Sensory and microbiological evaluation of Drâa goat cheese and study of its stability during storage

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Outlines

- INTRODUCTION

- METHODOLOGICAL APPROACH

- RESULTS

- CONCLUSION
Introduction

- RCAR of Errachidia (INRA Morocco): Young staff → created on 2003

<table>
<thead>
<tr>
<th>Laboratories</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers</td>
<td>7</td>
</tr>
<tr>
<td>Technicians</td>
<td>14</td>
</tr>
</tbody>
</table>

- 1 Research Unit
- 1 R/D Unit
- 2 Experimental Station

Research fields:
- Quality and food processing
- Plant biotechnology
- Animal production
- Plant ecology and pastoralism
- Plant pathology
IN MOROCCO:

- Goat breeding in Morocco: **Solid socio-economic activity** in Poor and remote areas (fragile populations).
- Size of livestock: about **5.3 millions**.
- Goat genetic resources: high diversity and heterogeneity → **4 populations**: Northern goat population, mountain goat, imported breeds and **Oasis population (Drâa)**.

IN THE OASES REGIONS:

- Intensive goat farming: (1) **covering food needs** of the rural population (fragile) and (2) income-generating activities (**women's cooperatives**).
- Herd size: **more than 510,000 heads** (Rahali, Drâa and Alpine).
- Drâa goat is the main goat breed raised in **oases of South-East of Morocco**.
  - Very prolific (160 – 200%) & considered as a source of supply of **oasis milk**...
Introduction

CONSTRAINTS !!

- existence of a large number of small unorganized farms;
- lack of infrastructure, making it difficult for the farmer to apply good hygiene practices;
- failure to meet quality requirements (from production to processing);
- existence of small goat cheese production units but lack of technical supervision;
- production remains traditional, seasonal and poorly controlled;
- difficulties in storing and preserving goat cheese, which is marketed fresh.
- lack of characterization of goat products ...
Objective

Continue research and R & D studies aimed the characterization of Drâa goat considered as a “typical goat breed in the oasis of South-East Morocco”, through:

1- Microbiological and sensorial characterization of Drâa goat cheese ...

2- Study of storage abilities of this cheese ...
Methodology (1/2)

- Drâa goat cheese was produced in the laboratory using goat milk from an intensive livestock at the Errachidia experimental station:

  - Preliminary steps
  - Pasteurization (72°C-20s)
  - Inoculation: 32.5ppm
  - Renneting: 0.2ml/l
  - Addition of CaCl₂
  - Coagulation (36°C-150min)
  - Cutting and patching
  - Moulding
  - Draining (25°C-15h)
  - Turning and salting
Methodology (2/2)

Drâa goat cheese Analyses

**Microbiological analysis**
- Count of:
  - Lactic Acid Bacteria (LAB)
  - Yeast and Molds
  - Psychrotrophic Bacteria
  - Fecal Coliforms

**Sensory evaluation**
- Three major tests:
  - Hedonic Test
  - Preference Test
  - Triangular Test
    (in comparison with Alpine & Drâa goat cheese)

**Quality during storage**
- Control of 3 parameters:
  - Acidity (Dornic degree)
  - Water content (%)
  - Yeast and Molds

**Panel of 50 persons**
- 54% Women – 46% Men

**Culture on specific “culture media”**

**Frequency of control**
- (0 - 8 and 16 days)
Results

I. Physicochemical analyses of Drâa goat cheese:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>4.58 ± 0.15</td>
</tr>
<tr>
<td>Acidity (°D)</td>
<td>211 ± 17.3</td>
</tr>
<tr>
<td>Humidity (%)</td>
<td>57.3 ± 2.65</td>
</tr>
<tr>
<td>Dry Matter (%)</td>
<td>42.7 ± 2.65</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>21.9 ± 3.07</td>
</tr>
<tr>
<td>FAT/DM</td>
<td>0.51 ± 0.05</td>
</tr>
<tr>
<td>DNF (%)</td>
<td>20.8 ± 2.34</td>
</tr>
<tr>
<td>TNM (%)</td>
<td>15.3 ± 2.60</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>2.26 ± 0.54</td>
</tr>
<tr>
<td>Cheese Yield (%)</td>
<td>18.8 ± 1.55</td>
</tr>
</tbody>
</table>

In general, Physical & chemical components of Drâa fresh cheese are comparable or higher than:
- Servilletta (Spain)
- Domati (Egypt)
- Mato (Spain)
- Cacioricotta (Italy) (review of Raynal-Ljutovac et al., 2014)
- Local goat breed (Northern Morocco) (Noutfia et al., 2014)
Results

