Foods 2025 Conference
The 6th International Electronic Conference on Foods
28–30 October 2025 | Online
MDPI

Fermented Plant-Based Milks: Effects of pH and Storage Conditions on Protein Stability

İdil TEKİN[1]
Science and Technology Application and Research Center, Dokuz Eylül University, 35390, Buca, İzmir, Türkiye

INTRODUCTION & AIM

The growing demand for plant-based dairy alternatives has accelerated the development of fermented plant-based milks (Boukid et al., 2023; Mengistu, 2025). Protein stability is one of the most important quality factors that affects texture, shelf life, and consumer acceptability. Although soy and oat milks are frequently used in various formulations, their protein systems are sensitive to changes in temperature and pH value (Sethi et al., 2016). This study aims to investigate how pH adjustments and storage temperatures affect protein stability in fermented soy and oat milks.

METHOD

Commercial soy and oat milks were inoculated with a starter culture containing *Lactobacillus* spp. and incubated at 37 ˚C for 12-24 h to initiate fermentation. Before inoculation, selected samples were adjusted to specific pH levels ranging from 4.5 to 6.5 to evaluate the impact of initial acidity. Following fermentation, all samples were kept for a maximum of 10 days at 25 ˚C and 4 ˚C. Protein stability was assessed by sedimentation analysis, and total protein content was measured using the Kjeldahl method (Figure 1).

