BRIDGING EMOTIONAL PREFERENCE AND ENVIRONMENTAL ASPIRATION IN DODOL PACKAGING DESIGN THROUGH KANSEI ENGINEERING

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ABSTRACT

Dodol, a traditional Indonesian food product, faces persistent packaging challenges related to perceived safety, visual appeal, and environmental considerations. This study aims to bridge the gap between consumers' emotional preferences and environmental aspirations in Dodol packaging design through a Kansei Engineering-based approach. Consumer emotional responses were collected using Kansei words and analyzed through Principal Component Analysis (PCA) to identify dominant design concepts. Specific design elements were determined using the Quantification Theory Type I (QTT1) method. The results indicate that aluminum foil emerged as the preferred primary packaging material due to its strong emotional association with hygiene, safety, and product quality, while environmentally oriented alternatives such as commercial edible packaging were perceived as unfamiliar, expensive, and difficult to implement in small-scale industries. To address this gap, secondary packaging was strategically developed based on the Classic–Trendy design concept with art carton material, a rounded rectangular shape, a secure closure lock and drawer feature, a photo illustration, a full color composition, and an informative label. The environmental performance in this study is discussed from a design-oriented perspective and consumer perception, rather than from a quantitative environmental impact assessment. These findings demonstrate how secondary packaging design can mediate emotional acceptance and support environmental aspirations in traditional food packaging through Kansei Engineering.

Keywords: *Kansei Engineering; Packaging Design; Environmental Performance; Emotional Preference; Traditional Food Packaging*

1 INTRODUCTION

Local culinary heritage contributes significantly to cultural identity and sustainable economic development (Chukwurah et al., 2025). Dodol is a sweet treat recognized as a cultural heritage in several Southeast Asian countries, such as Indonesia, Singapore, Malaysia, Thailand, and the Philippines (Yeoh et al., 2024). In Indonesia, Dodol is an alternative souvenir product, but it's packaging often lacks attention to safety, visual appeal, and environmental considerations.

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One example is Dodol Picnic, a Garut specialty, which has been around since 1956 and has earned the Wonderful Indonesia Co-Branding award. Despite its strong brand and product quality, the design of its secondary and primary packaging still fails to optimally meet consumers' emotional needs. According to Yu et al (2024), strengthening brand identity, using more engaging visuals, and presenting information are crucial to increasing consumer interest and trust. These design elements serve as communication tools that convey the product's character. Furthermore, paper-based primary packaging often sticks to the product, causing a risk of ingestion, as shown in Figure 1. This can trigger the migration of chemicals in the ink, reducing food safety, and increasing the risk of health impacts (Seref & Cufaoglu, 2025). Beyond its protective function, packaging plays a crucial role as a communication tool. Research by Ooijen et al. (2017) found that packaging design elements influence conclusions about product quality. Meanwhile, research by Khan & Lee (2020) highlights packaging function as a communication medium that uses a universal language, proven to shape consumer perceptions across demographic groups.



Figure 1. Dodol Picnic product packaging and primary paper packaging that is often eaten

According to Sostar et al. (2025), research on consumer behavior in recent years has increasingly emphasized psychological and emotional factors that influence purchasing decisions. Two key components that significantly influence consumer perceptions of quality and preferences are packaging and branding. According to Lewis et al. (2014), emotions are the primary drivers influencing environmentally friendly purchasing decisions. This study examines consumers' emotional and rational evaluations of environmentally friendly packaging. The conceptual model combines individuals' general environmental concerns, their rational beliefs about the environmental impact of product consumption, and the emotions they evoke.

According to Sostar et al. (2025), the food and beverage industry faces the challenge of balancing consumer preferences for packaging with environmental responsibility. Packaging materials are generally associated with packaging sustainability and waste reduction. According to Atta-Delgado et al. (2024), despite increasing environmental awareness in packaging design, consumer acceptance of environmentally oriented packaging remains heavily influenced by emotional factors. However, these emotional drivers do not always align with environmentally friendly materials, creating considerations that require careful examination. This creates a gap between emotional preferences and environmental aspirations, particularly for traditional food packaging. Research focusing on comparing product acceptance from a design-oriented perspective and consumer perception is particularly interesting. According to Bou-Mitri et al. (2021), emotional responses related to perceived cleanliness, safety, and quality significantly influence consumer preferences. Kansei engineering provides an effective framework for exploring these considerations by revealing how consumers emotionally evaluate alternative packaging solutions (Gao et al., 2024).

