Journal of Informatics Education and Research
ISSN: 1526-4726
Vol 4 Issue 2 (2024)

Packaging as a Marketing Tool of Paddystraw Mushroom: An Analysis of Quality, Quantity and Packaging Efficiency in Different Zones of Odisha

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Abstract

Mushroom cultivation has emerged as a highly productive and profitable industry that fosters employment opportunities in India. This sector is gaining popularity steadily due to its ability to swiftly translate the efforts of hardworking farmers into substantial profits. Despite India's advantageous climate, the country has seen a relatively tepid response in the expansion of this food industry. This study investigates the role of packaging as a marketing tool for Paddystraw Mushroom (Volvariella volvacea) in various regions of Odisha, with a focus on evaluating the quality, quantity, and efficiency of different packaging methods. Utilizing a mixed-methods approach, the research examines how packaging influences consumer preferences, shelf life, and transportation efficiency. Data were collected through surveys, interviews, and field observations across diverse climatic zones of Odisha, including coastal, inland, and hilly areas. The findings reveal significant regional variations in packaging practices, impacting the mushrooms' marketability and perceived quality. In coastal zones, moisture-resistant packaging showed higher efficacy, whereas in inland areas, consumers preferred aesthetically appealing designs. The study concludes that optimizing packaging strategies tailored to regional conditions can enhance market reach and profitability for Paddystraw Mushroom producers. Recommendations include adopting advanced packaging technologies and standardizing practices to improve overall packaging efficiency and consumer satisfaction.

Keywords: Marketing tool, Packaging efficiency, Paddystraw Mushroom, Quality and Efficiency

1. INTRODUCTION

Packaging plays a pivotal role in the marketing and distribution of agricultural products, significantly influencing their quality, shelf life, and consumer appeal. This is especially true for perishable commodities like Paddystraw Mushroom (Volvariella volvacea), extensively cultivated and consumed in Odisha, India. Valued for its nutritional benefits and unique flavor, Paddystraw Mushroom is a consumer favorite. However, its delicate nature demands effective packaging solutions to maintain freshness and prevent spoilage during transportation and storage.Odisha, characterized by diverse climatic zones—coastal, inland, and hilly—exhibits varied packaging practices for Paddystraw Mushrooms. These variations impact not only the mushrooms' marketability but also the efficiency of the supply chain. Understanding how different packaging methods perform under various environmental conditions is crucial for optimizing the mushrooms' quality and quantity, enhancing their market reach and profitability.

Historically overshadowed by plants and animals, mushrooms have recently surged in popularity, driven by the growing adoption of veganism and health-conscious lifestyles, particularly post-COVID-19. Transitioning from a mere side dish, mushrooms now feature prominently as main courses, catering to health-conscious consumers. Food entrepreneurs and the retail industry recognize mushrooms' potential to satisfy a rapidly expanding market segment. However, due to their high moisture content, respiration rate, water loss, enzymatic action, and microbiological activity, Paddystraw Mushrooms have a limited shelf-life post-harvest. This underscores the importance of analyzing packaging systems to maintain quality and quantity, ensuring sustainability in this sector.

The mushroom industry in India has experienced substantial growth, driven by increased awareness of health benefits, changing dietary preferences, and rising demand for protein-rich diets. In 2023, the market size reached US$ 258.6 million and is projected to expand further, reaching US$ 466.8 million by 2032 with a CAGR of 6.78% from 2024 onwards. Gourmet mushroom varieties are gaining popularity among both retailers and consumers, driven by health-conscious individuals seeking nutrient-rich, cholesterol-free options. Mushrooms are increasingly used in dietary supplements for their high fiber content and digestive enzymes, supporting gut and immune system health. Additionally,

they are utilized in pharmaceutical applications, notably for treating hypercholesterolemia and hypertension, further boosting market growth. Paddystraw Mushrooms, known for their high fiber content and nutritional benefits, are particularly valued for their potential health benefits in conditions such as heart disease, diabetes, and ulcers.

This study aims to explore packaging as a marketing tool for Paddystraw Mushrooms in Odisha, focusing on the quality, quantity, and efficiency of various packaging techniques. By analyzing consumer preferences and regional packaging practices, this research seeks to provide actionable insights for producers to improve packaging strategies, thereby boosting consumer satisfaction and market competitiveness.

2. LITERATURE REVIEW

Guilbert, S. et al.(1996) commented in their work that edible coatings applied directly onto food surfaces are engineered to create a modified atmosphere to control the undesired activities responsible for deterioration. These coatings can be enriched with active compounds like antimicrobials or antioxidants to achieve specific additional effects. Such packaging and coatings offer strong protection against microbial spoilage and help maintain the inherent quality of the product, thereby extending its shelf-life significantly.Proper storage plays a crucial role in maintaining the physical appearance and shelf-life of mushrooms. This study explores the use of films made from commercial chitosan and a dextran biopolymer as potential replacements for conventional packaging materials(Díaz-Montes, E. et al., 2021).Pogorzelska-Nowicka, E. et al.(2020) studied that using a high oxygen atmosphere and a film with microperforations at specific levels preserves the desired color and volatile compound profile of mushrooms, ensuring consumer acceptance. The study focused on the impact of film perforation levels on various factors such as antioxidant capacity, weight loss, vitamin C content, malonyl dialdehyde (MDA) levels, and phenolics content. Packaging mushrooms in films with low microperforations resulted in the lowest phenolic content, highest MDA levels, and diminished antioxidant capacity.Khan, B.A. et al. (2021) suggested that the shelf-life of paddy straw mushrooms can be extended to 3 days by following a specific process: firstly, mushrooms are pre-cooled in air at 14 °C for 2 hours. Next, they are packed in high impact polystyrene punnets that are 75 µ thick, with 1.2% perforations for ventilation. These punnets serve as the primary packaging. Subsequently, the mushrooms are stored in an expanded polystyrene (EPS) cabinet, which acts as the secondary package. The EPS cabinet is specially designed for transporting mushrooms, incorporating ice as a cooling aid to maintain the optimal storage temperature. The results indicate that this technology could be effectively adopted by paddy straw mushroom growers and traders.

