

EVALUATION OF COOKIE PACKAGING MATERIALS IN RETAIL SHOPS OF SANGAMNER, MAHARASHTRA: KRAFT WINDOW BOX AS THE BEST-PERFORMING FORMAT

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Abstract—Packaging determines how long cookies stay crisp, how well they survive handling and how attractive they look on the shelf. Although much is known about packaging materials in general, little field evidence exists on which cookie packaging works best in small-town Indian retail, where stock turns over quickly, supply chains are short and cost and sustainability matter equally. Cookie packaging was examined in 100 retail shops in Sangamner, Maharashtra. The packaging formats in use were identified and compared on practical criteria, namely product protection, visibility, shelf appeal, cost and environmental friendliness [edit to match your criteria]. Cookies were sold in a range of formats: plastic pouches, film flow-wraps, plastic jars, cardboard boxes, paper bags, tins and foil packs, as well as kraft window boxes. The kraft window box was found to be the best-performing format overall [add key figures, e.g. share of shops and scores]. For cookie sellers in Sangamner, the kraft window box offers the best combination of physical protection, product visibility, branding opportunity and sustainable image. Local producers and shops are advised to adopt it, with an inner liner where longer shelf life is needed.

Index Terms—Cookie packaging, kraft window box, retail study, Sangamner, food packaging, sustainability, shelf life

I. INTRODUCTION

Packaging is one of the most important and least visible parts of the food supply chain. It protects food from physical, chemical and microbiological deterioration, extends shelf life, communicates information to consumers and is increasingly judged by its environmental footprint. A well-designed pack reduces food waste, while a poorly chosen pack can spoil the product or add needless plastic waste.

Cookies are a demanding product to package. They are low in moisture, often rich in fat and brittle, so their quality is lost mainly through moisture gain, rancidity and breakage rather than microbial spoilage. In India, cookies are sold through bakeries, sweet and snack shops, general stores and supermarkets, frequently as loose or small-batch products packed by the seller. The choice of pack in these shops is usually based on habit, cost and availability rather than evidence.

Novelty and research gap. Most published work on food packaging focuses on laboratory shelf-life testing or large-scale industrial formats. Field evidence from small-town retail settings is limited [confirm with your literature search]. This study contributes original data from 100 shops in Sangamner, Maharashtra, and identifies the packaging format that performs best under real local conditions.

Objectives. The study aimed to:

- 1) identify the packaging materials and formats used for cookies in shops in Sangamner;
- 2) compare these formats on protection, visibility, appeal, cost and sustainability; and
- 3) determine which format performs best and recommend it to local cookie sellers.

II. BACKGROUND

A. Functions of Food Packaging

Food packaging serves four overlapping functions: protection from oxygen, water vapour, light, microorganisms, dust and mechanical damage; containment for handling and transport; communication through labels and branding; and convenience through features such as easy opening and resealing. Sustainability, covering recyclability, material efficiency and carbon footprint, is now treated as a fifth design criterion.

B. Packaging Materials and Technologies

The main classes of packaging material, with their typical forms, strengths and limitations, are summarized in Table I. Barrier performance is described by the water vapour transmission rate (WVTR) and the oxygen transmission rate (OTR). Polyolefins such as polyethylene and polypropylene are good moisture barriers but poor oxygen barriers. Thin metallised layers greatly improve both barriers at low weight, and aluminium foil remains the benchmark. Further technologies include modified atmosphere packaging (nitrogen flushing to slow rancidity), active packaging (oxygen scavengers and moisture absorbers), and intelligent packaging (time-temperature and freshness indicators). Sustainable strategies include light-weighting, mono-material design, recycled content, paper-based and compostable materials, and reuse systems. A sustainable pack that fails to protect its contents can increase total environmental impact, because wasted food usually has a larger footprint than the pack.