Kansei Engineering integrates emotional responses into packaging development (Schütte et al., 2024). The advantage of Kansei Engineering lies in its ability to identify consumer needs through emotional and psychological aspects (Soenandi et al., 2021). A combination of Principal Component Analysis (PCA) and Quantification Theory Type 1 (QTT-1) methods is used to support the packaging development process. According to Ahmad et al. (2025), PCA helps interpret the emotional relationship of Kansei words more clearly based on respondents' responses. The QTT-1 method is used to analyze the relationship between packaging elements and the desired packaging concept (Nagamachi & Lokman, 2015). This study aims to bridge the gap between consumers' emotional preferences and environmental aspirations in Dodol packaging design through a Kansei Engineering-based approach.

2 METHOD

The research flow is shown in Figure 2 below.

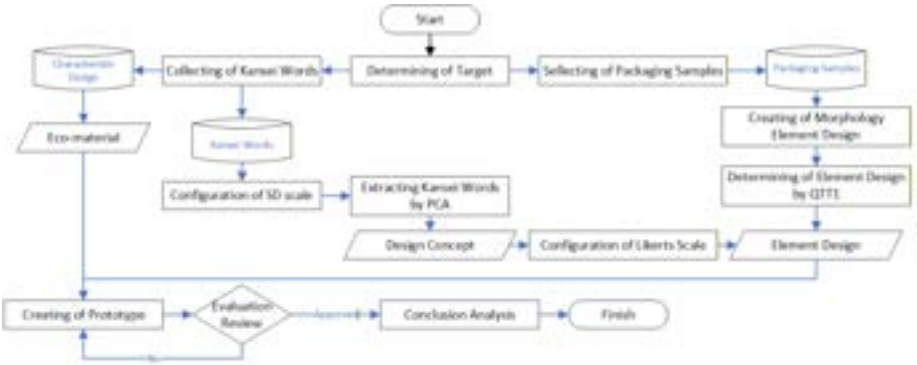


Figure 2. Process flow chart

The initial stage of collecting Kansei words from emotional respondents used an open-ended questionnaire with packaging sample stimuli (Mouludi & Sipahutar, 2024). Respondents were selected using purposive judgment sampling based on the criteria that they had previously consumed Dodol products and were familiar with packaged traditional foods. Participants consisted of males and females aged between 18 and 40 years totaling at least 30 respondents. According to Eltohamy et al. (2022), the sample size (n) was 30 based on the Central Limit Theorem (CLT), which shows a near-normal distribution of the mean for the appropriate parametric test. The obtained Kansei words were then identified as adjectives as Kansei words and non-adjectives as design characteristics (Chang et al., 2017). According to Nagamachi (2011), packaging samples were collected via the internet, with a minimum of 20-25 packaging samples and a minimum number of Kansei words of 30. The samples used were samples relevant to Dodol products (Papantonopoulos et al., 2021). The selection process was carried out by looking at similarities in terms of material, shape, design style, and size (Sari et al., 2024). According to Lin et al. (2022) , the obtained Kansei words were then examined for correlation with the selected samples using a semantic differential (SD) questionnaire with a 7-point scale. This scale is considered to have a good level of sensitivity. The questionnaire data results were then processed to determine Kansei word clusters as design concepts using the PCA method. According to Hasan & Abdulazeez (2021), this method is believed to be effective in reducing the dimensionality of

large data without losing information. The design concept will be assessed for correlation with the samples using a Likert questionnaire (Zuo & Wang, 2020). On the other hand, packaging samples will be identified based on the morphology of their design elements (Čok et al., 2022). The results of morphological identification and respondent perception data are synthesized using the QTT1 method (Zuo & Wang, 2020). This process will produce the most significant packaging design elements based on the design concept. The final stage is the creation of a prototype based on the results obtained and compared with alternative packaging prototypes that consider environmentally friendly materials. The results of this evaluation will indicate consumer acceptance preferences for packaging designs that prioritize emotional preferences or environmental aspirations.