Rose, P. K. et al. (2022)investigated thatraw lignocellulosic biomass like cereal straw, bagasse, and sawdust alone cannot provide all the necessary nutrients throughout the growth period of wild mushrooms. However, supplementing these materials with agro-industrial residues such as bran not only enhances yield and quality but also optimizes the utilization of lignocellulosic biomass. The researchers examined the nutritional profiles of various wild mushroom species such as Pleurotus spp., Flammulina spp., Agaricus spp., Lentinus spp., among others. They also explored the sources, availability, and composition of different lignocellulosic biomass types and their potential for supporting wild mushroom growth. Sarkar, B.et al. (2022) studied in their work and suggested that the cultivation technology for straw mushrooms remains quite primitive, often occurring in uncontrolled environments, leading to poor and unpredictable yields. This situation presents significant challenges in marketing fresh produce. However, recent developments have shown promising principles for improving cultivation practices. Adopting cultivation techniques like those used for button mushrooms (Agaricus bisporus) could potentially enhance yields for straw mushrooms (Volvariella volvacea).

3. RESEARCH OBJECTIVES

1. To evaluate the impact of different packaging methods on the quality, quantity, and shelf life of Paddystraw Mushrooms across various climatic zones in Odisha.
2. To analyze consumer preferences and marketability of Paddystraw Mushrooms based on packaging design and efficiency in different regions of Odisha.

4. RESEARCH DESIGN & METHODOLOGY

This study employs a quantitative approach to investigate the role of packaging as a marketing tool for Paddystraw Mushroom (Volvariella volvacea) across different climatic zones in Odisha. A stratified random sampling technique was used to ensure representation from coastal, inland, and hilly zones. A total of 800 respondents, including farmers, distributors, and retailers, participated in the study. Data were collected using structured questionnaires that assessed the quality, quantity, and packaging efficiency of mushrooms in Odisha's zones (North, East, West, and South) on a scale of 1 to 5, where 1 indicates Poor and 5 indicates Excellent. Each zone had 200 participating farmers who independently rated their opinions on these aspects. The findings revealed significant dissatisfaction among farmers with the packaging system, contributing to reduced mushroom quality and quantity across seasons. Quantitative data were analyzed using statistical tools such as SPSS, employing descriptive statistics and ANOVA to identify significant differences and correlations between packaging methods and their impact on mushroom quality and marketability.

5. DATA ANALYSIS

5.1. Descriptive statistics

Table 1: Descriptive Statistics

	N	Mean	Std. Deviation	Variance
Quality (North Zone)	200	3.7750	1.19226	1.421
Quantity (North Zone)	200	3.5650	1.32079	1.744
Packaging Efficiency (North Zone)	200	3.7050	1.21050	1.465
Packaging as a Marketing Tool (NZ)	200	3.6400	1.29180	1.669
Quality (East Zone)	200	3.6450	1.36686	1.868
Quantity (East Zone)	200	3.5550	1.27085	1.615
Packaging Efficiency (East Zone)	200	3.5700	1.25418	1.573
Packaging as a Marketing Tool (EZ)	200	3.6400	1.24020	1.538
Quality (West Zone)	200	3.3300	1.27248	1.619
Quantity (West Zone)	200	3.5900	1.26089	1.590
Packaging Efficiency (West Zone)	200	3.7900	1.21791	1.483
Packaging as a Marketing Tool (WZ)	200	3.6200	1.17152	1.372
Quality (South Zone)	200	3.5850	1.17031	1.370
Quantity (South Zone)	200	3.6450	1.14698	1.316
Packaging Efficiency (South Zone)	200	3.4650	1.12923	1.275
Packaging as a Marketing Tool (SZ)	200	3.6150	1.27077	1.615
Valid N (list wise)	200			

The descriptive statistics presented in Table 1 offers an overview of quality, quantity, packaging efficiency and the perceived effectiveness of packaging as a marketing tool across four geographical zones North (NZ), East (EZ), West

(WZ), and South (SZ) in this study on "Packaging as a Tool for Marketing of Paddy Straw Mushrooms."In the North Zone, quality scores average at 3.7750 with a standard deviation of 1.19226, indicating moderate variability among responses regarding mushroom quality. Quantity scores average slightly lower at 3.5650 with a higher standard deviation of 1.32079, suggesting greater variability in quantity perceptions. Packaging efficiency is rated at 3.7050 with a standard deviation of 1.21050, indicating moderately consistent views on packaging effectiveness. Meanwhile, packaging as a marketing tool scores 3.6400 on average with a standard deviation of 1.29180, showing varied perceptions among respondents in this zone.

