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Standardization of *Todedevu*: A malnad delicacy of Karnataka

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Abstract
The growing interest in functional and traditional foods has encouraged the development of millet-based value-added products. This study aimed that standardize *Todedevu*, a traditional sweet from the Malnad region of Karnataka, by incorporating different millets as substitutes for rice. Six formulations (T_1-T_6) were prepared using foxtail millet, finger millet, pearl millet, and little millet in varying blends. Sensory evaluation was carried out by a semi-trained panel using a 9-point hedonic scale for taste, aroma, texture, colour, and overall acceptability. Statistical analysis was performed using mean, standard deviation (SD), and Completely Randomized Design (CRD). Among the formulations, little millet-based *Todedevu* (T_5) recorded the highest acceptability scores across sensory parameters. To study storage stability, the best-accepted formulations were packed in High-Density Polyethylene (HDPE) bags and laminated pouches. Results revealed that laminated pouches retained sensory qualities better than HDPE bags during storage. The findings suggest that millet incorporation enhances the nutritional and sensory quality of *Todedevu*, while suitable packaging further extends its shelf-life, making it a promising functional traditional sweet for modern consumers.

Keywords: *Todedevu*, millets, jaggery, cardamom, sensory evaluation, traditional sweet

1. Introduction
Food is one of the most powerful expressions of cultural identity, heritage, and social belonging. Traditional foods, in particular, represent the accumulated wisdom of communities in utilizing local resources not only to satisfy hunger but also to maintain health and well-being. These foods have evolved over generations, shaped by climate, agriculture, and social practices, and they continue to hold symbolic value in festivals, rituals, and community gatherings. Unlike modern processed foods, traditional preparations are usually made with natural, minimally refined ingredients, offering a balance of nutrition, taste, and cultural continuity (Singh *et al*., 2023; Kaur and Kapoor, 2022) [17, 9].

Among Karnataka's traditional foods, *Todedevu* is a unique sweet from the Malnad region, commonly prepared by Havyaka Brahmin communities of Sirsi in Uttara Kannada. The sweet is traditionally made from soaked rice, rice flour, and jaggery, with optional flavouring agents such as cardamom or turmeric. The mixture is processed into thin, delicate sheets reminiscent of Andhra Pradesh's *Putharekulu* (Sivamma & Jagannadha Rao, 2023) [18], but *Todedevu* maintains its distinct identity. It is consumed during festivals, weddings, and household functions, often served with ghee or milk to enhance taste and aroma. *Todedevu* can be stored for months without losing quality, making it a convenient snack. Modern variations incorporate nutrient-rich millets and other functional ingredients to enhance nutritional and sensory properties. The study of *Todedevu* is important not only for documenting a fading culinary tradition but also for reimagining it in line with current nutritional priorities (Reddy *et al*., 2021; Patel *et al*., 2020) [15, 13].

The three core ingredients rice, millets, and jaggery each bring cultural, agricultural, and nutritional significance. Rice, a staple for millions, provides structure and energy. (Chaudhary *et al*., 2019) [3]. Millets, known as "nutri-cereals," enrich the preparation with dietary fibre and micronutrients, while jaggery, a natural sweetener, contributes taste, minerals, and functional health benefits. The integration of these ingredients creates a product that embodies both tradition and health, making *Todedevu* an excellent subject for research and development in food science. Rice cultivation thrives in Karnataka's Malnad region due to favourable rainfall and soil conditions. Nutritionally, rice is carbohydrate-rich

(75-80%), contains 6-8% protein, and supplies B-vitamins and minerals (Dhyani *et al*., 2025) [4]. Less-processed varieties retain fibre and micronutrients, further improving the health profile (Gopalan *et al*., 2004) [7].

Millets, once the backbone of Indian agriculture, declined in popularity after the Green Revolution but are now regaining attention for their impressive nutritional profile and climate resilience (Devi *et al*., 2021) [5]. They include finger millet (ragi), foxtail millet (navane), pearl millet (sajje), little millet (samai), barnyard millet, proso millet, and kodo millet. These grains grow well in poor soils, require minimal irrigation, and are resistant to pests, making them suitable for sustainable farming systems (ICRISAT, 2018) [8]. Nutrient-dense and gluten-free, they contain high levels of dietary fibre, protein, and micronutrients (Shobana and Malleshi, 2007) [16]. They also regulate blood sugar, support digestion, and provide antioxidants, making them ideal for functional traditional sweets (Tiwari *et al*., 2025; FAO, 2023) [19, 6].