TABLE I
PACKAGING MATERIALS, TYPICAL FORMS, STRENGTHS AND LIMITATIONS

Material	Typical forms	Strengths	Limitations
Glass	Jars, bottles	Inert, excellent barrier, reusable	Heavy, breakable, energy-intensive
Metal (steel, aluminium)	Cans, tins, foil, lids	Complete barrier, strong, long shelf life	Cost, weight, corrosion in some cases

Material	Typical forms	Strengths	Limitations
Paper and board	Cartons, sleeves, trays	Printable, renewable, widely recycled	Poor moisture and oxygen barrier unless coated
Plastics (PE, PP, PET, PA, EVOH)	Films, pouches, trays, bottles	Light, flexible, heat-sealable, tunable barrier	Recycling and end-of-life concerns
Laminates and coextrusions	Pouches, flow-wrap, lidding	Combine strengths of several layers	Hard to recycle when materials are mixed

C. Deterioration of Cookies and Packaging Needs

- **Moisture gain or loss.** Crisp cookies soften when water vapour enters; soft cookies dry out and harden. Packs must control moisture exchange.
- **Lipid oxidation.** Fat, nuts and chocolate chips oxidise under oxygen, light and heat, causing off-flavours.
- **Mechanical damage.** Cookies are brittle, so breakage during handling is a major cause of complaints and waste.
- **Odour and flavour transfer.** Fatty products absorb foreign odours and lose aroma.
- **Fat bloom.** Chocolate-containing cookies can show a white film after temperature cycling.

III. MATERIALS AND METHODS

A. Study Area and Design

The study was carried out in Sangamner, Maharashtra, as a cross-sectional field survey of cookie packaging in retail shops [edit: study period, e.g. months and year].

B. Sample

A total of **100 shops** selling cookies were included [edit: shop types and selection method, e.g. bakeries, sweet and snack shops, general stores and supermarkets, chosen by random or convenience sampling].

C. Packaging Formats Examined

The following formats were identified and examined: kraft window boxes; plastic pouches (LDPE or PP); film flow-wraps (BOPP or metallised film); plastic jars and containers (PET or PP); white or duplex cardboard boxes; paper bags and butter-paper wraps; tin or metal containers; and aluminium foil trays or packs [edit to match what you observed].

D. Evaluation Criteria and Data Collection

Each format was checked on the following criteria [edit to match your instrument]: protection of the product (moisture, crispness, breakage), product visibility, shelf appeal and branding, cost, and environmental friendliness. Data were collected by direct observation in the shops and [edit: shopkeeper interviews, consumer feedback, checklist or scoring sheet, rating scale].

E. Data Analysis

Responses were tabulated, and formats were compared using frequency counts, percentages and [edit: mean scores or ranking]. The format with the best overall outcome was identified as the best-performing option.

IV. RESULTS

A. Packaging Formats in Use

Cookies in the 100 shops were found in the formats shown in Table II.

TABLE II
COOKIE PACKAGING FORMATS OBSERVED IN 100 SHOPS IN SANGAMNER

Packaging format	Shops using it (of 100)	Overall result
Kraft window box	☐	Best-performing format
Plastic pouch (LDPE / PP)	☐	Lower
Film flow-wrap (BOPP / metallised)	☐	Moderate
Plastic jar or container (PET / PP)	☐	Good
White or duplex cardboard box	☐	Moderate
Paper bag or butter-paper wrap	☐	Lower
Tin or metal container	☐	Good, but costly
Aluminium foil tray or pack	☐	Moderate

B. Performance of Each Material

Plastic pouches (LDPE or PP) were cheap and light and showed the product, but gave poor protection against crushing and weak oxygen protection, with a basic appearance. **Film flow-wraps** gave the strongest moisture protection, particularly when metallised, but did not protect against breakage, cost more to print and run for small shops, and are hard to recycle. **Plastic jars and containers** protected well against crushing and moisture and were reusable, but were

costlier, bulkier and less sustainable. **Cardboard boxes without a window** protected shape and printed well but hid the product and offered little moisture barrier. **Paper bags and butter-paper wraps** were the cheapest and most recyclable but gave poor protection and suited only very short storage. **Tin containers** gave excellent protection and a premium image but were too costly and heavy for everyday sale. **Foil trays and packs** gave a good barrier but were less visible, costlier and rarely recycled. The comparative performance of all formats is summarized in Table III.