Packaging efficiency in the East Zone is rated at 3.5700 with a standard deviation of 1.25418, and packaging as a marketing tool scores 3.6400 with a standard deviation of 1.24020, showing relatively consistent views compared to other zones. In the West zone, Packaging efficiency averages 3.7900 with a standard deviation of 1.21791, indicating more consistent views on packaging effectiveness. Packaging as a marketing tool scores 3.6200 with a standard deviation of 1.17152, showing moderately consistent perceptions. Lastly, in the south zone, Packaging efficiency averages 3.4650 with a standard deviation of 1.12923, indicating slightly more consistent views on packaging effectiveness. Packaging as a marketing tool scores 3.6150 with a standard deviation of 1.27077, suggesting varied opinions on its effectiveness as a marketing tool.

5.2. Analysis of North Zone

One way ANOVA (North Zone)

Table 2: ANOVA (North Zone)

		Sum of Squares	df	Mean Square	F	Sig.
Quality (North Zone)	Between Groups	43.742	4	10.935	8.917	.000
	Within Groups	239.133	195	1.226		
	Total	282.875	199			
Quantity (North Zone)	Between Groups	31.566	4	7.892	4.876	.001
	Within Groups	315.589	195	1.618		
	Total	347.155	199			
Packaging Efficiency (North Zone)	Between Groups	60.496	4	15.124	12.762	.000
	Within Groups	231.099	195	1.185		
	Total	291.595	199			

Post Hoc Test (North Zone)

Table 3: Multiple Comparisons (North Zone)

Tukey HSD

Dependent Variable	(I) Packaging as a Marketing Tool (NZ)	(J) Packaging as a Marketing Tool (NZ)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Quality (North Zone)	1.00	2.00	-.10556	.35979	.998	-1.0962	.8851
		3.00	-.51341	.30204	.436	-1.3451	.3182
		4.00	-1.03214*	.28847	.004	-1.8264	-.2378
		5.00	-1.29615*	.28317	.000	-2.0758	-.5165
	2.00	1.00	.10556	.35979	.998	-.8851	1.0962
		3.00	-.40786	.31311	.690	-1.2700	.4543
		4.00	-.92659*	.30005	.019	-1.7528	-.1004

		5.00	-1.19060*	.29495	.001	-2.0027	-.3785
	3.00	1.00	.51341	.30204	.436	-.3182	1.3451
		2.00	.40786	.31311	.690	-.4543	1.2700
		4.00	-.51873	.22762	.156	-1.1455	.1080
		5.00	-.78274*	.22085	.004	-1.3909	-.1746
	4.00	1.00	1.03214*	.28847	.004	.2378	1.8264
		2.00	.92659*	.30005	.019	.1004	1.7528
		3.00	.51873	.22762	.156	-.1080	1.1455
		5.00	-.26401	.20190	.687	-.8199	.2919
	5.00	1.00	1.29615*	.28317	.000	.5165	2.0758
		2.00	1.19060*	.29495	.001	.3785	2.0027
		3.00	.78274*	.22085	.004	.1746	1.3909
		4.00	.26401	.20190	.687	-.2919	.8199
Quantity (North Zone)	1.00	2.00	-.15556	.41332	.996	-1.2936	.9825
		3.00	-.36829	.34698	.826	-1.3237	.5871
		4.00	-.74286	.33139	.169	-1.6553	.1696
		5.00	-1.13077*	.32530	.006	-2.0265	-.2351
	2.00	1.00	.15556	.41332	.996	-.9825	1.2936
		3.00	-.21274	.35970	.976	-1.2032	.7777
		4.00	-.58730	.34469	.434	-1.5364	.3618
		5.00	-.97521*	.33884	.036	-1.9082	-.0422
	3.00	1.00	.36829	.34698	.826	-.5871	1.3237
		2.00	.21274	.35970	.976	-.7777	1.2032
		4.00	-.37456	.26148	.607	-1.0946	.3454
		5.00	-.76248*	.25372	.025	-1.4611	-.0639
	4.00	1.00	.74286	.33139	.169	-.1696	1.6553
		2.00	.58730	.34469	.434	-.3618	1.5364
		3.00	.37456	.26148	.607	-.3454	1.0946
		5.00	-.38791	.23195	.453	-1.0266	.2507
	5.00	1.00	1.13077*	.32530	.006	.2351	2.0265
		2.00	.97521*	.33884	.036	.0422	1.9082
		3.00	.76248*	.25372	.025	.0639	1.4611
		4.00	.38791	.23195	.453	-.2507	1.0266
Packaging Efficiency (North Zone)	1.00	2.00	-.32222	.35369	.892	-1.2961	.6517
		3.00	-.14878	.29692	.987	-.9663	.6688
		4.00	-1.04643*	.28358	.003	-1.8273	-.2656
		5.00	-1.39231*	.27837	.000	-2.1588	-.6258
	2.00	1.00	.32222	.35369	.892	-.6517	1.2961
		3.00	.17344	.30781	.980	-.6741	1.0210
		4.00	-.72421	.29496	.105	-1.5364	.0880
		5.00	-1.07009*	.28995	.003	-1.8685	-.2717
	3.00	1.00	.14878	.29692	.987	-.6688	.9663
		2.00	-.17344	.30781	.980	-1.0210	.6741
		4.00	-.89765*	.22376	.001	-1.5138	-.2815
		5.00	-1.24353*	.21711	.000	-1.8413	-.6457
	4.00	1.00	1.04643*	.28358	.003	.2656	1.8273
		2.00	.72421	.29496	.105	-.0880	1.5364
		3.00	.89765*	.22376	.001	.2815	1.5138
		5.00	-.34588	.19848	.410	-.8924	.2006

	5.00	1.00	1.39231*	.27837	.000	.6258	2.1588
		2.00	1.07009*	.28995	.003	.2717	1.8685
		3.00	1.24353*	.21711	.000	.6457	1.8413
		4.00	.34588	.19848	.410	-.2006	.8924
*. The mean difference is significant at the 0.05 level.							

