

Preservation of Idli Using Blast Chiller: A Study

Mr. D. Antony Vijayaraj¹, Mr. J. Ezhilan²

¹M.Sc.(HM), M.B.A., M.T.M., Assistant Professor, Dept. of Catering Science & Hotel Management, RVS College Of Arts and Science, Sulur, Coimbatore – 641 402

²B.Sc.(CS&HA), MBA., in Tourism and Hotel Management., Assistant Professor, Dept. of Catering Science & Hotel Management, RVS College Of Arts and Science, Sulur, Coimbatore – 641 402

ABSTRACT

Idli, a traditional South Indian fermented food, is highly perishable due to its high moisture content, neutral pH, and active microbial population. Conventional preservation techniques such as refrigeration and freezing often lead to deterioration in texture and sensory quality. This research investigates the effectiveness of blast chilling as a scientific preservation method to enhance the shelf life and maintain the quality of idli. Blast chilling rapidly reduces the temperature of freshly steamed idlis, minimizing microbial growth, enzymatic activity, and moisture migration. Experimental observations reveal that blast-chilled idlis exhibit significantly lower microbial counts, improved texture, and extended shelf life compared to conventionally refrigerated idlis. The study concludes that blast chilling is a viable and superior preservation technique for idli in commercial and industrial food systems.

KEYWORDS: Idli preservation, Blast chilling, Shelf-life extension, Fermented foods, Food quality, Microbial control.

1. INTRODUCTION

Idli is a steamed, fermented food prepared from rice and black gram (urad dal). It is widely consumed for its soft texture, digestibility, and nutritional value. Despite these advantages, idli has a very short shelf life, typically less than 24 hours at room temperature. The growing demand for ready-to-eat traditional foods necessitates efficient preservation techniques that retain freshness and sensory attributes.

Blast chilling, a rapid cooling technology widely used in food service and food processing industries, has shown promising results in preserving cooked foods. This research examines the application of blast chilling for idli preservation and evaluates its effect on microbial safety, texture, and shelf life.

2. OBJECTIVES AND CAUSES OF SPOILAGE IN IDLI

Idli spoilage occurs primarily due to:

- High water activity
- Residual fermentation microorganisms
- Enzymatic reactions post-steaming
- Exposure to temperatures within the microbial danger zone (5–60 °C)

These factors result in sour odor, texture collapse, and visible microbial growth.

OBJECTIVES OF THE STUDY

The specific objectives of the present study are:

1. To study the spoilage characteristics of idli under normal and refrigerated storage conditions.
2. To apply blast chilling technology for the preservation of freshly steamed idli.
3. To compare the microbial growth patterns in refrigerated and blast-chilled idli during storage.
4. To evaluate the shelf life extension achieved through blast chilling.
5. To assess the sensory quality parameters (appearance, texture, flavor, and overall acceptability) of preserved idli.
6. To analyze the scientific feasibility of blast chilling for commercial and industrial applications in traditional food preservation.

3. PRINCIPLE OF BLAST CHILLING

Blast chilling is a rapid cooling process where cooked food is cooled from approximately 70–90 °C to below 3 °C within 90 minutes using high-velocity cold air.

Scientific Advantages

- Rapid exit from microbial danger zone
- Suppression of bacterial and fungal growth
- Reduced condensation and moisture loss
- Preservation of food structure and nutrients

4. MATERIALS AND METHODS

4.1 Sample Preparation

- Fresh idli batter prepared using standard rice–urad dal ratio (3:1)
- Fermented for 8–10 hours
- Steamed at 100 °C for 12 minutes

4.2 Preservation Methods Compared

Sample Code	Preservation Method
A	Conventional refrigeration (4 °C)
B	Blast chilling (0–2 °C)

4.3 Blast Chilling Procedure

1. Freshly steamed idlis cooled for 5 - 10 minutes
2. Transferred to blast chiller at 0–2 °C
3. High-velocity air circulation for 60–90 minutes
4. Stored at 0–4 °C

5. EXPERIMENTAL RESULTS AND DATA ANALYSIS

5.1 Microbial Count Analysis

Total Plate Count (CFU/g)

Storage Time	Refrigerated Idli	Blast-Chilled Idli
Day 0	1.2×10^3	1.2×10^3
Day 2	4.8×10^4	2.1×10^4
Day 4	9.2×10^5	4.5×10^4
Day 7	Spoiled	7.8×10^4

(Blast chilling significantly reduced microbial proliferation)

5.2 Shelf Life Comparison

Preservation Method	Shelf Life
Room temperature	< 24 hours
Refrigeration	2–3 days
Blast chilling	7–8 days