3 RESULT AND DISCUSSION

3.1 Design Concept of Packaging

Initially, 80 packaging samples were obtained, which were then narrowed down to 75 distinct samples, as shown in Figure 3.



Figure 3. Packaging samples

Table 1 shows examples of Kansei words (adjectives) and design characteristics (non-adjectives) with the number of times they were used by respondents. A total of 44 Kansei word pairs and 24 design characteristics were selected from a pool of 328 words based on the emotional responses of the first 40 respondents.

Table 1. The example of Kansei words and design characteristics

Kansei Word	QTY	Design Characteristic	QTY
Design interprets “sweet”	34	Brown-colored design	32
Non-sticky primary packaging	33	Aluminum foil primary packaging	11
Design interprets “chewy”	25	Plastic primary packaging	10
.....	....	.....	....
.....	....	.....	....
Innovative	1	Handle feature	1
Modern	1	Window feature	1

The results of the PCA analysis are shown in Figure 4. According to Jollife & Cadima (2016), a high standard deviation value indicates that the variable or Kansei word has good quality to be retained. According to Ma et al. (2021), the principal components are retained if they have a

Cumulative Proportion of Variance of at least 80%. PC1 and PC2 have Cumulative Proportion of Variance standard deviation values of (8.3928; 93.92%) and (1.12336; 95.6%).

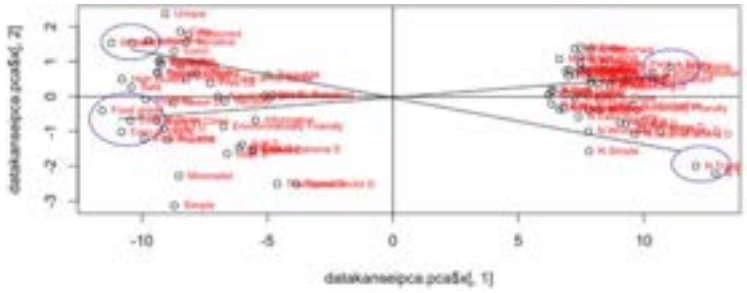


Figure 4. Plotting of Kansei word distribution using PCA

The concept is arranged based on a collection of Kansei words from each Main Component (PC) with the highest positive and negative values, or those at the very end of Figure 4. The positive side of PC 1 is the word "packaging that cannot be reused after being opened". In contrast, the negative side is the word "food-grade packaging that is easy to open and close, practical for storage, and easy to carry" so that the concept is concluded with the expert panelists' "cannot be reused" - "functional". The positive side of PC2 is the word "modern, attractive, and innovative design", while the negative side is the word "generic packaging appearance that reduces the unique characteristics of Dodol", so the concept is "trendy" - "classic".

3.2 Element Design Packaging

The morphological elements of the packaging sample in Figure 3 were identified through discussions with expert panelists in the field of packaging materials and design, as shown in Figure 5.

