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RESEARCH PAPER

Effect of Different Packaging Material and Storage Duration on Quality of Dried Cashew Apple Flour Breads

Sukanya Shivaji Yadav[1], Shrikant Baslingappa Swami[1*] and S.P. Salvi[2]

[1]Department of Post-Harvest Engineering, Post-Graduate Institute of Post-Harvest Management, Killa-Roha. Dist: Raigad (Maharashtra State) (Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-Campus Roha), India
[2]Post-Graduate Institute of Post-Harvest Management, Killa-Roha. Dist: Raigad (Maharashtra State) (Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-Campus Roha), India

*Corresponding author: swami_shrikant1975@yahoo.co.in

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ABSTRACT

This study was conducted to effect of different packaging material and storage duration on dried cashew apple flour breads. Breads were prepared using from dried cashew apple flour, baked at a temperature 230°C and baking time is 25 minutes. Breads can be stored up to 8 days. For storage duration Polypropylene (PP), and Low-Density Polyethylene (LDPE), packaging material are used. In comparison to the different packaging materials, it was observed that PP followed by best packaging material during the 8th days of storage studies. As the storage duration increases, the moisture content and carbohydrate content continue to increased and fat, protein, ash, fiber content and whitening index was decreased. Result revealed that the PP contain less amount of moisture and fat content % and good amount protein, ash, fiber, carbohydrate content %. compare to other packaging material During 8th days storage also results shows that the effect of different packaging material and storage duration on various sensory attributes. It was observed that as the storage duration increases the sensory score for colour, flavour, taste, texture and overall acceptability goes on decreasing.

Keywords: Cashew apple powder, breads, Shelf-life, Packaging material, Sensory attributes

Cashew apple is in a *Anacardiaceae* family, (*Anacardium occidentale* L.) species, is a native of North East Brazil in Latin America. Being an evergreen tree of tropics, it is cultivated in more than 28 countries for its delightful nutritious kernels, apple and cashew nut shell liquid. Cashew is one of the major horticultural crops of Konkan region, mainly grown on hill slopes as rain-fed perennial crop (Desai *et al.* 2010). Cashew apple is a valuable source of minerals and vitamins. Indeed, cashew apple juice reported to contain Five time as much vitamin C as citrus juice (Akinwale, 2000). As a result of the need to find a wider use for cashew apples, the cashew producing countries of the world have explored and developed many different products (Offia-ollua., 2015).

Bread is the most important staple food to meet the nutritional needs of the human diet, depending on economic and cultural habits (Borges *et al.* 2023). As the bread is very important food all over the world, wheat/rice blended is a promising food. For the people living in the tropical or the semitropical regions, high-yielding and low-cost rice is a promising crop to prepare their bread (Nakamura *et al.* 2009). Wheat (Triticum aestivum) is the principal crop used for bread making. Many epidemiological studies have

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been carried out on consuming whole wheat and indicated that whole wheat foods could reduce the risk of cancers, diabetes and coronary heart disease cashew apple (*Anacardium occidental* L.) is considered as a functional food and healthy. It is a rich source of soluble fiber, insoluble fiber, and antioxidants (Bhatt and Gupta, 2015).

Drying of cashew apple into powder is an excellent alternative to increase its shelf life. It allows conversion of perishable materials into stabilized products by lowering the water activity into appropriate levels (Uchoa *et al.* 2009). In the present study, composite flour bread was prepared using refined wheat flour and dried cashew apple flour with an aim to formulate an enriched flour which is high in protein, fiber content (Anderson, 2000).

Development of breads from dried cashew apple flour, it may be important potential cashew apple products in India. For longer shelf life and powder quality, moisture content is the most important factor as far as storage stability is concerned. Dried powder will be free from bacterial growth. The visual colour is the major quality criterion for determining the commercial quality with respect to consumer's preferences and cost of the powder. Packaging and storage condition are the most important quality control factors of breads preservation. Good packaging and storage condition extend the storage duration of breads. The present study was carried out to assess the quality and shelf life of dried cashew apple flour supplemented breads stored under different set of conditions. The aim of this study is therefore to evaluate the impact of different storage parameters on the shelf life of bread.