Jaggery, an unrefined sweetener derived from sugarcane or palm sap, enhances both flavour and nutrition. Rich in minerals such as iron, magnesium, potassium, and calcium, it also provides antioxidants and releases energy slowly, complementing *Todedevu* functional value (Rao *et al*., 2007) [14].

In this context, an attempt was made to enrich traditional recipe of preparation of *Todedevu* by incorporating millets and the sensory analysis was done to know the best accepted product.

2. Materials and Methods

2.1 Procurement of Raw materials

Raw materials such as rice, rice flour, jaggery, cardamom, and four types of millets finger millet, foxtail millet, pearl millet, and little millet were procured from local markets in Shivamogga. These ingredients are locally available and commonly used in traditional sweet preparations. The use of millets helps to enhance the nutritional quality while retaining the cultural authenticity of the *Todedevu* sweet.

2.2 Enrichment of the product

Enrichment of *Todedevu* was carried out by modifying the traditional recipe, similar to the technique used in making Putharekulu, a thin paper-like sweet from Andhra Pradesh. *Todedevu* was traditionally prepared and the recipe is from community preliminary trials were conducted for millet incorporation. In the traditional recipe raw rice and rice flour are taken in 60g: 120 g (T_1). Further, after incorporating different millets based on preliminary trials the proportion of raw rice, rice flour and finger millet was10g:50g: 120g (T_2). For T_3 the proportion of raw rice, rice flour and fox millet was10g:50g: 120g. For T_4 the proportion of raw rice, rice flour and pearl millet was10g:50g: 120g. For T_5 the proportion of raw rice, rice flour and little millet was10g:50g: 120g. For T_6 the proportion of raw rice, rice flour, finger millet, foxtail millet, pearl millet and little millet was10g:50g:30g:30g:30g:30g respectively. The product was optimized by incorporating millet blends along with rice to enhance its nutritional profile. For all the treatments jaggery and cardamom were constant. The details of the treatment used in the study are presented in table 1.

Table 1: Treatments formulated for *Todedevu* preparation

Treatments	Raw rice(g)	Rice flour(g)	Finger Millet (Ragi) (g)	Foxtail millet (Navane) (g)	Pearl millet (Sajje) (g)	Little millet (Same) (g)	Jaggery (g)	Cardamom (g)
T1(control)	60	120	-	-	-	-	150	1
T2	10	50	120	-	-	-	150	1
T3	10	50	-	120	-	-	150	1
T4	10	50	-	-	120	-	150	1
T5	10	50	-	-	-	120	150	1
T6	10	50	30	30	30	30	150	1

Preparation Method

The process of preparing *Todedevu* involves distinct stages begins with soaking cleaned rice and selected millets such as finger millet, foxtail millet, pearl millet, and little millet for about 6-8 hours to soften the grains. after which the water is discarded and the grains are rinsed thoroughly. The soaked grains are then ground in a wet grinder to obtain a smooth batter, to which rice flour is added for adjusting consistency. Freshly grated jaggery is incorporated directly into the batter and ground until it completely dissolves, followed by the addition of cardamom to enhance flavour and aroma. For cooking, a round-bottom earthen pot is placed in an inverted position over the stove, lightly heated, and greased with sunflower or castor oil to prevent sticking. The cooking surface is maintained at 120-135 °C to ensure uniform heating. A clean muslin cloth tied to a wooden stick is dipped in the batter and carefully dabbed onto the hot surface to create a thin, translucent sheet, which is cooked for 2-3 minutes. The sheet is then gently lifted with a spatula or stick, cooled, and lightly roasted. Finally, it is folded into a rectangular shape, packed in suitable packaging material, and stored in an airtight container to preserve freshness.