Element Design	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Element Design	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10	Type 11	Type 12
X1 Material primer	(GR, X1,1) Greaseproof paper	(GL, X1,2) Glassine paper	(I, X1,3) Ivory	(KR, X1,4) Kraft	(PP, X1,5) Polyprop ylene plastic	(MLP, X1,6) Multi layer plastic	(BP, X1,7) Blister pack	(AL, X1,8) Aluminium foil	(N, X1,9) Nothing	X2 Material sekunder	(I, X2,1) Ivory	(AC, X2,2) Art cartoon	(D, X2,3) Duplex	(CB, X2,4) Corrugated box	(PB, X2,5) Paperboard	(KR, X2,6) Kraft	(MLP, X2,7) Multiblayer paper	(PP, X2,8) Polyprop ylene plastic	(S, X2,9) Steel	(R, X2,10) Rattan		
X3 Design style	(N, X3,1) Natural	(F, X3,2) Fun	(T, X3,3) Traditional	(M, X3,4) Modern	(P, X3,5) Premium	(E, X3,6) Elegant	(Mi, X3,7) Minimalist	(S, X3,8) Simple		X4 Form primer	(S, X4,1) Sphere	(SC, X4,2) Square Cube	(R, X4,3) Rectangle	(H, X4,4) Hexagon	(T, X4,5) Triangle	(PY, X4,6) Pyramid	(PL, X4,7) Polygonal	(P, X4,8) Pouch	(C, X4,9) Candy	(U, X4,10) Umbrella	(N, X4,11) Nothing	
Element Design	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10	Type 11	Type 12	Type 13	Type 14	Type 15	Type 16	Type 17	Type 18	Type 19	Type 20		
X5 Form sekunder	(R, X5,1) Rectangle	(FR, X5,2) Flattened rectangle	(VR, X5,3) Vertical rectangle	(SC, X5,4) Square Cube	(FS, X5,5) Flattened Square	(RS, X5,6) Rounded square	(RFS, X5,7) Rounded flattened square	(P, X5,8) Pentagon	(H, X5,9) Hexagon	(PT, X5,10) Polygonal Tube	(GS, X5,11) Gem shape	(ATT, X5,12) Arch top tube	(C, X5,13) Cylinder	(PR, X5,14) Prism	(PU, X5,15) Purse	(B, X5,16) Bag	(SP, X5,17) Standing pouch	(FP, X5,18) Floral shape	(OS, X5,19) Organic shape	(CM, X5,20) Custom model		
Element Design	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Element Design	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Type 10	Type 11	
X6 Lid	(FT, X6,1) Flip Top	(TF, X6,2) Top Flap	(FTF, X6,3) Front Tuck Flap	(SF, X6,4) Special Flap	(EF, X6,5) Envelope Fold	(SL, X6,6) Slide lid	(FL, X6,7) Friction lock	(TP, X6,8) Two piece	(S, X6,9) Sealer	X7 Feature	(T, X7,1) Tray	(TW, X7,2) Tray & Window	(RW, X7,3) Rectangle window	(CW, X7,4) Circle window	(CUW, X7,5) Custom window	(DRW, X7,6) Drawer & Rectangle window	(DCW, X7,7) Drawer & Circle window	(D, X7,8) Drawer	(DO, X7,9) Dispenser drawer	(H, X7,10) Handle	(R, X7,11) Ribbon	(NF, X7,12) No feature
Element Design	Type 1	Type 2	Type 3	Element Design	Type 1	Type 2	Type 3	Type 4	Element Design	Type 1	Type 2	Type 3	Element Design	Type 1	Type 2	Type 3						
X8 Illustration	(P, X8,1) Photo	(I, X8,2) Illustration	(N, X8,3) Nothing	X9 Color	(FC, X9,1) Full colour	(W, X9,2) Warm	(N, X9,3) Neutral	(C, X9,4) Cool	X10 Printing technique	(NP, X10,1) No print	(DP, X10,2) Direct printing	(IP, X10,3) Indirect printing	X11 Information	(I, X11,1) Informative	(SI, X11,2) Semi informative	(U, X11,2) Uninformative						

Figure 5. The morphological elements design

The morphological results showed that there were 11 factors from X1-X11 with types from 1-20. Each sample in Figure 3 is analyzed by factor category and type according to the

morphological elements in Figure 5. For example, Sample B has a primary material of multi-layer plastic (6), secondary material is ivory (1), design style is natural (2), primary shape is square cube (2), secondary shape is prism (14), cover is slide (6), feature is drawer (8), has illustration (2), full color (1), printing technique is direct (2), and semi-informational (2). Meanwhile, the emotional results of respondents' perceptions from the Likert questionnaire had an average of 5.5 are shown in Table 2 below. The data is used to determine packaging design elements using the QTT1 method. Based on the R-square value from running QTT1, the Classic-Trendy concept (0.9994) has a greater value than Unreusable-Functional (0.9990). Figure 6 shows the design element results for the Classic-Trendy concept.

Table 2. Analysis of sample packaging elements and the results of respondents' emotional perceptions of the concept

Sample	Design Element											Classic-Trendy Value	
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	Mean	Std. Dev
A	5	1	2	3	2	1	12	2	1	2	1	6.7	0.70
B	6	1	2	2	14	6	8	2	1	2	2	5.5	1.26
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VVV	5	5	3	2	5	8	12	2	4	1	3	6.1	1.47
WWW	1	2	2	3	2	2	12	2	3	2	2	6.7	0.94

According to Sari et al. (2020), the selection of design elements is based on the longest histogram bar of each factor because it has the greatest influence on design perception.