5.3 Sensory Evaluation (9-Point Hedonic Scale)

Parameter	Refrigerated	Blast Chilled
Appearance	6	8
Texture	5	8
Flavor	6	8
Overall acceptability	5.7	8.0

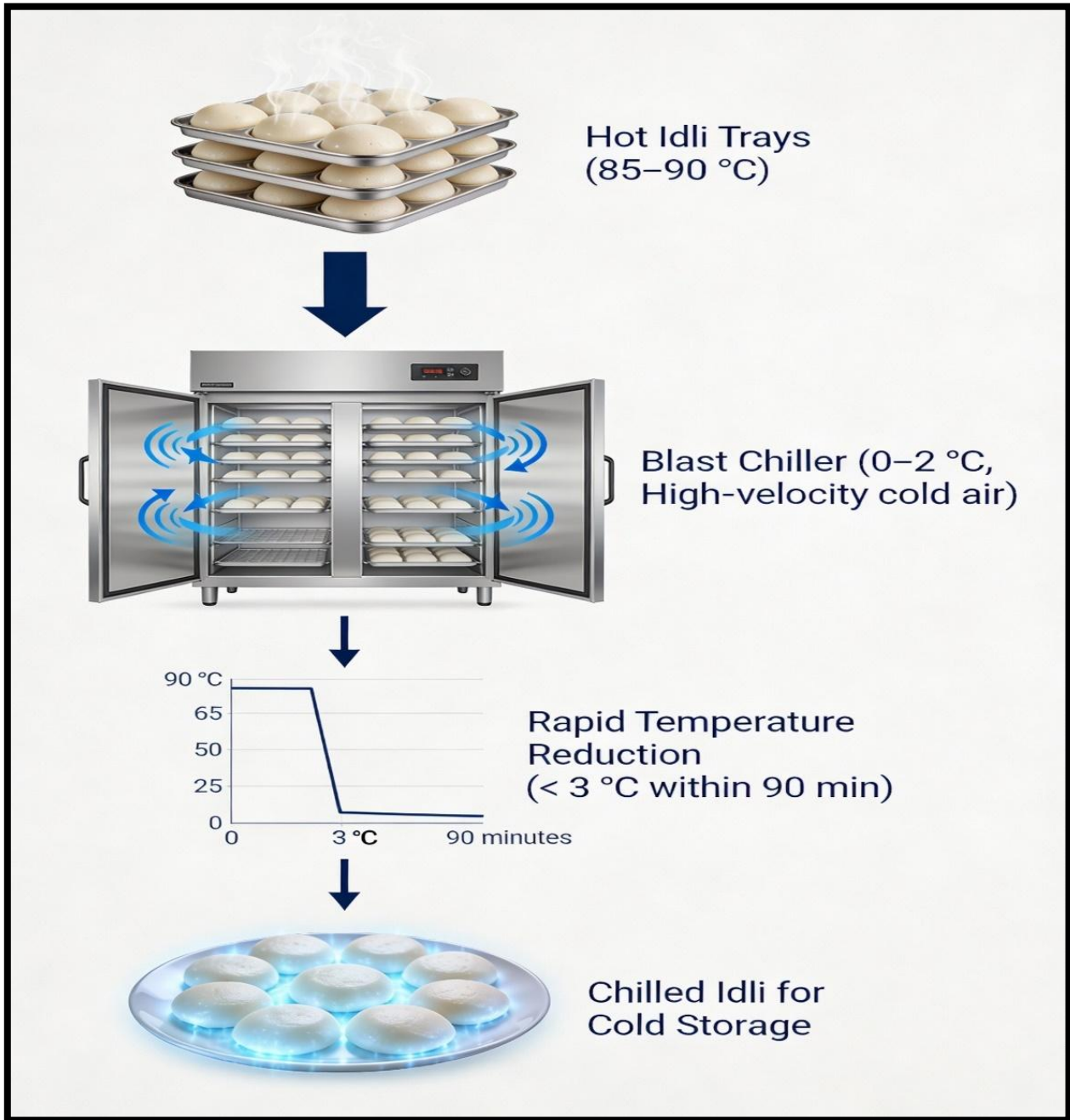