MATERIALS AND METHODS

Materials

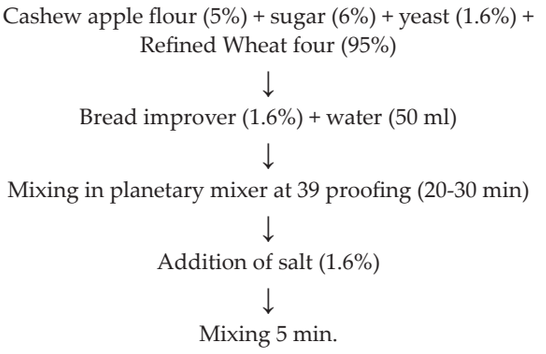
Cashew apple required for experimentation was collected from the Vengurla, Tal. Vengurla, Dist. Sindhudurg. The cashew apple was cleaned, washed with water and the damaged, infected apples were removed before beginning of experiments. The cashew apple slices of 'Vengurla-4' variety having 5 mm thickness, were dried in the convective hot air dryer at 50° up to 210 min. were grounded by using hammer mill (Make: M/S. Sagar Engineering Works Pvt. Ltd, Kudal) and pass through the 0.150 mm sieve to obtain dried cashew apple powder. The experimental work was carried out in Department of Post harvest Engineering of Post Graduate Institute of Post Harvest Technology and Management, Killa Roha.

Methods

1. Bread Making

Fig 1. Shows the process technology for preparation of breads from dried cashew apple flour. The dried cashew apple flour of best the best treatment C1 (5%) and refined wheat flour of level (95%), were mixed together. Mixed well up to foam formation, which was defected through visual observation. The mixture was added with the sugar (6%), yeast (1.6%), improver (1.6%) and salt (1.6%), edible oil (6%), water (50 ml) were used as per treatment combination to make flour composition, and it was added according to the treatment, and it was added into the earlier dough mass and the mixture was thoroughly mixed to a homogeneous mixture to form a dough. The dough poured into mould proofing well (R_h 80% temp. 40°). The mould was placed in baking tray and baked in oven at about 230° for 25 Min. Control sample was procured from the market and considered as a control for comparison with the above treatment.

Fig. 1 Shows the process flow chart for preparation of breads from dried cashew apple flour.



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Addition of edible oil (6%) and mixing well

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Moulding

↓

Proofing (R_h 80% temp.40)

↓

Baking (Temperature, 230°)

↓

Cooling and slicing properly

Fig. 1: Process flow chart for preparation of breads from dried cashew apple flour

Storage studies

The breads from cashew apple flour packed P1 = Polypropylene and P2 = Low-Density polyethylene samples were subjected to storage studies at ambient temperature (32±1°C). The sample stored at ambient temperature were analysed 0, 2,4,6 and 8 days for physicochemical properties Moisture (%), Protein (%), Fat (%), Fiber (%), Ash (%), Carbohydrate (%), Whitening index and sensory qualities like colour, flavour, texture, taste and overall acceptability.

Table 1: Shows the details of Packaging materials used for storage studies

Sl. No.	Name of the packaging material	Size of the packaging material	Thickness of packaging material	Capacity
1	Polypropylene	8 × 10 inch	75 Micron	300 gm
2	Low density polyethylene	7 × 12 inch	+51 Micron	300 gm

(a) **(b)**

Fig. 2: Packaging material used for storage and packaging of breads. **(a)** Polypropylene; **(b)** Low density polyethylene

Evaluation of Quality Parameter for development of breads from dried cashew apple flour

1. Moisture content (%)

Initial moisture content of the sample dried cashew apple flour bread packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were determined by AOAC (2010). 5 g of bread sample taken into the moisture box with lid. The initial weight of moisture box was recorded. The sample were exposed to 105°C ±1°C for 24 hr in a hot air oven (Make M/s: Aditi Associate, Mumbai. Model: ALO-136). The final weight was recorded. The moisture content of sample was determined by equation (1);

$$\text{Moisture content (\% db.)} = \frac{W_2 - W_1}{W_3 - W_1} \times 100 \qquad \ldots(1)$$