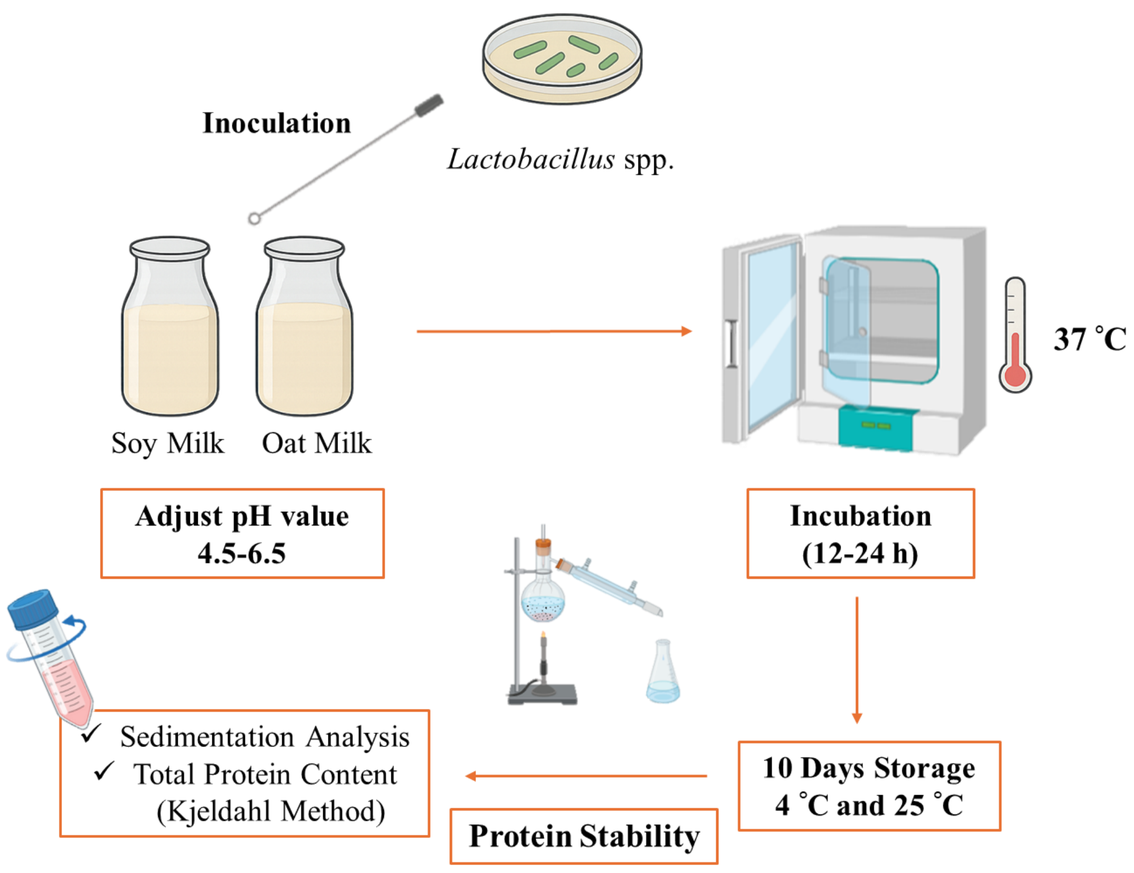

Figure 1. Overview of sample preparation, fermentation conditions, and protein assessment in soy and oat milk.

RESULTS & DISCUSSION

Table 1. Total protein content of soy and oat milk.

Before Fermentation	Soy Milk	Oat Milk
Total Protein (g/100 mL)	4.6 ± 0.02	1.7 ± 0.05

Table 2. Total protein and sediment content of fermented soy and oat milk after 10 days of storage (4 and 25 °C).

After Fermentation (10th day of storage)		Soy Milk 4 ˚C	Soy Milk 25 ˚C	Oat Milk 4 ˚C	Oat Milk 25 ˚C
Total Protein (g/100 mL)	pH Value				
	4.5	3.29 ± 0.01^{a}	2.52 ± 0.17^{b}	1.35 ± 0.02^{a}	0.98 ± 0.01^{b}
	5.0	3.03 ± 0.03^{a}	2.38 ± 0.21^{b}	1.31 ± 0.01^{a}	0.90 ± 0.02^{b}
	5.5	2.98 ± 0.01^{a}	2.10 ± 0.01^{b}	1.20 ± 0.15^{a}	0.83 ± 0.00^{b}
	6.0	2.73 ± 0.00^{a}	1.82 ± 0.00^{b}	1.08 ± 0.07^{a}	0.72 ± 0.21^{b}
	6.5	2.45 ± 0.02^{a}	1.58 ± 0.03^{b}	0.98 ± 0.05^{a}	0.60 ± 0.01^{b}
Sediment (g/100 mL)	pH Value				
	4.5	0.21 ± 0.02^{b}	0.98 ± 0.02^{a}	0.15 ± 0.01^{b}	0.52 ± 0.11^{a}
	5.0	0.31 ± 0.01^{b}	1.12 ± 0.01^{a}	0.19 ± 0.02^{b}	0.60 ± 0.03^{a}
	5.5	0.52 ± 0.03^{b}	1.40 ± 0.00^{a}	0.30 ± 0.02^{b}	0.68 ± 0.01^{a}
	6.0	0.77 ± 0.01^{b}	1.68 ± 0.03^{a}	0.42 ± 0.01^{b}	0.78 ± 0.01^{a}
	6.5	1.05 ± 0.11^{b}	1.92 ± 0.01^{a}	0.52 ± 0.00^{b}	0.90 ± 0.01^{a}

Data represent the mean values and standard deviations. [a, b] Different letters regarding each analysis represent statistically significant differences ($P<0.05$).

CONCLUSION

The results highlight the importance of both pH value adjustment and cold storage in preserving protein stability in fermented plant-based milks. These findings provide useful insights for optimizing formulation and storage strategies, ultimately supporting the development of higher-quality plant-based dairy alternatives.

REFERENCES

Mengistu, B. A. (2025). Development of Plant-Based Milk Alternatives and Its Future Trends in the Middle East. *Journal of Food Processing and Preservation*, *2025*(1), 2743414.
Boukid, F., Hassoun, A., Zouari, A., Tülbek, M. Ç., Mefleh, M., Aït-Kaddour, A., & Castellari, M. (2023). Fermentation for designing innovative plant-based meat and dairy alternatives. Foods, 12(5), 1005.
Sethi, S., Tyagi, S. K., & Anurag, R. K. (2016). Plant-based milk alternatives an emerging segment of functional beverages: a review. Journal of food science and technology, 53(9), 3408-3423.