EXPLORING THE OPTIMISATION MODEL OF VIETNAMESE CONSUMERS FOR STERILISED MILKS

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Abstract
The objective of this study was to describe the sensory and physico-chemical properties of seven commercial strawberry sterilised milk products bought in local supermarkets and to evaluate consumer preferences for these products. We performed three types of analyses: (1) descriptive analysis, (2) physico-chemical analysis, and (3) consumer analysis. For the descriptive analysis, six trained panellists identified and evaluated 13 sensory attributes (involving taste, aroma, texture) using 7-point structured line scales. In the second analysis, the gross physico-chemical compositions of the milk products were determined for total protein, fat content, viscosity, and colour using the CIE L*a*b tristimulus method. In the third analysis, we performed a consumer analysis, in which 140 consumers from a panel were asked to evaluate the overall-liking of the samples using a 7-point hedonic scale.

The results differentiated the milk samples based on sensory attributes (e.g., pink colour, greasiness, creaminess) and physico-chemical properties (fat content and viscosity), respectively. We found that health and sensory appeal were the most important factors when choosing products and that sweetness and greasiness were the key sensory attributes driving consumer preference. Multiple factor analysis (MFA) showed that consumer preference was more correlated to sensory attributes than to physico-chemical properties. Preference mapping revealed four clusters of consumers.

Key words: dairy products, Vietnamese consumer, preferences, food choice

1. INTRODUCTION
Until recently cow milk was not easily available in the Vietnamese market and so dairy products were not part of Vietnamese food habits. It is only for the last twenty years that Vietnamese companies have been producing fresh milk. Today Vietnam has a total of 22 milk factories. Vinamilk with nine plants has a productivity equal to 1.2 billion litres per year (Dinh, 2009). Recent surveys indicate that the consumption of fresh milk and dairy products is increasing (USDA, 2007). Consumers consider dairy products as high value processed food products which also have nutritional and health benefits. Among the dairy products currently available in the market, strawberry sterilised milks are the most popular. Yet, consumer motivations for choosing this type of products are still not well understood. So the purpose of
this research was to analyse (1) the sensory attributes of strawberry sterilised milk, (2) its physico-chemical parameters, and (3) consumer preference.

2. MATERIALS AND METHODS

2.1 Stimuli

We used seven strawberry sterilised milks produced by Tetrapak technology: DutchLady, Vinamilk, Nutifoods, Daisy, Izzi, Milky, and Ancomilk. The strawberry sterilised milk samples were stored in refrigerated conditions (4 to 5°C); they were taken out of the refrigerator one hour before the experiment and maintained at room temperature (25°C). Samples were served in 30 ml white plastic cups coded with three-digit numbers.

2.2 Methods

*Descriptive test.* Six panelists (4 females and 2 males) were screened and trained under ISO 13300-1:2006 and ISO 5492, 2008 standard. During training, panelists tasted products and agreed on a list of attributes, definitions, references, and scale measurements. The training lasted for one week with one session of two hours per day. At the end of training, panellists evaluated the seven strawberry milk samples on 7-point structured line scales with one repetition. Thirteen scales were used to perform the evaluation. These scales were 1) astringent, 2) butter, 3) brown, 4) cream, 5) film, 6) greasiness, 7) oral viscosity, 8) sourness, 9) sour flavour, 10) sweetness, 11) strawberry aroma, 12) stickiness, and 13) pink. Samples were presented in a randomised balanced block design within each session.

*Consumer test.* One hundred and forty consumers from Hochiminh City (Vietnam) agreed to participate in this study. All consumers were adults and most were between the age of 18 and 65 year old and their distribution roughly matched the Vietnamese population age distribution. The numbers of men and women were roughly equal. Participants had to evaluate their overall liking of strawberry sterilised milk products on 7-point scales. Samples were served in random orders. Participants were also asked to fill in a small questionnaire on their food habits and preferences for dairy products.

*Gross composition parameters.* The Color of products was determined with a Konica Minolta CR-410 colorimeter using color scale CIE L*a*b* (Gámbaro, Ares, Giménez, & Pahor, 2007). The apparent viscosity of products was measured with a Brookfield VI rotary viscometer (Brookfield Engineering Laboratories Inc., Stoughton, MA); using spindle no. 1 at 60 r.p.m. Measurements were made at ambient temperature. To avoid thixotropic effects, the samples were thoroughly stirred just before measurements. The Kiendahj method was used to measure total protein content of strawberries sterilised milks (TCVN 5537:1991) and the gravimetric method to was used to determine fat content in milk products. (TCVN 6508:1999)

*Data analysis:* The packages SensomineR and FactomineR (with R version 2.8.0, Lê & Husson, 2006) were used to analyse sensory and consumer preferences data. Descriptive test data were analysed with analysis of variance (ANOVA). Preference mapping (PREFMAP) was
used to combine sensory properties and consumer data to explore consumer-preferences. ANOVA was also used to analyse the difference between the physico-chemical properties of the milk products. Consumer data, physio-chemical properties, and sensory properties were combined using multiple factor analysis (MFA, see Morand & Pagès, 2006) to describe the relationship between sensory, physio-chemical properties, and consumer preferences.