Where,

W_1 = Weight of moisture box, g

W_2 = Weight of moisture box + sample g

W_3 = Weight of moisture box + oven dried sample g

2. Ash content (%)

The ash content of bread sample prepared by dried cashew apple flour bread packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were determined using the method of AOAC (1990) porcelain crucible were dried and cooled in desiccators before weighing. Five grams of the bread sample were weighted into the crucible and the weight was taken. The crucible containing the samples were placed into the muffle furnace at 500°C. This temperature was maintained for three hours. The muffle furnace was allowed to cool; the crucible was then brought out, cooled and weighted. The ash content was calculated as follows the experiment was repeated for three times for replication the average reading reported.

$$\text{Ash content \%} = \frac{(W_2 - W_1)}{(\text{Weight of sample})} \times 100 \qquad \ldots(2)$$

Where,

W_2 = Weight of crucible + ash,

W_1 = Weight of empty crucible

3. Fat content (%)

Fat content of bread sample prepared by dried cashew apple flour bread packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were determined using Solvent extraction in a Soxhlet apparatus as described by James, (1995). Two grams of each bread sample wrapped in filter paper and placed in a Soxhlet reflux flask which is connected to a condenser on the upper side and to a weighted oil extraction flask full with two hundred mili petroleum ether. The ether was brought to its boiling point the vapour condensed into the reflux flask immersing the samples completely for extraction to take place on filling up the reflux flask siphons over carrying the oil extract back to the boiling solvent in the flask. The process of boiling, condensation, and reflux was allowed to go for hours before the defatted samples were removed. The oil extract in the flux was dried in the oven 60°C for thirty minutes and weighted. The experiment was repeated for three times replication. The average reading reported.

$$\% \text{ Fat} = \frac{W_4 - W_3}{W_2 - W_1} \times 100 \quad \ldots(3)$$

Where,

W_1 = Weight of oven dried thimble,

W_2 = Weight of sample used,

W_3 = Weight of round bottom flask,

W_4 = weight of round bottom flask with fat residue

4. Protein content

Protein content of bread sample prepared by dried cashew apple flour bread packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were determined by a micro-Kjeldahl distillation method (AOAC, 1990). The sample were digested by heating with concentrated sulphuric acid (H_2SO_4) in the presence of digestion mixture, potassium sulphate (K_2SO_4) and copper sulphate ($CUSO_4$). The mixture was made alkaline with 40% NaOH. Ammonium sulphate thus formed. Released ammonia which collected in 4% boric acid solution and titrated again with standard HCL. The percent nitrogen content of the sample was calculated by the formula given below. Protein content was calculated by using equation (4);

$$\% \text{ (N)} = 1.4 \times (\text{ml HCL} - \text{ml blank}) \times \text{Conc. of } \frac{HCL}{Weight} \text{ of sample (g)} \quad \ldots(4)$$

$$\% \text{ Protein} = \% \text{ N} \times \text{Factor (6.25).} \quad \ldots(5)$$

5. Crude Fiber (%)

About 2 g fat free residue of dried cashew apple flour bread sample packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were taken and then transferred to the digestion flask. 200 ml boiling sulphuric acid was added and immediately the flask was connected to condenser. The flask was heated, boiled by frequently rotating for 30 min. and the volume was maintained with hot water Then filtered through filter cloth in a fluted funnel. The residue was washed on cloth with hot water or potassium sulphate solution. The residue was returned to digestion flask by washing with hot water. 200 ml boiling sodium hydroxide was added and boiled for 30 min. The volume was adjusted with boiling water, filtered through the muslin cloth and the residue free of alkali was washed. The residue was transferred into crucible and washed with 15 ml alcohol and the crucible was dried at 110°C for 2 hours. The crucible was cooled in desiccators and weighted the crucible was ignited in the furnace at 550°C for 30 min then cooled and weighted. The loss in weight represented the crude fiber. The experiment was repeated three times and average reading was repeated.

$$\text{Crude Fiber (\%)} = \frac{(W_1 - W_2)}{\text{Weight of sample (g)}} \quad \ldots(6)$$

Where,

W_1 = Weight of material before ashing (g)

W_2 = Weight of material after ashing (g)

6. Carbohydrate (%)

Carbohydrate content fresh bread sample prepared by dried cashew apple flour bread sample packed in Polypropylene and Low-density polyethylene bags at 0,2,4,6 and 8 days storage duration were determined by a subtracting the total sum of protein, fiber, ash and fat from the product sample James, (1995). The carbohydrate was calculated by using following equation (7);