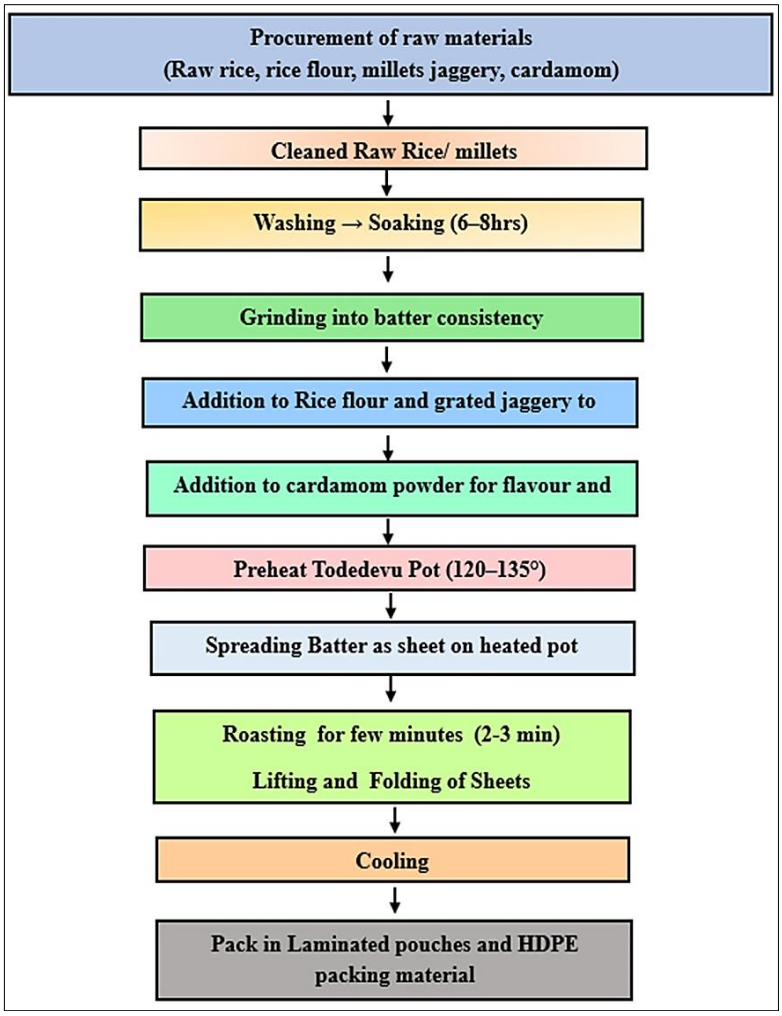

Fig 1: Flow Chart for Preparation of *Todedevu*

2.3 Sensory evaluation

The sensory quality of *Todedevu* was evaluated using a 9-point hedonic scale assessing colour, texture, aroma, taste, and overall acceptability.

A panel of 15 semi-trained participants was selected, including faculty and post-graduate students from the Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga. The panel consisted of 8 females and 7 males, aged 21-50 years.

Panellists were familiarized with the appearance, texture, colour, taste, flavour, and overall quality before evaluation. A maximum of two samples were presented at a time, and panelists were advised to cleanse their palate between samples.

Sensory scores were assigned based on a 9-point hedonic scale:

9 - Like extremely, 8 - Like very much, 7 - Like moderately, 6 - Like slightly, 5 - Neither like nor dislike, 4 - Dislike slightly, 3 - Dislike moderately, 2 - Dislike very much,1 - Dislike extremely (Annexure-I)

Each judge gave scores for all sensory attributes, and the average scores were calculated. The results were analysed to identify the best *Todedevu* variant based on sensory preferences.

2.4 Packaging materials

The prepared *Todedevu* samples were packed in two types of packaging materials:

- **HDPE bags:** cost-effective, transparent, lightweight.
- **Laminated pouches:** multi-layered packaging with moisture and oxygen barrier properties.

2.5 Shelf life study of developed products at ambient temperature

The best product based on sensory evaluation was taken for the shelf life study. The product was packed in HDPE and Laminated pouches and stored at ambient temperature (30±10 **°C**) for 3 months. Sample was drawn at monthly intervals and analysed for sensory quality parameters.

2.5 Statistical analysis

Statistical analysis was carried out to evaluate the effect of different parameter on the south Indian snack - *Todedevu* The results were expressed as mean ± standard deviation (SD). To determine the level of significance among treatments, the data were subjected to one-way Analysis of Variance (ANOVA) and when required, t-tests were applied to compare the means between selected formulations. Statistical analyses were carried out using Microsoft Excel. Differences were considered statistically significant at $p<0.05$.