6. FIGURES AND SCIENTIFIC IMAGES

Figure 1: Idli Preparation Process



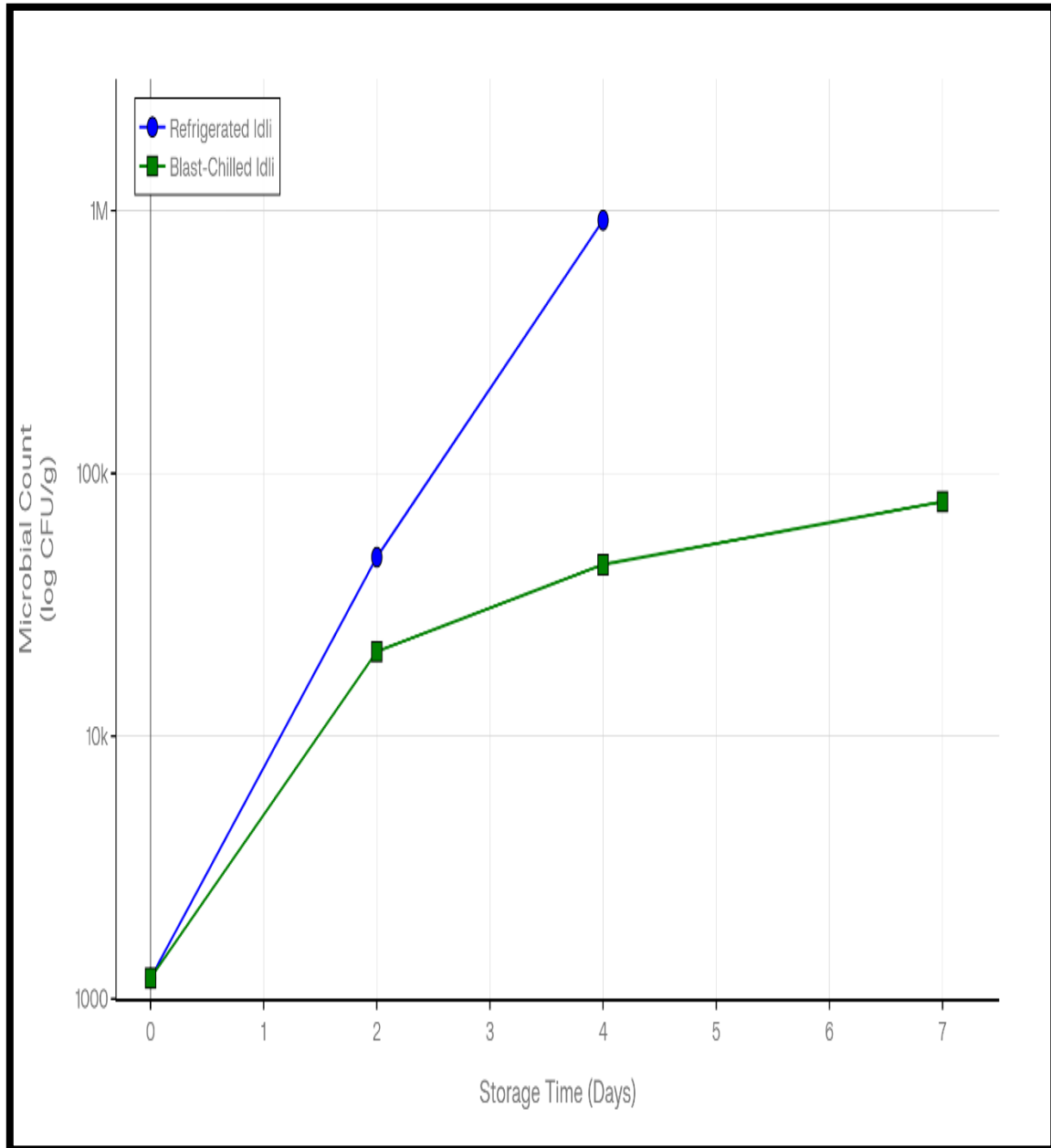
(Figure 1. Flow diagram showing the preparation of idli from rice and urad dal through fermentation and steaming.)