3. RESULTS AND DISCUSSION

3.1. Physico-chemical properties

Fat content, total protein, viscosity, and color of milk products are shown in Table 1. The results indicate that Ancomilk and Izzi have high fat content, as opposed to Milky, Nutifood, Daisy, and Dutchlady which all have a low fat content. We found no significant differences about total protein amount \( p > .05 \). Nutifood has the highest viscosity.

3.2. Sensory properties

The thirteen scales rated by the six trained panellists were analysed using principal component analysis (PCA). The first two principal components (PCs) of the analysis explained 62.4% of the variance.

Table 1. Physio-chemical analysis and colorimetry of products: L*, a*, b*: colour parameters

(Gámbaro et al., 2007)

<table>
<thead>
<tr>
<th>Products</th>
<th>Fat [g/100ml]</th>
<th>Total Protein [g/100ml]</th>
<th>L<em>a</em>b colormetric</th>
<th>Viscosity [Cp]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L*</td>
<td>a*</td>
</tr>
<tr>
<td>Milky US</td>
<td>0.804±0.03</td>
<td>1.364±0.03</td>
<td>107.300±2.82</td>
<td>37.97±2.50</td>
</tr>
<tr>
<td>Nutifood</td>
<td>1.110±.003</td>
<td>1.348±0.04</td>
<td>104.157±2.63</td>
<td>05.54±2.90</td>
</tr>
<tr>
<td>Daisy</td>
<td>0.911±0.03</td>
<td>1.218±0.03</td>
<td>108.963±2.54</td>
<td>37.43±2.80</td>
</tr>
<tr>
<td>Vinamilk</td>
<td>1.726±0.05</td>
<td>1.422±0.05</td>
<td>109.937±2.80</td>
<td>34.62±2.75</td>
</tr>
<tr>
<td>DutchLady</td>
<td>1.084±0.06</td>
<td>1.466±0.04</td>
<td>110.943±2.74</td>
<td>24.59±2.76</td>
</tr>
<tr>
<td>Ancomilk</td>
<td>1.726±0.04</td>
<td>1.494±0.06</td>
<td>101.450±2.53</td>
<td>35.39±2.54</td>
</tr>
<tr>
<td>Izzi</td>
<td>2.004±0.04</td>
<td>1.417±0.04</td>
<td>110.455±2.64</td>
<td>41.06±2.55</td>
</tr>
</tbody>
</table>

Figure 1b shows the plot of the correlations between the sensory scales and the first two PCs along with the “correlation circle.” As can be seen from this graph, the sensory scales form two distinct clusters. The first cluster includes texture properties such as: oral viscosty, greasiness, stickiness; and the second cluster includes aroma properties such as: sweetness, strawberry aroma, sour flavour. The brown color was negatively correlated with pink color \( r = -.85; p < .05 \) and strawberry aroma \( r = -.80, p < .05 \).

Figure 1a displays the projections of the products on the first two PCs. Ancomilk and Nutifood are clearly differentiated from the other products. Ancomilk was associated to stickiness, greasiness, stickiness, and strawberry; Nutifood was associated to the brown color and at the opposite side of PC-1, Izzi was characterised by sweetness, pink color, and strawberry aroma.
3.3. Consumer preferences

For all products studied, the average of overall liking score was around 4 except for Daisy. We analysed the data using a repeated measurement design ANOVA with product being the within subject factor. We observed a significant difference between product preferences \((p < .05)\). The most liked product was Vinamilk and the least liked product was Daisy (Figure 2).

The results of survey on milk consumer habit showed that more than 87% of the consumers reported that they often drink milk, at least “1 to 3 times per week.” Among the products studied, Vinamilk and Dutch Lady are the most familiar products as more than 90% participants reported usually drinking them. When choosing milk, consumers were interested in health (71%), sensory appeal (64%), origin (41%), trademark (40%), and price (26%). Only 5% of consumers reported being concerned by package (see Figure 3).
A preference mapping analysis confirmed the results of the hedonic test. About 70% of consumers liked Vinamilk and Izzi products and about 60% liked Dutch Lady, Daisy, Nutifood, and Ancomilk. From the preference mapping analysis, we can derive a description for an optimum product which would be close to Vinamilk and Izzi and which would be characterised by *pink color, strawberry aroma*, and *sweetness* (Figure 4).

The analysis also indicate that there were four clusters of consumers which were cluster 1 (46 consumers), cluster 2 (37 consumers), cluster 3 (28 consumers), and cluster 4 (29 consumers) as shown Figure 5.
3.4. Relationship between sensory, physico-chemical, and consumer data

Multiple factor analysis (MFA) was used to analyse a data matrix obtained by the concatenation of three data sets: sensory profile, physico-chemical parameters, and average score of each of the four clusters of consumers obtained from the preference mapping analysis. The first three PCs of the MFA explained 75.59% of the variance. Figure 6 shows the plot of the correlation of these PCs with variables used in the analysis. Consumer clusters 1 and 2 are associated with sweetness, protein, and greasiness; consumers cluster 3 is associated with strawberry aroma, sour flavor and pink colour, and consumer cluster 4 was associated with film, strawberry sourness and oral viscosity.

![Figure 6](image_url)
4. CONCLUSION

This study examined thirteen sensory properties of strawberry sterilised milk products and their relationships with the physico-chemical properties of these milks. Among the products studied, the preferred product was Vinamilk, which was characterised by strawberry aroma, sweetness, and pink color. Finally, sensory appeal and health are very important when choosing milk products.

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