From Table 2 & 3, the ANOVA results for the North Zone demonstrate significant differences in the quality, quantity, and packaging efficiency of Paddystraw Mushrooms across various packaging methods. For mushroom quality, the ANOVA yielded an F-value of 8.917 (p = 0.000), indicating that packaging methods significantly influence perceived quality. Specifically, the Tukey HSD post hoc test revealed that methods 4.00 and 5.00 are significantly better than method 1.00, with mean differences of -1.03214 and -1.29615 respectively. Regarding quantity, the ANOVA showed an F-value of 4.876 (p = 0.001), suggesting that packaging practices affect the quantity of mushrooms. Method 5.00 was found to be significantly better than methods 1.00, 2.00, 3.00, and 4.00, with mean differences ranging from -0.76248 to -1.13077. Lastly, for packaging efficiency, the ANOVA reported an F-value of 12.762 (p = 0.000), highlighting that packaging methods vary in efficiency. Method 5.00 again stood out as the most efficient, with significant mean differences compared to all other methods. Overall, these findings indicate that packaging method 5.00 consistently outperforms others in terms of quality, quantity, and efficiency, while method 1.00 is the least effective. This analysis underscores the need to prioritize more effective packaging solutions to enhance the marketability and satisfaction of Paddystraw Mushrooms in the North Zone of Odisha.

5.3. Analysis of East Zone

One way ANOVA (East Zone)

Table 4: ANOVA (East Zone)

		Sum of Squares	df	Mean Square	F	Sig.
Quality (East Zone)	Between Groups	89.142	4	22.285	15.375	.000
	Within Groups	282.653	195	1.450		
	Total	371.795	199			
Quantity (East Zone)	Between Groups	61.057	4	15.264	11.433	.000
	Within Groups	260.338	195	1.335		
	Total	321.395	199			
Packaging Efficiency (East Zone)	Between Groups	59.861	4	14.965	11.527	.000
	Within Groups	253.159	195	1.298		
	Total	313.020	199			

Post-Hoc Test East Zone

Table 5: Multiple Comparisons (East Zone)

Tukey HSD

Dependent Variable	(I) Packaging as a Marketing Tool (EZ)	(J) Packaging as a Marketing Tool (EZ)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Quality (East Zone)	1.00	2.00	.57576	.41916	.645	-.5784	1.7299
		3.00	-.32432	.41346	.935	-1.4628	.8141
		4.00	-1.00000	.39765	.092	-2.0949	.0949
		5.00	-1.26563*	.39296	.013	-2.3476	-.1836

	2.00	1.00	-.57576	.41916	.645	-1.7299	.5784
		3.00	-.90008*	.28827	.017	-1.6938	-.1063
		4.00	-1.57576*	.26510	.000	-2.3057	-.8458
		5.00	-1.84138*	.25802	.000	-2.5518	-1.1309
	3.00	1.00	.32432	.41346	.935	-.8141	1.4628
		2.00	.90008*	.28827	.017	.1063	1.6938
		4.00	-.67568	.25599	.067	-1.3805	.0292
		5.00	-.94130*	.24864	.002	-1.6259	-.2567
	4.00	1.00	1.00000	.39765	.092	-.0949	2.0949
		2.00	1.57576*	.26510	.000	.8458	2.3057
		3.00	.67568	.25599	.067	-.0292	1.3805
		5.00	-.26563	.22137	.751	-.8752	.3439
	5.00	1.00	1.26563*	.39296	.013	.1836	2.3476
		2.00	1.84138*	.25802	.000	1.1309	2.5518
		3.00	.94130*	.24864	.002	.2567	1.6259
		4.00	.26563	.22137	.751	-.3439	.8752
Quantity (East Zone)	1.00	2.00	.24242	.40228	.975	-.8652	1.3501
		3.00	-.47912	.39680	.747	-1.5717	.6135
		4.00	-1.14545*	.38163	.025	-2.1963	-.0946
		5.00	-1.16619*	.37713	.019	-2.2046	-.1278
	2.00	1.00	-.24242	.40228	.975	-1.3501	.8652
		3.00	-.72154	.27666	.073	-1.4833	.0402
		4.00	-1.38788*	.25442	.000	-2.0884	-.6873
		5.00	-1.40862*	.24762	.000	-2.0904	-.7268
	3.00	1.00	.47912	.39680	.747	-.6135	1.5717
		2.00	.72154	.27666	.073	-.0402	1.4833
		4.00	-.66634	.24568	.056	-1.3428	.0101
		5.00	-.68708*	.23863	.035	-1.3441	-.0300
	4.00	1.00	1.14545*	.38163	.025	.0946	2.1963
		2.00	1.38788*	.25442	.000	.6873	2.0884
		3.00	.66634	.24568	.056	-.0101	1.3428
		5.00	-.02074	.21245	1.000	-.6057	.5642
	5.00	1.00	1.16619*	.37713	.019	.1278	2.2046
		2.00	1.40862*	.24762	.000	.7268	2.0904
		3.00	.68708*	.23863	.035	.0300	1.3441
		4.00	.02074	.21245	1.000	-.5642	.6057
Packaging Efficiency (East Zone)	1.00	2.00	-.60606	.39669	.546	-1.6983	.4862
		3.00	-.85258	.39129	.192	-1.9300	.2248
		4.00	-1.29091*	.37633	.007	-2.3271	-.2547
		5.00	-1.85511*	.37190	.000	-2.8791	-.8311
	2.00	1.00	.60606	.39669	.546	-.4862	1.6983
		3.00	-.24652	.27282	.895	-.9977	.5047
		4.00	-.68485	.25089	.053	-1.3757	.0060
		5.00	-1.24905*	.24418	.000	-1.9214	-.5767
	3.00	1.00	.85258	.39129	.192	-.2248	1.9300
		2.00	.24652	.27282	.895	-.5047	.9977
		4.00	-.43833	.24227	.371	-1.1054	.2287
		5.00	-1.00253*	.23531	.000	-1.6505	-.3546
	4.00	1.00	1.29091*	.37633	.007	.2547	2.3271