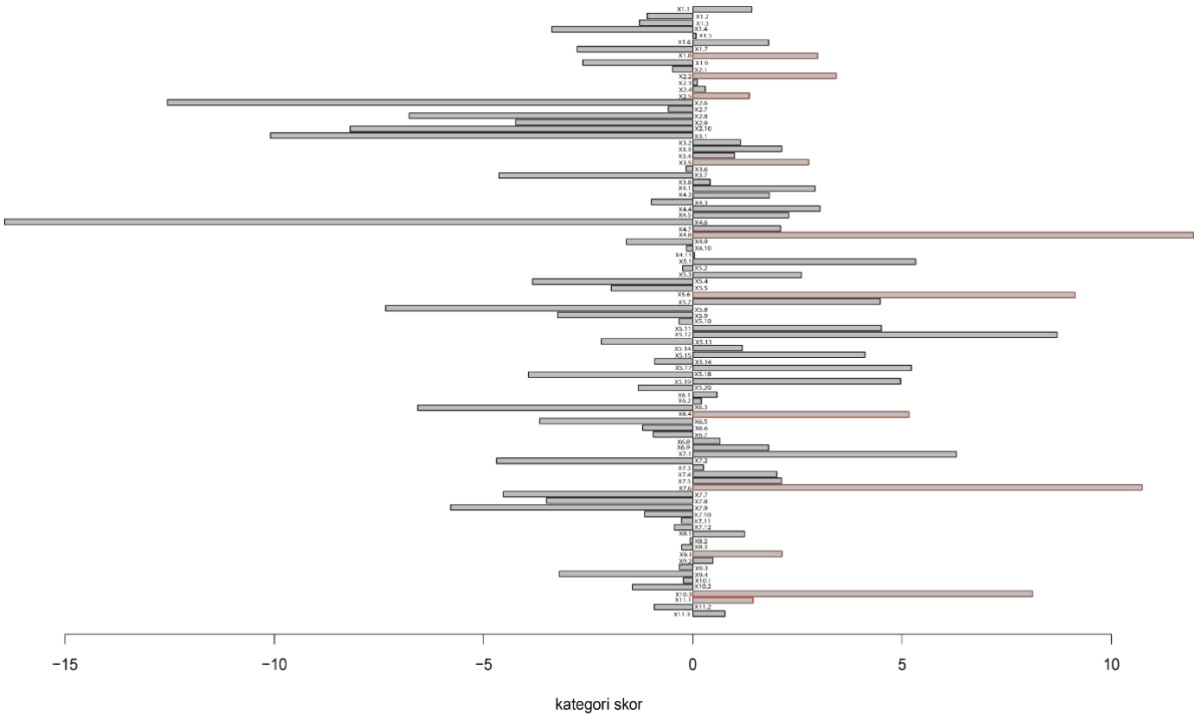


Figure 6. Design element results by QTT1

The 'Trendy' design element obtained primary packaging aluminum foil (X1.8), secondary material art carton (X2.2), premium design style (X3.5), primary packaging shape pouch (X4.8), secondary packaging shape round square (X5.6), special flap lock shape (X6.4), additional features

rectangular drawer (X7.6), photo illustration (X8.1), full color (X9.1), indirect printing technique (X10.3), and informative label design (X11.1).

