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ASSESSING THE QUALITY AND SAFETY OF RAW MILK SOLD THROUGH VENDING MACHINES: A CASE STUDY FROM TIMIȘOARA

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Abstract: This study examines the quality and safety of raw milk distributed through vending machines in Timișoara, responding to growing consumer demand for unprocessed dairy products marketed as healthier alternatives. Raw milk vending, which has gained popularity across European nations, allows direct sales from farm to consumer, yet poses potential health risks if strict quality and safety protocols are not maintained. In this research, 13 milk samples from vending machines were collected over two months and subjected to comprehensive physicochemical and microbiological analyses, including fat, protein, lactose, and total dry matter (TDS) content measurements, cryoscopic point, acidity, total mesophilic count (TNGMA), and somatic cell count (SCC). The findings revealed notable variability across samples and locations, even though the milk originated from a single dairy supplier. Inconsistent fat (2.1%-6.4%) and protein (3.2%-3.8%) levels suggest improper homogenization, while high SCC and TNGMA values, with most samples surpassing safety thresholds, indicate issues in milk hygiene practices. Some samples also showed indications of water addition, inferred from cryoscopic point deviations. Furthermore, the potential for unregulated heat treatment was identified, which contravenes raw milk vending standards, and could compromise product integrity and nutritional value. The frequent non-compliance with microbial and somatic cell count standards underscores inadequate adherence to milking hygiene and poor mammary health management within dairy herds. Consequently, while raw milk vending machines offer direct consumer access to fresh milk, this study emphasizes the need for stringent oversight to ensure that marketed products meet safe and consistent quality standards, aligning with regulatory expectations for direct raw milk sales.

Keywords: milk, freshness, hygiene, microbiology

• Introduction

• In recent years, consumer interest in minimally processed and locally sourced food has markedly increased, with raw milk becoming a favored option due to its perceived health advantages. In numerous European nations, vending machines have emerged as a prevalent means for farmers to sell raw milk directly to consumers, facilitating access to fresh, unprocessed dairy products (1).

• This study aims to evaluate the physicochemical properties and microbial quality of raw milk sold through vending machines in Timișoara. By analyzing samples from multiple machines, this research provides insights into the consistency, nutritional profile, and safety of milk available in these outlets. The findings seek to inform regulatory authorities, consumers, and producers, highlighting the necessity for stringent hygiene protocols and regulatory supervision in the distribution of raw milk.

• Material and method

- This study assessed the quality and safety of raw milk sold through 13 vending machines in Timișoara, Romania. Milk samples were collected from each machine over two consecutive months (May and June) to account for any temporal variations. The milk sourced for these vending machines came from a single milk supplier, ensuring a controlled comparison across different machines.
- A total of 13 raw milk samples were collected from each vending machine on the same day for each sampling period. To maintain sample integrity, the milk was stored under refrigerated conditions during transport to the laboratory.
- Each sample underwent analysis for key components: fat, protein, lactose, and total dry matter (TDS) using the Lactoscope Rapid Analyzer (Delta Instruments, Drachten, the Netherlands) (Fig.1). To assess freezing point consistency, the cryoscopic point was measured using a Cryostar device (Fig 2). Acidity was also measured and expressed in degrees Thörnér.
- The microbial quality of each sample was determined by analyzing the total mesophilic count (TNGMA- Fig.3) and somatic cell count (SCC).

• Conclusions

- This study highlights significant variability in the quality and safety of raw milk sold through vending machines in Timișoara, underscoring the challenges of maintaining consistent standards in direct farm-to-consumer milk sales.
- The analysis revealed fluctuations in key nutritional components—such as fat and protein levels—indicating inconsistent homogenization practices.
- Additionally, high microbial counts and somatic cell numbers in most samples exceeded European safety thresholds, suggesting insufficient hygiene during milking and potential health issues within supplying dairy herds. These factors collectively reduce the reliability of raw milk from vending machines as a consistently safe and nutritious option for consumers.
- The study's findings highlight concerns regarding current practices that may compromise product integrity, including potential heat treatment of raw milk and possible mixing from various sources, in violation of direct-sale regulations.



Fig.1 Lactoscope analyser



Fig 2. Criostar apparatus

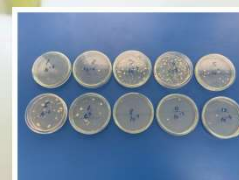


Fig. 3 Total mesophilic count

• Results and discussions

Table1. Values of the collected raw milk in
May

No. Cr.	Location	Fat (%)	Protein (%)	Lactose (%)	TDS (%)	Cryoscopic point (°C)	Acidity (°T)
1	Timișoara 1	4,4	3,7	4,9	13,8	0,54	19
2	Timișoara 2	4,3	3,6	4,8	13,5	0,51	20
3	Timișoara 3	2,1	3,7	5,0	11,6	0,53	19
4	Timișoara 4	4,2	3,7	4,8	13,5	0,53	20
5	Timișoara 5	4,4	3,7	4,8	13,7	0,50	19
6	Timișoara 6	4,2	3,7	4,9	13,4	0,54	20
7	Timișoara 7	3,1	3,7	4,8	12,4	0,52	19
8	Timișoara 8	2,5	3,7	4,9	11,8	0,52	19
9	Timișoara 9	4,2	3,7	4,8	13,5	0,52	19
10	Timișoara 10	4,4	3,7	4,8	13,7	0,56	20
11	Timișoara 11	4,3	3,4	4,7	13,2	0,52	19
12	Timișoara 12	6,4	3,7	4,7	15,6	0,52	19
13	Timișoara 13	4,4	3,7	4,8	13,7	0,52	20

Table 2. Values of the collected raw milk in
June

No. Cr.	Location	Fat (%)	Protein (%)	Lactose (%)	TDS (%)	Cryoscopic point (°C)	Acidity (°T)
1	Timișoara 1	4,4	3,7	4,8	13,7	0,52	19
2	Timișoara 2	4,3	3,6	4,8	13,5	0,52	19
3	Timișoara 3	3,9	3,6	4,8	13,1	0,52	20
4	Timișoara 4	2	3,7	5,0	11,4	0,51	20
5	Timișoara 5	4,4	3,7	4,8	13,7	0,52	19
6	Timișoara 6	3,8	3,2	4,6	12,4	0,53	20
7	Timișoara 7	4,4	3,6	4,8	13,5	0,52	19
8	Timișoara 8	4,2	3,6	4,8	13,4	0,53	20
9	Timișoara 9	4,2	3,6	4,8	13,5	0,52	20
10	Timișoara 10	2	3,8	4,8	11,4	0,52	19
11	Timișoara 11	1,4	3,8	4,8	10,7	0,52	20
12	Timișoara 12	3,8	3,6	4,8	13,5	0,52	19
13	Timișoara 13	3,6	3,6	4,9	11,9	0,53	20

