus sp. and total coliforms which are within the 28 principal foodborne infections and those are transmissible by milk and milk products (Tauxe, 2002). In industrialized countries, nevertheless technologic levels and food safety programs, Salmonella has been recognized one of the main lethal foodborne pathogen (Altekruse et al., 1997). With the objective of increase cheese safety researchers have been proposed the use of preservatives and bacteriostats on cheese elaboration. However, those strategies are expensive and may produce secondary effects like antibiotic resistance and in extreme cases, human hypersensitivity (Jones and Seymour, 1988). At the 20 century, research of antioxidant substances increased within this group, it is recognized the poliphennols which have been shown antimicrobial and anti-inflammatory properties (Silveira-Rodriguez et al., 2003). Poliphennols have been found in different products including apples in which its concentrations vary from 7-24 mg g⁻¹ (Lu and Foo, 1997). Increase on cheese yield has been addressed by increasing milk protein through animal feeding strategies.

As well, fat milk has been used for improvement on cheese texture and flavor (Bauman et al., 2006; Jenkins and McGuire, 2006). Apple pomace has been reported to increased fat and protein milk concentrations on dairy cattle (Anrique and Dossow, 2003). Apple pomace has been used for feeding dairy cattle. However, the low protein content of this by-product limits its use. It has been proposed that the inclusion of Non-protein Nitrogen (NPN) to solid state fermented apple pomace increased crude protein from 4-24% (Hernandez et al., 2007). Moreover, this fermentation process maintains

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818
RESULTS AND DISCUSSION

No effects (p>0.05) on yield of Chihuahua cheese were observed with the addition of AP-SSF (Fig. 1). Moreover, yield was within international parameters obtaining 1 kg of cheese per 10 L of milk (Banks, 1990; Villegas, 2004). The addition of AP-SSF was not enough to increase milk protein levels, those levels have been reported to increase cheese yield (Bauman et al., 2006; Gutierrez-Pina, 2007). Feed antioxidants are excreted within milk and significantly maintained in cheese (Pizzoferrato et al., 2007). In the present study, it was hypothesized that polyphenol level of Chihuahua cheese decrease bacteriological count of foodborne pathogens. Results shown that microbial load of Salmonella sp., Staphylococcus sp., Streptococcus sp. and total coliforms were unaffected (p>0.05) by AP-SSF (Table 1), only numerical differences were observed on the study decreasing bacterial load with the AP-SSF treatment. Moreover, foodborne pathogen ranges for both treatments were within recommendation levels of the (IDF) International Dairy Federation (ISO, 2004) (Table 1). Apple pomace-SSF improved (p<0.05) sensorial properties of Chihuahua cheese (Table 2). Nevertheless, no effects were observed with AP-SSF on percentage of fat milk. The AP-SSF enhanced appearance, flavor and texture also cheese was more selected and better overall qualified than the control group cheese. Improvement of sensorial properties can be associated with fat milk.

![Fig. 1: Effects of apple pomace-SSF on yield (50 L⁻¹ of milk) of Chihuahua cheese](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Apple pomace-SSF</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella sp.</td>
<td>17±0.3</td>
<td>19±0.6</td>
</tr>
<tr>
<td>Total coliforms</td>
<td>31±0.4</td>
<td>32±0.7</td>
</tr>
<tr>
<td>Staphylococcus sp.</td>
<td>30±0.5</td>
<td>35±0.6</td>
</tr>
<tr>
<td>Streptococcus sp.</td>
<td>17±0.1</td>
<td>24±0.8</td>
</tr>
</tbody>
</table>

No effects for any variable was observed (p>0.05)
because fat is responsible for different physic properties, production characteristics and organoleptic qualities (Bauman et al., 2006). It has been reported that sensorial properties of cheese can be modified due to fatty acid content of fat milk (Lock and Bauman, 2004). Moreover, aldehydes and ketones derived from free fatty acid metabolism are responsible for flavor and aroma cheese and an increment on free fatty acids from triglycerides modified organoleptic properties (Lucey et al., 2003) which could explain in part results of the study (Table 2).

CONCLUSION

Results suggest that AP-SSF improved sensorial properties of Chihuahua cheese. More research has to be done to assess the effect of AP-SSF on milk fatty acids.

REFERENCES