FIGURE 2: BLAST CHILLING PROCESS



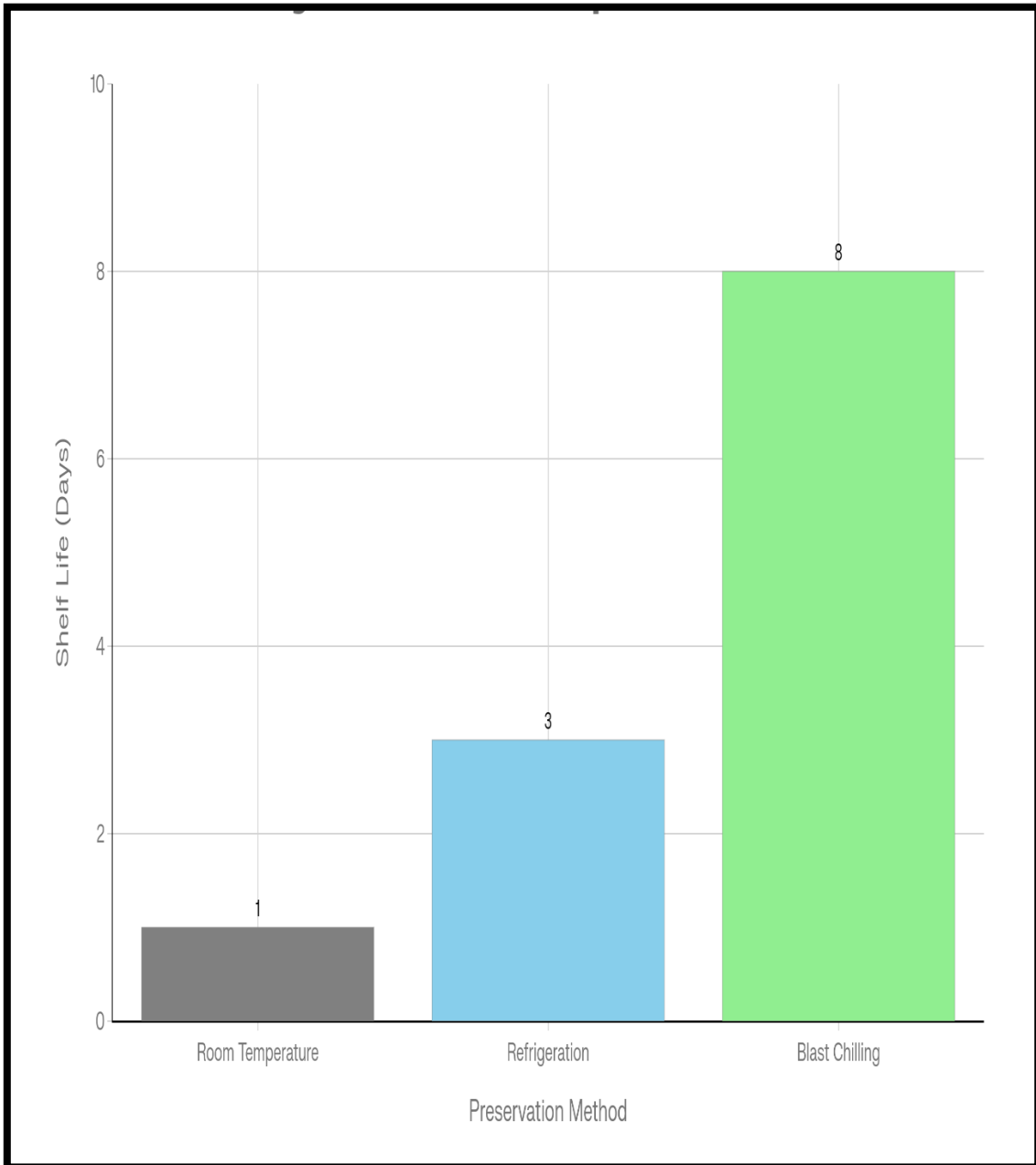
(Figure 2. Schematic representation of blast chilling process used for idli preservation.)

FIGURE 3: MICROBIAL GROWTH CURVE



(Figure 3. Microbial growth pattern of idli during storage under refrigerated and blast-chilled conditions.)

FIGURE 4: SHELF LIFE COMPARISON CHART



(Figure 4. Comparison of shelf life of idli preserved using different methods)

7. DISCUSSION

Blast chilling effectively extends idli shelf life by rapidly lowering temperature and minimizing microbial activity. Unlike freezing, blast chilling preserves the soft and spongy texture of idli. The results demonstrate that blast chilling maintains freshness, sensory quality, and safety significantly better than conventional refrigeration.

8.Limitations of the Study

Despite its significance, the study has certain limitations:

1. The study is conducted on a small experimental scale, and results may vary under large-scale indus-

trial conditions.

2. Only one traditional idli formulation (rice–urad dal ratio) is considered; variations in ingredients may influence outcomes.
3. The research focuses mainly on microbial load, shelf life, and sensory attributes, without detailed biochemical or molecular analysis.
4. Storage conditions are limited to short-term chilled storage; long-term frozen storage was not evaluated.
5. Economic analysis, including cost–benefit and energy consumption of blast chillers, is not included in this study.

9. INDUSTRIAL AND COMMERCIAL APPLICATIONS

- Ready-to-eat idli packaging
- Catering services and hotels
- Cloud kitchens and institutional food supply
- Traditional food export industry

10. CONCLUSION

Blast chilling is a scientifically efficient and commercially viable method for preserving idli. The technique significantly extends shelf life while maintaining microbial safety, texture, and sensory quality. This approach bridges traditional food preparation with modern food preservation technology and holds strong potential for industrial adoption.

11. FUTURE SCOPE

Based on the findings, future research may include:

- Application of blast chilling to other fermented foods (dosa, idiyappam, appam)
- Study of nutritional and probiotic retention
- Integration of modified atmosphere packaging (MAP) with blast chilling
- Large-scale industrial validation studies

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