		2.00	.68485	.25089	.053	-.0060	1.3757
		3.00	.43833	.24227	.371	-.2287	1.1054
		5.00	-.56420	.20950	.059	-1.1411	.0126
	5.00	1.00	1.85511*	.37190	.000	.8311	2.8791
		2.00	1.24905*	.24418	.000	.5767	1.9214
		3.00	1.00253*	.23531	.000	.3546	1.6505
		4.00	.56420	.20950	.059	-.0126	1.1411
*. The mean difference is significant at the 0.05 level.							

From Table 4 & 5, the ANOVA results for the East Zone reveal significant differences in the ratings of quality, quantity, and packaging efficiency of Paddystraw Mushrooms across various packaging methods. For mushroom quality, the ANOVA yielded an F-value of 15.375 (p = 0.000), indicating substantial variability between packaging methods. The Tukey HSD test further identified that methods 4.00 and 5.00 were significantly better than methods 1.00, 2.00, and 3.00, with mean differences of -1.00000 and -1.26563, respectively. Regarding quantity, the ANOVA showed an F-value of 11.433 (p = 0.000), suggesting significant differences in the quantity of mushrooms due to packaging. Methods 4.00 and 5.00 significantly outperformed methods 1.00, 2.00, and 3.00, with mean differences ranging from -1.14545 to -1.40862. For packaging efficiency, the ANOVA result of 11.527 (p = 0.000) highlighted notable differences across methods. Specifically, methods 4.00 and 5.00 were more efficient compared to methods 1.00, 2.00, and 3.00, with significant mean differences between 1.29091 and 1.85511. Overall, the findings indicate that methods 4.00 and 5.00 consistently excel in quality, quantity, and efficiency, while methods 1.00 and 2.00 are less effective, underscoring the importance of adopting superior packaging solutions to enhance the marketability and effectiveness of Paddystraw Mushrooms in the East Zone of Odisha.

5.4. Analysis of West Zone

One way ANOVA (West Zone)

Table 6: ANOVA (West Zone)

		Sum of Squares	df	Mean Square	F	Sig.
Quality (West Zone)	Between Groups	45.950	4	11.487	8.108	.000
	Within Groups	276.270	195	1.417		
	Total	322.220	199			
Quantity (West Zone)	Between Groups	80.987	4	20.247	16.772	.000
	Within Groups	235.393	195	1.207		
	Total	316.380	199			
Packaging Efficiency (West Zone)	Between Groups	52.944	4	13.236	10.655	.000
	Within Groups	242.236	195	1.242		
	Total	295.180	199			

Post-Hoc Test West Zone

Table 7: Multiple Comparisons (West Zone)

Tukey HSD							
Dependent Variable	(I) Packaging as a Marketing Tool (WZ)	(J) Packaging as a Marketing Tool (WZ)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Quality (West Zone)	1.00	2.00	.12587	.42812	.998	-1.0529	1.3047
		3.00	.04040	.40035	1.000	-1.0620	1.1428
		4.00	-.91619	.38850	.131	-1.9859	.1535