3.3 Prototype

The resulting design elements align with the established concept, namely Trendy. The primary packaging material is aluminum foil (X1.8). This aligns with consumer emotions, as observed in the design characteristics in Table 1. Aluminum foil is the priority of material choice. According to Nugroho & Redjeki (2015), aluminum foil is considered aesthetic, safe, and hygienic. The secondary packaging material is art cardboard (X2.2), with the addition of a matte lamination touch, giving the product a trendy impression. The design style is achieved with a premium design style (X3.5) through the selection of serif fonts, namely "Bilderberg and TT Ramillas", which support a premium impression. According to Parra (2025), serif fonts are often used to support a premium impression. The gold color of the font also reinforces the premium impression (Sari et al., 2020). The main packaging form is a pouch (X4.8). This form is a new alternative to the main Dodol packaging. The pouch shape gives a trendy or modern impression (Wibowo et al., 2025). While the secondary packaging shape is a rounded square (X5.6), because the material chosen is art carton, the shape that can be implemented is close to a square. The chosen closing system is a special flap (X6.4). An additional feature is a rectangular drawer (X7.6). The use of photo illustrations (X8.1) in the packaging design can support a premium impression. Full color (X9.1) is implemented with a combination of pattern designs for a stronger premium style; the choice of dominant brown color on the outside is supported by the results of consumer emotions in the characteristic design in Table 1. This color is identical to the color of the Dodol product, which gives a distinctive impression. The combination of gold and minimalist design maintains the premium image of the packaging. The printing technique used is indirect printing (X10.3), and an informative design label (X11.1). All design elements are realized in the form of a 3D mockup as the final representation of the Trendy Dodol packaging concept using Adobe Illustrator and Blender. The mockup results for the trend concept are shown in Figure 7.



Figure 7. Prototype 3D

3.4 Evaluation of Environmental Performance

The final step is to evaluate the prototype results in Figure 7 against consumer perceptions. This research gap is addressed by measuring consumer perceptions of packaging design based on consumer emotional preferences and environmental aspirations through a Kansei Engineering-based approach. Packaging material is a key factor in supporting environmental sustainability. Eco-friendly packaging is highly valued. The results of this study indicate that the secondary packaging material is Art Carton, while the primary packaging material is aluminum foil. Research (Otto et al., 2021) indicates that natural assessments of consumer perceptions of environmental sustainability of paper/cardboard and metal materials are more in line with their impact on environmental sustainability. Eco-friendly packaging was simulated by substituting edible paper

for the primary Dodol packaging. This refers to the results of design characteristics where respondents proposed edible packaging. The survey was conducted with 20 respondents who had consumed Dodol using edible paper. The results showed a significant difference in consumer perceptions of aluminum foil and edible paper, with a significance level of 0.034 (<0.05) and the highest mean value for edible paper at 25.65. Therefore, it can be concluded that, based on consumer perception, edible paper has a higher environmental performance. However, consumer trust and a lack of understanding about edible packaging led to respondents' initial hesitation about the product. Consumers questioned the product's hygiene and the dangers of edible paper. This finding is consistent with research (Atta-Delgado et al., 2024), which showed that biodegradable packaging is widely accepted by respondents. However, the negative health impacts and lack of willingness to consume edible packaging reflect greater concerns about what consumers eat rather than the amount of food wasted. The solution is to provide clear information about the safety and benefits of packaging (Atta-Delgado et al., 2024). Consumers' perception of primary aluminum foil packaging conveys a premium, safe, and hygienic impression. This, in turn, creates consumer uncertainty in packaging choices. If consumers consider emotional environmental concerns, they will still choose recyclable packaging, but if they consider safety, they will choose aluminum foil. According to Nugroho & Redjeki (2015), the advantage of aluminum foil lies in its resistance to water vapor, gas, and physical and biological contamination. A'yun et al. (2023) explained that aluminum foil is more flexible, waterproof, airtight, heat-resistant, and non-toxic. From the overall consumer perception of the Dodol packaging redesigned with the Kansei Engineering approach, the packaging was very well received by respondents. All respondents tended to prefer the new packaging, which gives a premium impression. Based on data processing, there was a significant difference in respondents' perceptions of the old and new designs of 0.001 (<0.05), and the highest average value was found in the new secondary packaging design, namely 37.25. So, it can be concluded that in consumer perception, the new design is more attractive and increases purchasing demand compared to the old design. Emotional factors still play a role in consumer purchasing decisions. According to Koenig-Lewis et al (2014), emotions are the main drivers that influence decisions to purchase environmentally friendly products. This study evaluates environmental performance primarily from the perspective of consumer perception rather than through objective environmental assessment methods. Therefore, the findings should be interpreted as reflecting consumers' environmental aspirations and acceptance of packaging alternatives, rather than the actual environmental impacts of the materials. Future studies should integrate Life Cycle Assessment (LCA), carbon footprint analysis, or other quantitative sustainability assessment methods to provide a more comprehensive evaluation of packaging environmental performance.

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