3. Results

The organoleptic scores of different treatments of *Todedevu* are depicted in Table 2. The results revealed significant variation in quality parameters such as appearance, texture, colour, flavour, taste, and overall acceptability. Among the

treatments, T5 recorded the highest scores across all attributes with appearance (8.28), texture (8.12), colour (8.28), flavour (8.12), taste (8.32), and overall acceptability (8.36), indicating superior consumer preference. This was closely followed by T3 with an overall acceptability of 8.28. In contrast, T2 scored the lowest in almost all attributes, particularly in appearance (6.88) and flavour (6.92), showing comparatively poor acceptance. Treatments T1, T4, and T6 showed moderate acceptability with values ranging from 7.28 to 7.96. The statistical analysis confirmed that differences among treatments were significant ($p<0.01$) for all sensory attributes as indicated by the F-test. Treatment T5 was more acceptable compared to T1 (control) and highlights the potential of millet incorporation in enhancing the nutritional values and consumer acceptance of traditional sweets.

Table 2: Organoleptic scores of *Todedevu* samples for various sensory attributes

Samples	Quality parameters					
	Appearance	**Texture**	**Colour**	**Flavour**	**Taste**	**Overall acceptability**
T_1	7.92±0.03	7.60±0.00	7.88±0.05	8.08±0.01	7.96±0.12	7.96±0.06
T_2	6.88±0.09	6.96±0.17	7.00±0.11	6.92±0.02	7.32±0.13	7.12±0.06
T_3	8.12±0.16	8.21±0.16	8.04±0.02	8.04±0.03	8.20±0.15	8.28±0.22
T_4	7.44±0.00	7.28±0.09	7.24±0.13	7.44±0.07	7.24±0.06	7.36±0.04
T_5	8.28±0.27	8.12±0.23	8.28±0.16	8.12±0.14	8.32±0.15	8.36±0.02
T_6	7.32±0.08	7.24±0.07	7.12±0.23	7.16±0.05	7.44±0.17	7.28±0.18
Significance	*	*	*	*	*	*
S. Em ±	0.06	0.07	0.04	0.09	0.07	0.07
CD at 1%	0.25	0.30	0.18	0.36	0.30	0.30

Note: *S- Significant ($p\leq0.01$)
All values are mean± standard deviation

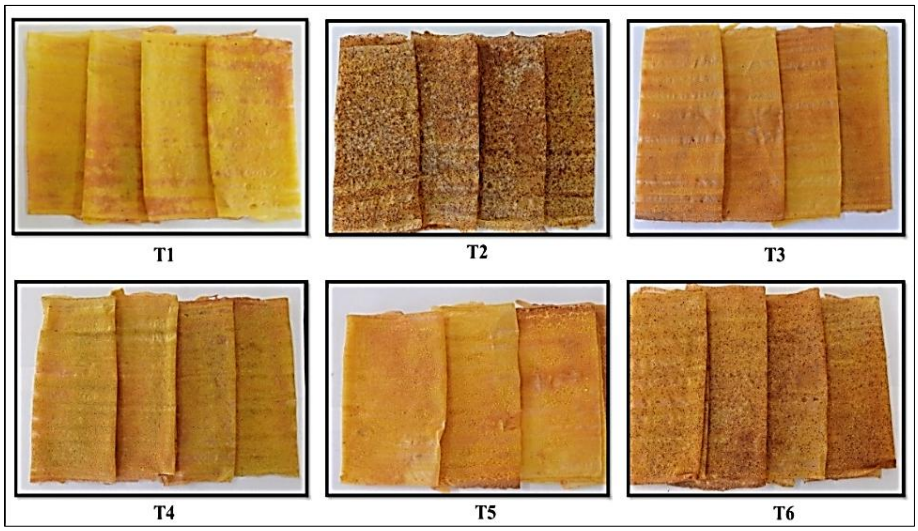

Fig 2: Rice and millets based *Todedevu*

Effect of storage on organoleptic evaluation of *Todedevu*

Effect of storage on organoleptic scores of Todedevu samples packed in laminated pouches Storage stability is an important factor in determining the shelf life and consumer acceptability of ready-to-eat products like *Todedevu*. In this study, the effect of storage on sensory quality was evaluated to assess how millet incorporation influenced the retention of appearance, flavour, texture, and overall acceptability over time.