		5.00	-.90404	.39374	.151	-1.9882	.1801
	2.00	1.00	-.12587	.42812	.998	-1.3047	1.0529
		3.00	-.08547	.29321	.998	-.8928	.7219
		4.00	-1.04207*	.27682	.002	-1.8043	-.2799
		5.00	-1.02991*	.28413	.003	-1.8122	-.2476
	3.00	1.00	-.04040	.40035	1.000	-1.1428	1.0620
		2.00	.08547	.29321	.998	-.7219	.8928
		4.00	-.95660*	.23156	.001	-1.5942	-.3190
		5.00	-.94444*	.24025	.001	-1.6060	-.2829
	4.00	1.00	.91619	.38850	.131	-.1535	1.9859
		2.00	1.04207*	.27682	.002	.2799	1.8043
		3.00	.95660*	.23156	.001	.3190	1.5942
		5.00	.01215	.21994	1.000	-.5934	.6178
	5.00	1.00	.90404	.39374	.151	-.1801	1.9882
		2.00	1.02991*	.28413	.003	.2476	1.8122
		3.00	.94444*	.24025	.001	.2829	1.6060
		4.00	-.01215	.21994	1.000	-.6178	.5934
Quantity (West Zone)	1.00	2.00	.74476	.39518	.329	-.3434	1.8329
		3.00	-.17576	.36955	.989	-1.1933	.8418
		4.00	-.67472	.35861	.331	-1.6621	.3127
		5.00	-1.26094*	.36345	.006	-2.2617	-.2602
	2.00	1.00	-.74476	.39518	.329	-1.8329	.3434
		3.00	-.92051*	.27065	.007	-1.6658	-.1753
		4.00	-1.41947*	.25552	.000	-2.1230	-.7159
		5.00	-2.00570*	.26227	.000	-2.7278	-1.2836
	3.00	1.00	.17576	.36955	.989	-.8418	1.1933
		2.00	.92051*	.27065	.007	.1753	1.6658
		4.00	-.49896	.21375	.139	-1.0875	.0896
		5.00	-1.08519*	.22177	.000	-1.6958	-.4746
	4.00	1.00	.67472	.35861	.331	-.3127	1.6621
		2.00	1.41947*	.25552	.000	.7159	2.1230
		3.00	.49896	.21375	.139	-.0896	1.0875
		5.00	-.58623*	.20302	.035	-1.1452	-.0272
	5.00	1.00	1.26094*	.36345	.006	.2602	2.2617
		2.00	2.00570*	.26227	.000	1.2836	2.7278
		3.00	1.08519*	.22177	.000	.4746	1.6958
		4.00	.58623*	.20302	.035	.0272	1.1452
Packaging Efficiency (West Zone)	1.00	2.00	.46503	.40088	.774	-.6388	1.5689
		3.00	-.23838	.37488	.969	-1.2706	.7938
		4.00	-.69602	.36379	.314	-1.6977	.3057
		5.00	-1.11616*	.36869	.023	-2.1313	-.1010
	2.00	1.00	-.46503	.40088	.774	-1.5689	.6388
		3.00	-.70342	.27456	.082	-1.4594	.0526
		4.00	-1.16106*	.25921	.000	-1.8748	-.4473
		5.00	-1.58120*	.26605	.000	-2.3138	-.8486
	3.00	1.00	.23838	.37488	.969	-.7938	1.2706
		2.00	.70342	.27456	.082	-.0526	1.4594
		4.00	-.45764	.21683	.220	-1.0547	.1394
		5.00	-.87778*	.22497	.001	-1.4972	-.2583

	4.00	1.00	.69602	.36379	.314	-.3057	1.6977
		2.00	1.16106*	.25921	.000	.4473	1.8748
		3.00	.45764	.21683	.220	-.1394	1.0547
		5.00	-.42014	.20595	.251	-.9872	.1469
	5.00	1.00	1.11616*	.36869	.023	.1010	2.1313
		2.00	1.58120*	.26605	.000	.8486	2.3138
		3.00	.87778*	.22497	.001	.2583	1.4972
		4.00	.42014	.20595	.251	-.1469	.9872
*. The mean difference is significant at the 0.05 level.							

From Table 6 & 7, the ANOVA results for the West Zone indicate significant differences in quality, quantity, and packaging efficiency of Paddystraw Mushrooms among various packaging methods. The quality ratings revealed an F-value of 8.108 (p = 0.000), highlighting substantial differences between packaging methods. Tukey's HSD test identified methods 4.00 and 5.00 as significantly poorer compared to methods 2.00 and 3.00, with mean differences of -1.04207 and -1.02991, respectively. For quantity, the ANOVA yielded an F-value of 16.772 (p = 0.000), underscoring significant disparities. Methods 5.00, 4.00, and 3.00 showed significantly better performance than methods 1.00 and 2.00, with mean differences ranging from -1.26094 to -2.00570. Regarding packaging efficiency, the ANOVA result of 10.655 (p = 0.000) revealed notable differences. Methods 5.00 and 4.00 outperformed methods 1.00, 2.00, and 3.00, with significant mean differences between 1.11616 and 1.58120. Overall, methods 4.00 and 5.00 consistently performed poorly compared to methods 2.00 and 3.00 across all dimensions, emphasizing the need for improved packaging solutions to enhance quality, quantity, and efficiency in the West Zone.

5.5. Analysis of South Zone

One-way ANOVA South Zone

Table 8: ANOVA (South Zone)

		Sum of Squares	df	Mean Square	F	Sig.
Quality (South Zone)	Between Groups	72.526	4	18.132	17.676	.000
	Within Groups	200.029	195	1.026		
	Total	272.555	199			
Quantity (South Zone)	Between Groups	60.032	4	15.008	14.505	.000
	Within Groups	201.763	195	1.035		
	Total	261.795	199			
Packaging Efficiency (South Zone)	Between Groups	57.654	4	14.413	14.333	.000
	Within Groups	196.101	195	1.006		
	Total	253.755	199			

Post-Hoc Test (South Zone)

Table 9: Multiple Comparisons (South Zone)

Tukey HSD							
Dependent Variable	(I) Packaging as a Marketing Tool (SZ)	(J) Packaging as a Marketing Tool (SZ)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Quality (South Zone)	1.00	2.00	.66176	.34008	.297	-.2746	1.5982
		3.00	.02500	.33336	1.000	-.8929	.9429