TABLE III
COMPARATIVE PERFORMANCE OF COOKIE PACKAGING MATERIALS [INDICATIVE RATINGS; REPLACE WITH STUDY SCORES]

Material	Moisture protection	Breakage protection	Product visibility	Eco-friendliness	Overall outcome
Kraft window box	Moderate	High	High	High	Best
Plastic pouch	Moderate	Low	High	Low	Lower
Film flow-wrap	High	Low	Moderate	Low	Moderate
Plastic jar	High	High	High	Low	Good
Cardboard box (no window)	Low to moderate	High	Low	Moderate to high	Moderate
Paper bag / butter paper	Low	Low	Low	High	Lower
Tin container	High	High	Low	Moderate	Good, but costly
Foil tray / pack	High	Moderate	Low	Low to moderate	Moderate

C. Best-Performing Format

Across the 100 shops, the **kraft window box was found to be the best packaging format** for cookies. It outperformed the other formats on the overall assessment [add key figures, e.g. percentage of shops or mean score].

V. DISCUSSION

A. Why the Kraft Window Box Performed Best

The result can be explained by how well the kraft window box answers the main needs of cookie retail, in line with the deterioration mechanisms in Section II-C.

- **Physical protection.** The rigid board holds cookies in place and reduces breakage during handling and display.
- **Visibility without opening.** The window lets buyers see the actual product, which supports trust and impulse purchase.
- **Natural, eco-friendly image.** Kraft paper signals a natural, artisan product and matches growing interest in sustainable packaging.
- **Printability and branding.** Small producers can print a logo, ingredients and shelf-life details on the board at modest cost.
- **Gifting and display.** The box stacks neatly, presents well and works as a gift pack.
- **Recyclability.** The paper body can enter paper recycling, with the thin window film as the main complication.

B. Comparison with Other Materials

Film flow-wrap and tin gave the strongest barrier but lacked breakage protection or were too costly. Plastic jars protected well but were heavier, costlier and less sustainable. Pouches and paper bags were cheap but weak in protection and presentation. The kraft window box did not lead on any single property, but it gave the best balance across all criteria, which explains its overall ranking.

C. Practical and Sustainability Implications

For cookie makers selling through local shops with fast turnover, the kraft window box offers a practical, attractive and more sustainable option than plastic-based formats. Kraft board alone is a weaker moisture and oxygen barrier than metallised film, but this weakness is offset in local retail by quick stock turnover and can be reduced further with an inner liner. Where cookies must be stored for long periods or shipped over long distances, a barrier inner layer remains advisable.

D. Limitations

The study covers one town and a snapshot of retail practice, so results may not transfer directly to other regions, climates or supply chains. Barrier properties and shelf life were not measured in the laboratory, so the findings reflect overall suitability in retail use rather than a measured shelf-life advantage. [Add any limitations of your sampling or scoring method.]

E. Future Research

Future work should pair this field result with shelf-life testing of kraft window boxes with and without an inner liner, measuring water activity, texture, peroxide value and sensory quality under ambient and accelerated storage, together with transport breakage tests, consumer preference surveys, and a life cycle assessment that includes food waste. The same survey could be repeated in other towns and seasons.

VI. CONCLUSION

This study examined the packaging used for cookies in 100 shops in Sangamner, Maharashtra, and compared a range of materials including plastic pouches, film flow-wraps, plastic jars, cardboard boxes, paper bags, tins and foil packs. The kraft window box was found to be the best-performing format, combining physical protection, product visibility, branding opportunity and a sustainable image. Cookie sellers and producers in the region are recommended to adopt kraft window boxes, adding an inner liner where longer shelf life is required.

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REFERENCES

- [1] G. L. Robertson, *Food Packaging: Principles and Practice*. CRC Press.
- [2] R. Coles, D. McDowell, and M. J. Kirwan, Eds., *Food Packaging Technology*. Blackwell Publishing, 2003.
- [3] K. Marsh and B. Bugusu, "Food packaging: roles, materials, and environmental issues," *J Food Sci*, vol. 72, no. 3, pp. R39–R55, 2007.
- [4] D. Manley, *Technology of Biscuits, Crackers and Cookies*. Woodhead Publishing.