% Carbohydrate =100 – (% protein + % fat + % fiber + % ash + % moisture content ...(7)

7. Colour

A colour of bread sample prepared from dried cashew apple flour composition C1 to C5 and temperature T1 to T3 measured by (Make: M/s Konika Minolta, Japan; Model Meter CR-400). The colour of bread sample prepared from dried cashew apple flour were measured in dark room. The equipment was calibrated by placing on the white tile. After the calibration is over, the bread prepared from dried cashew apple flour was placed in the petri dish and keeping the colori reader on the top of the product and colour was measured. The colour was measured as per $10°/D_{65}$ (ASTM) standard. It represents *L*, *a* and *b* value. Degree of lightness or darkness of the sample was represented by '*L*' value, redness or greenness by '*a*' and yellowness to blueness by '*b*' value on hunter scale. The experiment was repeated five times and average values are reported. The whiteness index samples were measured in 4 no. replication for each sample to estimate the degree of lightness (L), redness/greenness (a), and yellowness/blueness (b) using a colorimeter. Whiteness index was calculated by the following equation (8) of Park, (1994);

$$\text{Whiteness} = [(100–L)]^2 + a^2 + b^2]^{1/2} \ldots(8)$$

Where,

L = lightness (100) to darkness (0)

a = redness (+60) to Greenness (-60)

b = yellowness (+60) to blueness (-60)

Sensory Evaluation

Sensory evaluation of dried cashew apple flour breads baked at 230°C temperature for 25 min. baking time and stored in different packaging materials for 8 days of storage duration with the interval of 0, 2, 4, 6 and 8 days from storage day was conducted.

RESULTS AND DISCUSSION

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on Moisture content of Breads during 8 days storage

Fig. 3 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on Moisture content (%) of breads from dried cashew apple flour. The moisture (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag increase from 30.433±0.02 to 32.470±0.02% for 0 to 8 days of storage period and Low-density polyethylene for moisture content (%) increases from 30.433±0.01 to 33.030±0.01 for 0 to 8 days of storage period respectively. And breads which was control sample increase from 30.571±0.07 to 33.162±0.04 %.

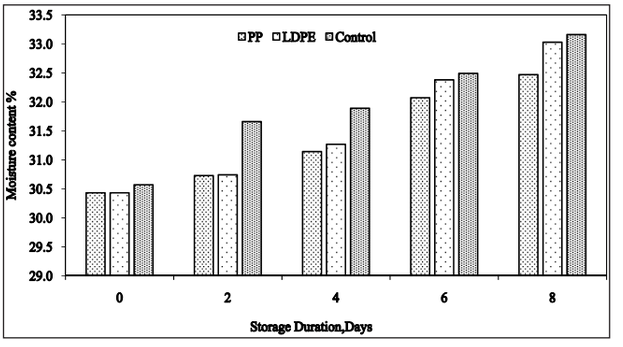

Fig. 3: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on moisture content % of dried cashew apple flour breads during eight days storage duration

From Fig. 3 it is clear that as storage period increases, the moisture (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag increases.

Table 2 Shows the ANOVA for the effect of packaging material and storage duration on moisture content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on moisture content % of breads was significantly different at p ≤ 0.05. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on moisture content of bread prepared from dried cashew apple flour.

Similarly, Karuppasamy *et al.* 2012 reported that the bread prepared from the small millet incorporated bread the moisture content of bread increased with increasing storage period the moisture content was 10.25 % to 10.33% from initial 0 to final 4 days of storage period. Similar result was found in, Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat increase the moisture content during 10 days period. The result shows that the storage period increased the moisture content also increased from 11.44 to 13.24 %. Similarly, Alpers *et al.* 2021 reported that the bread was stored in LDPE bag the moisture content of bread increased from 30.19 to 33.08 % from 10 days storage period.

Similarly, Upsen and Wattanachai, 2018 reported that the bread was stored in LDPE film the moisture content of bread increased from 29.08 to 31.56 % from 10 days storage period.

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on protein content of Breads during 8 days storage.