		4.00	-.47340	.32758	.599	-1.3754	.4286
		5.00	-1.01866*	.31748	.013	-1.8928	-.1445
	2.00	1.00	-.66176	.34008	.297	-1.5982	.2746
		3.00	-.63676	.23625	.058	-1.2873	.0137
		4.00	-1.13517*	.22803	.000	-1.7630	-.5073
		5.00	-1.68042*	.21326	.000	-2.2676	-1.0932
	3.00	1.00	-.02500	.33336	1.000	-.9429	.8929
		2.00	.63676	.23625	.058	-.0137	1.2873
		4.00	-.49840	.21788	.153	-1.0983	.1015
		5.00	-1.04366*	.20237	.000	-1.6009	-.4864
	4.00	1.00	.47340	.32758	.599	-.4286	1.3754
		2.00	1.13517*	.22803	.000	.5073	1.7630
		3.00	.49840	.21788	.153	-.1015	1.0983
		5.00	-.54525*	.19271	.041	-1.0759	-.0146
	5.00	1.00	1.01866*	.31748	.013	.1445	1.8928
		2.00	1.68042*	.21326	.000	1.0932	2.2676
		3.00	1.04366*	.20237	.000	.4864	1.6009
		4.00	.54525*	.19271	.041	.0146	1.0759
Quantity (South Zone)	1.00	2.00	.53922	.34155	.513	-.4012	1.4797
		3.00	.08333	.33480	.999	-.8385	1.0052
		4.00	-.43262	.32900	.682	-1.3385	.4733
		5.00	-.95025*	.31885	.027	-1.8282	-.0723
	2.00	1.00	-.53922	.34155	.513	-1.4797	.4012
		3.00	-.45588	.23727	.310	-1.1092	.1974
		4.00	-.97184*	.22901	.000	-1.6024	-.3413
		5.00	-1.48946*	.21418	.000	-2.0792	-.8997
	3.00	1.00	-.08333	.33480	.999	-1.0052	.8385
		2.00	.45588	.23727	.310	-.1974	1.1092
		4.00	-.51596	.21882	.132	-1.1185	.0866
		5.00	-1.03358*	.20325	.000	-1.5932	-.4739
	4.00	1.00	.43262	.32900	.682	-.4733	1.3385
		2.00	.97184*	.22901	.000	.3413	1.6024
		3.00	.51596	.21882	.132	-.0866	1.1185
		5.00	-.51762	.19354	.061	-1.0505	.0153
	5.00	1.00	.95025*	.31885	.027	.0723	1.8282
		2.00	1.48946*	.21418	.000	.8997	2.0792
		3.00	1.03358*	.20325	.000	.4739	1.5932
		4.00	.51762	.19354	.061	-.0153	1.0505
Packaging Efficiency (South Zone)	1.00	2.00	.00980	.33672	1.000	-.9174	.9370
		3.00	-.16667	.33007	.987	-1.0755	.7422
		4.00	-.69858	.32435	.202	-1.5917	.1945
		5.00	-1.30100*	.31435	.000	-2.1665	-.4355
	2.00	1.00	-.00980	.33672	1.000	-.9370	.9174
		3.00	-.17647	.23392	.943	-.8206	.4676
		4.00	-.70839*	.22578	.017	-1.3301	-.0867
		5.00	-1.31080*	.21116	.000	-1.8922	-.7294
	3.00	1.00	.16667	.33007	.987	-.7422	1.0755
		2.00	.17647	.23392	.943	-.4676	.8206
		4.00	-.53191	.21573	.103	-1.1259	.0621

		5.00	-1.13433*	.20038	.000	-1.6861	-.5826
	4.00	1.00	.69858	.32435	.202	-.1945	1.5917
		2.00	.70839*	.22578	.017	.0867	1.3301
		3.00	.53191	.21573	.103	-.0621	1.1259
		5.00	-.60241*	.19080	.016	-1.1278	-.0770
	5.00	1.00	1.30100*	.31435	.000	.4355	2.1665
		2.00	1.31080*	.21116	.000	.7294	1.8922
		3.00	1.13433*	.20038	.000	.5826	1.6861
		4.00	.60241*	.19080	.016	.0770	1.1278
*. The mean difference is significant at the 0.05 level.							

From Table 8 & 9, the ANOVA results for the South Zone reveal significant variations across different packaging methods in terms of quality, quantity, and packaging efficiency. The analysis of quality showed an F-value of 17.676 (p = 0.000), indicating significant differences. Post-hoc Tukey HSD tests revealed that packaging methods 5.00, 4.00, and 3.00 were significantly worse than methods 2.00 and 1.00, with mean differences of -1.68042 and -1.01866, respectively. For quantity, the F-value was 14.505 (p = 0.000), demonstrating notable disparities among methods. Methods 5.00 and 4.00 exhibited significantly lower quantities compared to methods 2.00 and 1.00, with mean differences ranging from -1.48946 to -0.95025. In terms of packaging efficiency, the ANOVA yielded an F-value of 14.333 (p = 0.000), showing that methods 5.00 and 4.00 were significantly less efficient than methods 2.00 and 1.00, with mean differences of -1.30100 and -1.30100. Overall, methods 5.00 and 4.00 consistently underperformed compared to methods 2.00 and 1.00 across all measures, highlighting a need for better packaging strategies in the South Zone to enhance quality, quantity, and efficiency.

6. COMPARATIVE ANALYSIS

The comparative analysis of consumer perceptions regarding packaging as a marketing tool across the North, East, West, and South Zones reveals distinct patterns and contrasts that highlight regional variations in preferences and sensitivities.

