CORRELATION of pH AND REDUCTION TIME TO SHELF LIFE OF FRESH PERANAKAN ETAWAH (PE) GOAT MILK ADDED SODIUM BICARBONATE AND “KAPUR SIRIH” (CaO)

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ABSTRACT
“Peranakan Etawah” (PE) goat milk is a high potential foodstuff, and is highly perishable. Study to maintain longer shelf life of PE goat milk was done using completely randomized design with three treatments: A (control without addition of sodium becarbonate and CaO to the milk), B (adition of CaO), C (addition of natrium becarbonate), and twelve (12) replications. Data was analysed using one way ANOVA with SPSS 13 for word, then continued with least significant different if there were any significant sdifferent. Result showed that there were a highly significant correlation between pH and reduction time to shelf life of the milk added CaO and natrium becarbonate.

Key word: goat milk, shelf life, natrium becarbonate, CaO

Introduction
Goat milk is a complete, high nutritional food with a health benefits potency. Goat milk contains almost all substances needed by the body, such as protein, fat, lactose, vitamins and other trace elements as well as very easily digested and absorbed in the gastro intestinal (GI) tract. Due to its complete nutritional food, milk become a favorable medium for microbial growth, which make it easily damaged, especially when the milk is not handled properly after milking.

Spoilage of milk can be caused by the activity and growth of microbes, insects, enzymes, chemical reactions and physical changes. Spoilage resulted from the activity and microbial growth is usually more hazardous than other damage. To prevent milk spoilage resulted from microbial contamination of milk, and extend the shelf life, it is necessary to implements any technique such as addition of preservatives. Preservatives that can be added to milk is sodium bicarbonate dam calcium carbonate (kapur sirih). Calcium carbonate is an alkaline solution and when added to fresh milk, the milk that has been experienced acidity will return to neutral or alkaline, while sodium bicarbonate, an alkaline substance, used to neutralize the excess acid.

Milk preservation research has been done, on cow's milk. Harlia (1984) reported that the addition of whiting with a concentration of 1000 ppm can maintain the shelf life of milk cows for 10.14 hours. While Susanto (1992) suggested that the addition of sodium bicarbonate into the cow's milk at a concentration of 1000 ppm can extend the shelf life of
milk 15.56 hours. Thus it would be better if there is information about the use of additives to Peranakan Etawah (PE) goat milk. This study was conducted to determine the relationship of pH and reduction time with shelf life of PE goat milk added sodium bicarbonate and calcium carbonate. The results of this study are expected to provide information about the use of sodium bicarbonate and calcium carbonate in extending the shelf life of goat milk.

**Research methods**

**Materials.** The milk used in the study was goat milk heard in Wanagiri village, District of Selemadeg, Tabanan. Sampling was weekly done. The sample was taken to the Dairy Laboratory, Faculty of Animal Husbandry, University of Udayana, for further analysis.

**Chemical.** Chemicals used were sodium bicarbonate (NaHCO₃), “kapur sirih” (CaO), alcohol 50%, sodium hydroxide (NaOH) 0.1 N, concentrated sulfuric acid (H₂SO₄), methylene blue, phenolphthalein, pH 7 buffer solution.

**Equipments.** Equipment used in this study were: test tube, Erlenmeyer, pipettes, pH meter, thermometer, water bath, oven.

**Chemical Test.**

Chemical test such as alcohol precipitation test (APT), pH and shelf life determination were done according to Standard methods for Examination of dairy products (Wehr and Frank, 2004)

**Determination of Reduction Time**

Reduction time was determined according to Standard methods for Examination of dairy products (Wehr and Frank, 2004)

**Research design**

Complete Randomized Design (CRD) with three treatments and 12 replications were implemented in this research. The treatments were: treatment A, milk without the addition of sodium bicarbonate or “kapur sirih” as control; treatment B, addition of “kapur sirih” with a concentration of 1000 ppm to milk; while treatment C was addition of sodium bicarbonate with a concentration of 1000 ppm.

Data obtained were analyzed using one-way ANOVA with The SPSS version 13 program for Windows. If there were significant differences between mean (P<0.05) Least significant different test were then conducted.
Results and discussion

pH

The average pH at the beginning of the study in milk of treatments B and C were respectively 1.52% and 2.28% higher than that of milk in treatment A (Table 1), and were significantly different (P<0.01). Differences in pH of milk from treatments A,B and C were due to addition of “kapur sirih” and Natrium becarbonate in treatments B and C which caused the acidity of milk from treatment B (added “kapur sirih”) and C (added natrium becarbonate) were lower or the pH were higher than that of milk from treatment A. On the other side the final pH of milk from treatments B and C were respectively 0.7% and 0.9% higher than that of pH of milk in treatment A and were not significantly different (P >0.05). This is because the three milk of treatments A,B and C were in spoiled condition.