Fig. 4 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on protein content (%) of breads from dried cashew apple flour. The protein (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag decrease from 8.221 ± 0.02 to 7.680±0.01 % for 0 to 8 days of storage period and Low-density polyethylene for protein content (%) decreases from 8.221±0.09 to 7.223±0.09 % for 0 to 8 days of storage period respectively. And breads which was control sample decrease from 8.019±0.03 to 7.133±0.01%. From Fig.4 it is clear that as storage period increases, the protein (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag decreases.

Table 3 Shows the ANOVA for the effect of packaging material and storage duration on protein content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at p≤ 0.05. Similarly,

Table 2: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on moisture content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Moisture Content (%)					
	0	**2**	**4**	**6**	**8**	**Mean A**
PP	30.433 ± 0.02	30.730 ± 0.04	31.143 ± 0.07	32.072 ± 0.03	32.470 ± 0.02	31.369
LDPE	30.433 ± 0.01	30.743 ± 0.09	31.270 ± 0.06	32.381 ± 0.02	33.030 ± 0.01	31.571
Control	30.571 ± 0.07	31.660 ± 0.09	31.891 ± 0.03	32.492 ± 0.02	33.162 ± 0.04	31.955
Mean B	30.479	31.044	31.434	32.315	32.887	
Factors		**C.D.**			**SE(m)**	
Factor (A)		0.018			0.006	
Factor (B)		0.021			0.007	
Factor (A × B)		0.036			0.012	

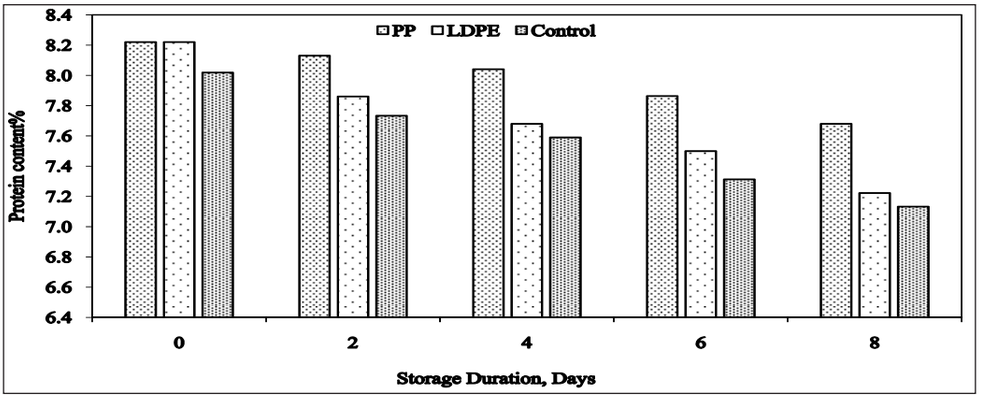

Fig. 4: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on protein content % of dried cashew apple flour breads during eight days storage duration

Table 3: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on protein content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Protein Content (%)					
	0	2	4	6	8	Mean A
PP	8.221±0.02	8.131±0.04	8.041±0.07	7.864±0.02	7.680±0.01	7.987
LDPE	8.221±0.09	7.861±0.07	7.680±0.04	7.500±0.01	7.223±0.09	7.697
Control	8.019±0.03	7.734±0.09	7.590±0.02	7.313±0.03	7.133±0.01	7.557
Mean B	8.153	7.908	7.770	7.559	7.345	
Factors			**C.D.**		**SE(m)**	
Factor (A)			0.026		0.009	
Factor (B)			0.033		0.011	
Factor (A × B)			0.060		0.020	

the effect of storage duration on protein content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on protein content of bread prepared from dried cashew apple flour.

Similarly, Karuppasamy *et al.* 2012 reported that the bread prepared from the small millet incorporated bread the protein content of bread decreased with increasing storage period the protein content was 11.26 to 11.14% from initial 0 to final 4 days of storage period.

Similarly, Patyal (2019) reported that the bread prepared from the mushroom fortified bread the protein content was significantly decreasing with increasing storage period i.e. 11.27 to 11.14% (Up to 4 days). According to Muga Sundari and Anandakumar, 2022. The bread sample was stored polypropylene (PP) the protein content of the bread samples significantly decreased and it ranged from 9.83% to 9.12% from 14 days storage period. Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat decrease the protein content during 10 days period.

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on fat content of Breads during 8 days storage.