II. Microbiological analyzes:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Tolerated limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log10 (CFU/g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fecal coliforms</td>
<td>2.34</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>Lactic acid bacteria</td>
<td>8.92</td>
<td>-</td>
</tr>
<tr>
<td>Psychrotrophic bacteria</td>
<td>6.97</td>
<td>&lt; 6</td>
</tr>
<tr>
<td>Yeast</td>
<td>4.34</td>
<td>5</td>
</tr>
<tr>
<td>Molds</td>
<td>3.83</td>
<td>5</td>
</tr>
</tbody>
</table>

- The **fecal bacterial flora** → well below the threshold set by the standard → Good conduct of milking and best processing conditions.
- **Lactic acid bacteria**: High amount → Good technological abilities (ripening, probiotics ...)
- **Yeast & Molds** lower than (Log10 (CFU/g): 5-6) which is associated to yeasty and fermented off-flavors and gassy appearance.
Results

III. Sensory analyses:

1) **Preference Test** (Tasting preferences)

### Mid-goat cheese

<table>
<thead>
<tr>
<th>Acidity (°D)</th>
<th>Ash</th>
<th>Lipids</th>
<th>Proteins</th>
<th>Water content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>158</td>
<td>1.2</td>
<td>19.8</td>
<td>16.4</td>
<td>60.9</td>
</tr>
</tbody>
</table>

Preferred: (N = 40%)

### Alpine-goat cheese

<table>
<thead>
<tr>
<th>Acidity (°D)</th>
<th>Ash</th>
<th>Lipids</th>
<th>Proteins</th>
<th>Water content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>153</td>
<td>0.79</td>
<td>16.6</td>
<td>11.7</td>
<td>66.4</td>
</tr>
</tbody>
</table>

Preferred: (N = 38%)

### Drâa-goat cheese

<table>
<thead>
<tr>
<th>Acidity (°D)</th>
<th>Ash</th>
<th>Lipids</th>
<th>Proteins</th>
<th>Water content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>1.7</td>
<td>23.4</td>
<td>15.7</td>
<td>57.0</td>
</tr>
</tbody>
</table>

Preferred: (N = 22%)
Results

III. Sensory analyses:

2) **Hedonic Test**

- Sensorial attributes of mid-goat cheese and Alpine cheeses are similar.
- In addition, the best sensory profile is that of mid-goat cheese, followed by Alpine cheese.

→ This confirms the results identified in the preference test.
Results

III. Sensory analyzes:

3) **Triangular Test**

A highly significant difference* between Drâa goat cheese (local breed) and Alpine goat (imported breed):

- 62% of tasters: Able to differentiate between the two types of cheese ...
- 38%: Not able ...

*chi-squared test ($\chi^2$ test)

→ This shows that the characteristics of the Drâa goat cheese, namely the acid taste, the slightly yellowish coloring, the firm consistency, the pronounced odor, are easily detected by the panel.
Results

IV. Quality of cheese during storage:

1) Water content

- Changes in water content during storage increased slightly from 56.7% to 57.2%.
- However, the analysis of variance, *ie shelf life at + 4 °C*, showed that there was no significant difference between the water content at processing day and 16 days of storage.
Results

IV. Quality of cheese during storage:

2) Acidity (Dornic degree)

- The lactic acid content increases during storage, from 204°D at the beginning → 225°D after 16 days ...
  → Significant difference (p < 0.05) between the acidity of the cheese at 16 and 0 day.

This indicates a lactic fermentation in the stored cheese ... This finding is consistent with the conclusions reported by Yedri (2010) and Yessraoui (2002).
Results

IV. Quality of cheese during storage :

3) Yeast and Molds

- Yeasts and molds have been reported to be the major determinant parameter of shelf-life of fresh cheese (Lewis and Dale, 2000).
- A cut-off of $\geq 10^5$ CFU/g for yeasts and molds was chosen to mark the end of shelf-life (Al-Kadamany et al., 2003).

$\rightarrow$ Yeast and mold growth rate increases significantly ($p<0.05$) during storage.

$\rightarrow$ Estimated Shelf-life of our cheese is reached on the 7 - 8th day : Similarity with the study of Arriagada et al. (2012) report a shelf life of 7 days for fresh cheese ...
Conclusion

1 - Further research on the microbiological aspect: sharp characterization of the lactic flora of oases goat cheeses (bacteriocins, etc) ...

2 - Diversify the range of cheeses produced in the oases regions: semi-ripened, flavored cheeses with indigenous aromatic & medicinal plants ...

3 - Start research activities related to the quality characterization of Drâa goat meat ...
- Characterization and improvement of local know-how in cheese processing...

- Training of cheese makers in cheese processing & making techniques...

- Training of 3 local cheese factories on Good manufacturing and hygiene practices (GMP & BPH)...

Thank you