The sensory quality of sample packed in laminated pouches declined gradually during storage for both T_1 and T_5 as shown in Table 3. At zero days, the sensory scores of appearance, flavour, overall acceptability in T_1 were 7.93, 7.86 and 7.60 respectively and T_5 showed comparatively higher values of 8.20, 8.06 and 8.16 for appearance, flavour, overall acceptability respectively, indicating better consumer preference at zero days. After 30 days, a reduction in all parameters was observed, with T_1 control showing a sharper decline, particularly in flavour (6.60) and overall acceptability (6.90). By 60 days, the scores further decreased, with T_1 recording 6.93 for appearance and 6.70 for overall acceptability, whereas T_5 maintained relatively better values for appearance (7.46) and texture (7.40). These results suggest that although storage negatively affects the sensory quality of Todedevu samples. T_5 retained higher acceptability than control T_1, demonstrating better stability during storage.

Table 3: Effect of storage on organoleptic scores of *Todedevu* samples packed in laminated pouches

Sample	Storage duration	Sensory Parameters					
		Appearance	Texture	Colour	Flavour	Taste	Overall acceptability
T_1 Laminated pouches	Initial	7.93±0.05	7.73±0.09	7.8±0.21	7.86±0.21	7.6±0.04	7.6±0.18
	30 DAS	7.26±0.21	7±0.17	7.3±0.22	6.6±0.18	7.2±0.13	6.9±0.15
	60 DAS	6.93±0.08	7.33±0.15	7±0.02	7.1±0.19	6.9±0.15	6.7±0.21
	S. Em ±	0.05	0.07	0.06	0.04	0.03	0.07
	CD at 1%	0.20	0.27	0.24	0.16	0.12	0.28
T_5 Laminated pouches	Initial	8.2±0.02	8.26±0.02	8.13±0.11	8.06±0.05	8.13±0.18	8.13±0.15
	30DAS	8±0.19	7.6±0.13	7.73±0.09	7.6±0.15	7.73±0.21	7.8±0.22
	60DAS	7.46±0.20	7.4±0.03	7.5±0.14	7.46±0.18	7.3±0.18	7.4±0.16
	S. Em ±	0.06	0.05	0.09	0.02	0.04	0.07
	CD at 1%	0.26	0.20	0.35	0.09	0.18	0.28

All values are mean± standard deviation
DAS - Days after storage
T_1: 60g raw rice +120 g rice flour +150g jaggery + 1g cardamom
T_5: 10g raw rice+ 60g rice flour +150g jaggery+120g little millet +1g cardamom

Effect of storage on organoleptic scores of Todedevu samples packed in HDPE covers

Packaging plays a crucial role in maintaining the sensory quality and shelf life of ready-to-eat products. In this study, the effect of HDPE packaging on the organoleptic properties of *Todedevu* was evaluated to compare its efficiency with laminated pouches and to determine how millet incorporation influences sensory stability during storage.

The storage study showed that both laminated and HDPE packaging materials influenced the sensory quality of *Todedevu* over time, with a gradual reduction in scores for appearance, texture, colour, flavour, taste, and overall acceptability. In HDPE packaging, overall acceptability scores for T_1 dropped sharply from 7.7 at the initial stage to 6.21 after 60 days, whereas T_5 maintained higher scores, reducing from 8.21 to 7.3 over the same period (Table 4). When comparing packaging types, laminated pouches preserved the sensory attributes slightly better than HDPE, particularly for T_5, which consistently retained higher acceptability scores than the T_1 control product throughout storage. These findings suggest that T_5 packed in laminated pouches was the most stable and best accepted during the 60-day (2-month) storage period. Beyond this duration, a further decline in sensory scores may be expected due to cumulative effects of moisture absorption, flavour loss, and textural changes. Thus, laminated pouches can be recommended for extending the shelf life and maintaining consumer acceptability of *Todedevu.*

Table 4: Effect of storage on organoleptic scores of *Todedevu* samples packed in HDPE covers