Fig. 5 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on fat content (%) of

breads from dried cashew apple flour. The fat (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag decrease from 2.820±0.03 to 1.982±0.04 % for 0 to 8 days of storage period and Low-density polyethylene for fat content (%) decreases from 2.820±0.01 to 1.680±0.04 % for 0 to 8 days of storage period respectively. And breads which was control sample decrease from 2.461±0.07 to 1.782±0.02. From Fig. 2 it is clear that as storage period increases, the fat (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag decreases.

Table 5 Shows the ANOVA for the effect of packaging material and storage duration on fat content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on fat content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on fat content of bread prepared from dried cashew apple flour.

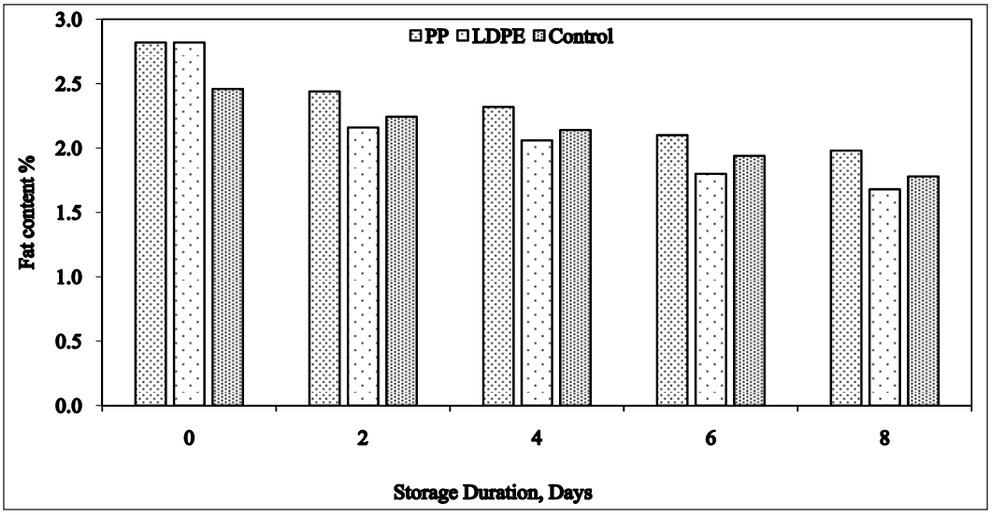

Fig. 5: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on fat content % of dried cashew apple flour breads during eight days storage duration

Table 4: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on fat content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Fat Content (%)					
	0	2	4	6	8	Mean A
PP	2.820±0.03	2.441±0.07	2.322±0.09	2.100±0.01	1.982±0.04	2.332
LDPE	2.820±0.01	2.161±0.04	2.060±0.07	1.803±0.03	1.680±0.04	2.104
Control	2.461±0.07	2.243±0.03	2.144±0.08	1.940±0.06	1.782±0.02	2.112
Mean B	2.700	2.281	2.173	1.947	1.813	
Factors			**C.D.**		**SE(m)**	
Factor (A)			0.025		0.009	
Factor (B)			0.019		0.007	
Factor (A × B)			0.045		0.015	

Similarly, Karuppasamy *et al.* 2012 reported that the bread prepared from the small millet incorporated bread the fat content of bread decreased with increasing storage period the fat content was 2.86 to 2.81% from initial 0 to final 4 days of storage period. Similarly, Patyal (2014) reported that the bread prepared from the mushroom fortified bread the fat content was significantly decreasing with increasing storage period i.e. 1.39 to 1.36 % (Upto 4 days).

According to Mugasundari and Anandakumar, 2022. The bread sample was stored polypropylene (PP) the fat content of the bread samples significantly decreased and it ranged from 5.04 to 1.81%, from 14 days storage period. Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat decrease the fat content during 10 days period. Similarly, Patel (2019) reported that the bread prepared from the mushroom fortified bread the fat content was significantly decreasing with increasing storage period i.e. 4.33 to 2.14 % (Up to 4 days).

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on ash content of Breads during 8 days storage

Fig. 6 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on ash content (%) of breads from dried cashew apple flour. The ash (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag decrease from 1.540±0.03 to 0.960±0.01% for 0 to 8 days of storage period and Low-density polyethylene for ash content (%) decreases from 1.340±0.07 to 0.940±0.09 % for 0 to 8 days of storage period respectively. And breads which was control sample decrease from 1.260±0.01 to 0.780±0.08 %. From Fig. 6 it is clear that as storage period increases, the ash (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag decreases.