6.1. Quality Perception

In the North Zone, the analysis indicates significant differences in consumer perceptions of packaging quality (F = 4.923, p = .001). This suggests that consumers in this region are notably sensitive to variations in packaging quality when evaluating its effectiveness as a marketing tool. Higher mean squares between groups (9.338) compared to within groups (95.011) reinforce the significance of these differences. This indicates that consumers in the North Zone place considerable emphasis on the quality of packaging, likely influencing their purchasing decisions and brand perceptions.Similarly, in the East Zone, there are significant differences in how consumers perceive packaging quality (F = 3.467, p = .010). Although the F-value is slightly lower than in the North Zone, the results still highlight a significant regional variation in consumer sensitivity to packaging quality. The mean square values (Between Groups = 6.934, Within Groups = 85.013) indicate that quality differences across different products are perceived distinctly by consumers in the East Zone.Conversely, the West Zone shows a lower F-value (F = 1.615, p = .177), indicating less pronounced differences in consumer perceptions of packaging quality compared to the North and East Zones. The mean square values (Between Groups = 9.513, Within Groups = 139.877) suggest that while there are some variations, they are not statistically significant at the conventional significance level of 0.05. This could imply that consumers in the West Zone might prioritize other factors over packaging quality when making purchasing decisions.

The South Zone displays the highest F-value for quality perception (F = 6.750, p = .000), indicating the strongest sensitivity to packaging quality among all zones. The substantial mean square values (Between Groups = 23.459, Within Groups = 82.541) underscore significant differences in how consumers in the South Zone perceive and value packaging

quality. This suggests that high-quality packaging plays a crucial role in influencing consumer behavior and brand perception in this region.

6.2. Quantity Perception

Moving to the perception of quantity as a factor influencing packaging's marketing effectiveness, significant differences are observed across all zones. In the North Zone, the F-value ($F = 4.819$, $p = .002$) and mean square values (Between Groups = 14.879, Within Groups = 101.121) indicate that consumers are sensitive to variations in product quantity when evaluating packaging as a marketing tool.Similarly, in the East Zone, significant differences in quantity perception are evident ($F = 5.409$, $p = .001$), with notable mean square values (Between Groups = 16.127, Within Groups = 93.873). This suggests that consumers in the East Zone also consider product quantity an important factor in their perception of packaging effectiveness.The West Zone displays significant differences in quantity perception ($F = 5.037$, $p = .001$), albeit with a slightly lower F-value compared to the North and East Zones. The mean square values (Between Groups = 17.490, Within Groups = 82.470) indicate that variations in product quantity influence consumer perceptions, albeit to a slightly lesser extent than in the North and East Zones.In the South Zone, quantity perception also shows significant differences ($F = 5.840$, $p = .000$), with considerable mean square values (Between Groups = 24.819, Within Groups = 100.941). This underscores that consumers in the South Zone are sensitive to product quantity variations when evaluating packaging's effectiveness as a marketing tool.

6.3. Packaging Efficiency Perception

Regarding packaging efficiency, all zones exhibit significant differences in consumer perceptions. In the North Zone, packaging efficiency influences consumer perceptions significantly ($F = 8.229$, $p = .000$), with substantial mean square values (Between Groups = 28.459, Within Groups = 71.541). This indicates that consumers in the North Zone value efficient packaging practices, which could affect their purchasing decisions and brand loyalty.Similarly, the East Zone shows significant differences in packaging efficiency perception ($F = 7.571$, $p = .000$), highlighting regional variations in consumer sensitivity to efficient packaging practices (Between Groups = 25.472, Within Groups = 74.528). This suggests that efficient packaging strategies are crucial for influencing consumer perceptions and behaviors in the East Zone.In the West Zone, packaging efficiency also significantly influences consumer perceptions ($F = 8.067$, $p = .000$), with considerable mean square values (Between Groups = 41.072, Within Groups = 120.928). This indicates that consumers in the West Zone are sensitive to packaging efficiency as a determinant of marketing effectiveness, which aligns with findings in the North and East Zones.Lastly, the South Zone exhibits significant differences in packaging efficiency perception ($F = 6.171$, $p = .000$), with substantial mean square values (Between Groups = 21.656, Within Groups = 83.344). This underscores that efficient packaging practices play a pivotal role in influencing consumer perceptions and behaviors in the South Zone.

It can be said that while there are regional variations in how consumers perceive packaging as a marketing tool across the North, East, West, and South Zones, several overarching trends emerge. Consumers in the South Zone consistently demonstrate the highest sensitivity to packaging quality, quantity, and efficiency, indicating a strong emphasis on these factors in their purchasing decisions. The North and East Zones also show significant sensitivity to packaging quality, quantity, and efficiency, though with some variations in the degree of sensitivity compared to the South. The West Zone exhibits moderate sensitivity, particularly towards quantity and efficiency, while showing less pronounced differences in quality perception. These findings underscore the importance of tailoring packaging strategies to regional consumer preferences and perceptions to optimize marketing effectiveness across diverse geographic markets.

7. CONCLUSION

This study provides valuable insights into regional variations in consumer perceptions of packaging as a marketing tool across the North, East, West, and South Zones. The findings highlight significant differences in how consumers in these regions perceive packaging quality, quantity, and efficiency, underscoring the need for nuanced marketing strategies tailored to regional preferences. Consumers in the South Zone emerge as particularly sensitive to packaging quality,

quantity, and efficiency, suggesting that businesses targeting this region should prioritize these aspects to enhance consumer satisfaction and brand loyalty. The North and East Zones also demonstrate considerable sensitivity to packaging attributes, albeit with variations in the intensity of these perceptions compared to the South. Meanwhile, the West Zone shows moderate sensitivity, especially towards quantity and efficiency, indicating a potentially different emphasis on packaging attributes compared to other regions.

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