Sample	Storage duration	Sensory Parameters					
		Appearance	Texture	Colour	Flavour	Taste	Overall acceptability
T_1 HDPE Covers	Initial	7.81±0.00	7.54±0.16	7.65±0.09	7.35±0.02	7.5±0.13	7.7±0.07
	30DAS	7.1±0.22	6.88±0.07	6.76±0.11	6.53±0.21	6.61±0.03	6.45±0.00
	60DAS	6.7±0.05	6.35±0.18	6.12±0.19	6.05±0.16	6.31±0.19	6.21±0.19
	S. Em ±	0.05	0.06	0.05	0.06	0.05	0.04
	CD at 1%	0.19	0.23	0.021	0.22	0.21	0.17
T_5 HDPE Covers	Initial	8.3±0.13	8.1±0.16	8.03±0.23	7.96±0.11	8.1±0.05	8.21±0.15
	30DAS	7.9±0.15	7.7±0.22	7.81±0.14	7.73±021	7.61±0.23	7.5±0.07
	60DAS	7.5±0.14	7.3±0.14	7.4±0.22	7.5±0.18	7.21±0.23	7.3±0.11
	S. Em ±	0.05	0.07	0.08	0.06	0.05	0.05
	CD at 1%	0.22	0.28	0.32	0.26	0.21	0.19

All values are mean± standard deviation
DAS - Days after storage
T_1: 60g raw rice +120 g rice flour +150g jaggery + 1g cardamom
T_5: 10g raw rice +60g rice flour +150g jaggery+120g little millet +1g cardamom

4. Discussion

The significantly higher organoleptic scores obtained for T_5 highlighted the positive role of little millet in improving the sensory profile of *Todedevu*, as observed in Table 2 3, possibly due to their fine texture, mild flavour, and synergistic interaction with jaggery and cardamom. Similar enhancement in acceptability with millet incorporation has been reported by Reddy *et al.* (2021) [15], in millet-based laddus, where improved flavour and texture contributed to higher consumer preference. On the other hand, the comparatively lower organoleptic scores of T_2 and T_6 indicate that not all millets are equally suitable for all sweet preparations, a result consistent with the findings of Lavanya *et al.* (2022) [11], who noted reduced acceptability in bajra-based sweet products due to coarse texture and strong flavour. The current findings, therefore, establish that judicious selection of millet type plays a vital role in optimizing sensory qualities and consumer acceptance of traditional sweets like *Todedevu.*

The observed decline in sensory attributes of *Todedevu* samples (Table 3) over the storage period aligns with findings by Kumari (2023) [10], who reported significant changes in flavour, colour, and texture of traditional sweets during storage. The decrease in scores for appearance and texture in both T_1 and T_5 suggests that factors such as moisture content and packaging material play crucial roles in maintaining product quality. Similar observations were made by Naidu *et al.* (2013) [12], who noted that packaging

materials significantly affect the shelf life and sensory quality of traditional sweets. The millet-based *Todedevu* (T_5) maintained higher sensory scores compared to the rice-based control (T_1), indicating that millet incorporation may offer better preservation of organoleptic qualities during storage. This finding is consistent with research by who found that millet-enriched snacks exhibited improved sensory attributes over time compared to their rice counterparts. The significant differences in sensory scores across storage durations highlight the importance of optimizing storage conditions and packaging materials to prolong the shelf life and maintain the quality of traditional sweets like *Todedevu.*

The decline in sensory scores over storage (Table 4) aligns with observations in traditional Indian sweets, where prolonged storage led to changes in texture and flavour due to moisture migration and minor oxidation reactions. The higher retention of sensory quality in millet-based *Todedevu* (T_5) compared to rice-based T_1 corroborates findings by Anitha *et al*. (2024) [2], who reported that millet incorporation enhanced texture and overall acceptability in traditional meals. Ahmad *et al*. (2017) [1] also noted that protein-enriched snacks showed better sensory stability under similar storage conditions, likely due to the binding and water-holding properties of the added ingredients. These results indicate that HDPE packaging can moderately preserve sensory characteristics for up to two months, while millet-enriched formulations help in maintaining texture, flavour, and overall quality, similar to trends reported for Putharekulu (Sivamma & Jagannadha Rao, 2023) [18]. Optimizing packaging type and formulation could extend shelf life while retaining desirable organoleptic properties in traditional sweets.

5. Conclusion

The study demonstrated that the incorporation of millets, especially little millet, in Todedevu significantly enhanced sensory and nutritional qualities. Among all formulations, T5 (little millet) was the most acceptable. Packaging played a crucial role in product stability laminated pouches outperformed HDPE bags in retaining sensory and physical quality during storage. Thus, millet-based Todedevu, when packed in laminated pouches, presents a viable functional sweet with improved consumer appeal, nutritional value, and market potential.

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