Table 5 Shows the ANOVA for the effect of packaging material and storage duration on ash content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on ash content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on ash content of bread prepared from dried cashew apple flour.

Similarly, Karuppasamy *et al.* 2012 reported that the bread prepared from the small millet incorporated bread the ash content of bread decreased with

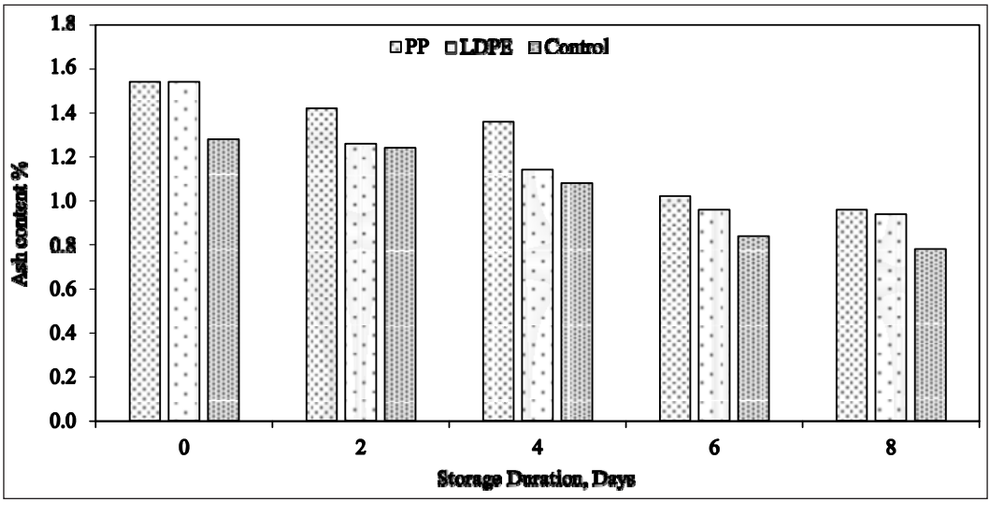

Fig. 6: Effect of various Packaging materials (PP = Polypropylene; LDPE = Low Density Polyethylene; C = Control) on ash content % of dried cashew apple flour breads during eight days storage duration

Table 5: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on ash content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Ash Content%					
	0	**2**	**4**	**6**	**8**	**Mean A**
PP	1.540±0.03	1.420±0.07	1.360±0.03	1.020±0.01	0.960±0.01	1.260
LDPE	1.540±0.07	1.260±0.09	1.140±0.05	0.960±0.02	0.940±0.09	1.168
Control	1.280±0.01	1.240±0.06	1.080±0.02	0.840±0.03	0.780±0.08	1.044
Mean B	1.453	1.307	1.193	0.940	0.893	
Factors			**C.D.**		**SE(m)**	
Factor (A)			0.027		0.009	
Factor (B)			0.033		0.011	
Factor (A × B)			0.059		0.020	

increasing storage period the ash content was 1.29 to 1.26% from initial 0 to final 4 days of storage period. Similarly, Patel (2019) reported that the bread prepared from the mushroom fortified bread the fiber content was significantly decreasing with increasing storage period i.e. 0.91 to 0.87% (Up to 4 days).

Similarly, Alpers *et al.* 2021 reported that the bread was stored in LDPE bag the ash content of bread decreased from 1.54 to 0.94 % from 10 days storage period. Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat decrease the ash content during 10 days period. Similarly, Upsen and Wattanachai, 2018 reported that the bread was stored in LDPE film the ash content of bread decreased from 1.43 to 0.84 % from 10 days storage period.

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on fiber content of Breads during 8 days storage.

Fig. 7 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on fiber content (%) of breads from dried cashew apple flour. The fiber (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag decrease from 2.350±0.05 to 2.000±0.07 % for 0 to 8 days of storage period and Low-density polyethylene for fiber content (%) decreases from 2.350±0.09 to 1.600±0.04 % for 0 to 8 days of storage period respectively. And breads which was control sample decrease from 2.10±0.03 to 1.550±0.03 %. From Fig.7 it is clear that as storage period decreases, the fiber (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag decreases.