Reduction Time

Average reduction time at the beginning of milk in treatments B and C were 1.87% and 1.71% longer than that of milk in treatment A and were statistically different (P<0.01). While the end of study average reduction time of milk in treatments B and C were 2.38% and 4.76% longer higher than that of milk in treatment A and were not statistically different (P>0.05). The longer reduction time of milk in treatments B and C were caused by lower number of microorganisms present in milk of treatments B and C. Corral et al. (1988) stated that, sodium becarbonate can inhibit growth of bacteria such as Escherichia coli, Lactobacillus plantarum, Staphylococcus aureus dan Pseudomonas aeruginosa. Furthermore Silhacek and Taake (2005) reported that, sodium becarbonate inhibit growth gram negative bacteria. Inhibition effect of these two salt namely sodium becarbonat and Calcium monoxide (CaO) were not due to their capability to modified the pH of the milk but caused by the hydrophobic character of both salt (Yaganza et al., 2009)

Table 1. Average pH, Reduction Time and Shelf Life of Milk Added “kapur sirih” and Natrium becarbonate.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>pH</th>
<th>Reduction Time (hour)</th>
<th>Shelf Life (hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>begining</td>
<td>end</td>
<td>begining</td>
</tr>
<tr>
<td>A</td>
<td>6.57 ± 0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.41 ± 0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.41 ± 0.04&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>B</td>
<td>6.67 ± 0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.46 ± 0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.53 ± 0.02&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>C</td>
<td>6.72 ± 0.04&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.47 ± 0.03&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.52 ± 0.02&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: Values with different superscript in the same column were significantly different
Shelf life

Average shelf life of milk added inorganic salt sodium becarbonate and calcium monoxide namely treatments B and C, were significantly higher than that of milk in treatment A (P<0.01). Milk added sodium carbonate showed longer shelf life than that of milk added calcium mono oxide (CaO), but statistically not significant (P>0.05) (Table 1). The longer shelf life shown by milk in treatments B and C were resulted from the higher pH, compared to milk in treatment A at the beginning of the study, the slower acid formation by microorganisms contaminating the milk. Slower acid formation in milk added CaO and NaHCO$_3$ were assumed due to lower bacterial number that convert lactose in milk to lactic acid since CaO and NaHCO$_3$ have characteristic of antibacterial (Silhacek and Taake, 2005; Yaganza et al., 2009).

Correlation between pH, Reduction Time and Shelf Life

There were significant positive correlation between initial pH with shelf life of milk in treatments A, B and C (P<0.01) (Table 2 and 3). It means that, the lower the pH of the milk, the shorter the shelf life the faster the milk become spoil. Spoilage of milk was determined by alcohol test. In alcohol test the milk was decided as spoil, when there were precipitate appear in milk mix with 70% alcohol (cow milk) or 50% alcohol for goat milk (Wehr and Frank, 2004).

Table 2 Correlation Coefficient of pH and Shelf Life of Peranakan Etawah (PE) Goat Milk.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>The correlation coefficient (r)</th>
<th>Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.761 **</td>
<td>YA = -1,973 + 2,512 XA</td>
</tr>
<tr>
<td>B</td>
<td>0.718**</td>
<td>YB = 10,721 + 0.856 XB</td>
</tr>
<tr>
<td>C</td>
<td>0.832**</td>
<td>YC = 12,542 + 0.782XC</td>
</tr>
</tbody>
</table>

Description: ** significance (P < 0,01)

Table 3. Correlation Coefficient of Reduction Time and Shelf Life of PE Goat Milk

<table>
<thead>
<tr>
<th>Treatment</th>
<th>The correlation coefficient (r)</th>
<th>Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.783**</td>
<td>YA = 9,685 + 0,732 XA</td>
</tr>
<tr>
<td>B</td>
<td>0.780**</td>
<td>YB = 9,543 + 1,058 XB</td>
</tr>
<tr>
<td>C</td>
<td>0.790**</td>
<td>YC = 8,236 + 1,420 XC</td>
</tr>
</tbody>
</table>

Description: ** significance (P < 0,01)

Conclusion

Statistical analysis showed that, Shelf life of PE goat milk added 1000 ppm sodium becarbonate and 1000 ppm calcium mono oxide were both more than 3 hours longer
compared to control (without addition of sodium bicarbonate and calcium mono oxide). pH of PE goat milk added 1000 ppm sodium bicarbonate and 1000 ppm calcium mono oxide were higher than that of control, while their reduction time were longer than that of control.

Positive Correlation was obtained between pH and reduction time with shelf life of PE goat milk obtained from heard at Wanagiri village, sub-district of Selemadeg, Tabanan regency, added sodium bicarbonate at a concentration of 1000 ppm and calcium mono oxide at concentration of 1000 ppm.

**Suggestion**

From the above conclusion it was suggested that sodium bicarbonate and calcium mono oxide can be used for preservation of raw goat milk, since they were inorganic salt usually used in food processing.

**Reference**


This is to certify that Ketut Suhardi has attended as presenter at the ISSAAS International Symposium and Congress 2011.


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