Table 6 Shows the ANOVA for the effect of packaging material and storage duration on fiber content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on fiber content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on fiber content of bread prepared from dried cashew apple flour.

Similarly, Karuppasamy *et al.* 2012 reported that the bread prepared from the small millet incorporated bread the fiber content of bread decreased with increasing storage period the ash content was 0.36 to 0.33 % from initial 0 to final 4 days of storage period. Similarly, Patel (2019) reported that the bread prepared from the mushroom fortified bread the fiber content was significantly decreasing with increasing storage period i.e. 0.72 to 0.74% (Up to 4 days).

Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat decrease the fiber content during 10 days period. Similarly, Alpers *et al.* 2021 reported that the bread was stored in LDPE bag the fiber content of bread decreased from 0.85

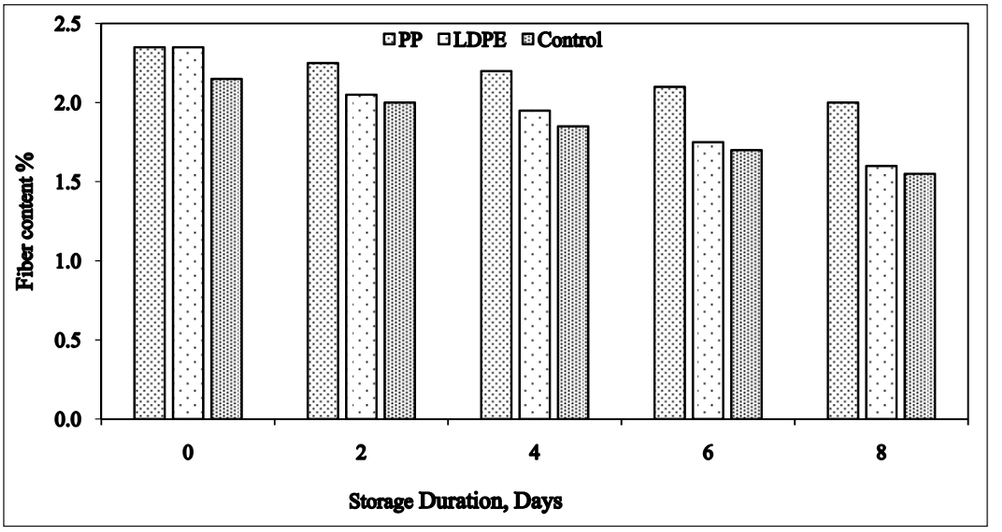

Fig. 7: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on fiber content % of dried cashew apple flour breads during eight days storage duration

Table 6: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on fiber content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Fiber Content%					
	0	2	4	6	8	Mean A
PP	2.350±0.05	2.250±0.02	2.200±0.03	2.100±0.02	2.000±0.07	2.180
LDPE	2.350±0.09	2.050±0.06	1.950±0.07	1.750±0.09	1.600±0.04	1.940
Control	2.150±0.03	2.000±0.01	1.850±0.06	1.700±0.01	1.550±0.03	1.850
Mean B	2.283	2.100	2.000	1.850	1.717	
Factors			**C.D.**		**SE(m)**	
Factor (A)			0.126		0.042	
Factor (B)			0.156		0.054	
Factor (A × B)			0.279		0.093	

to 0.74 % from 10 days storage period. Similarly, Upsen and Wattanachai, 2018 reported that the bread was stored in LDPE film the fiber content of bread decreased from 1.75 to 1.42 % from 10 days storage period.

Effect of concentrations (%) of Dried Cashew apple flour and baking temperature (°C) on carbohydrate content of Breads during 8 days storage.

Fig. 8 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on carbohydrate content (%) of breads from dried cashew apple flour. The carbohydrate (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag increase from 54.403±0.06 to 55.203±0.02 % for 0 to 8 days of storage period and Low-density polyethylene for carbohydrate content (%) increases from 54.403±0.04 to 55.190±0.09 % for 0 to 8 days of storage period respectively. And breads which was control sample increase from 54.212±0.07 to 55.041±0.03 %. From Fig. 8 it is clear that as storage period increases, the carbohydrate (%) of bread

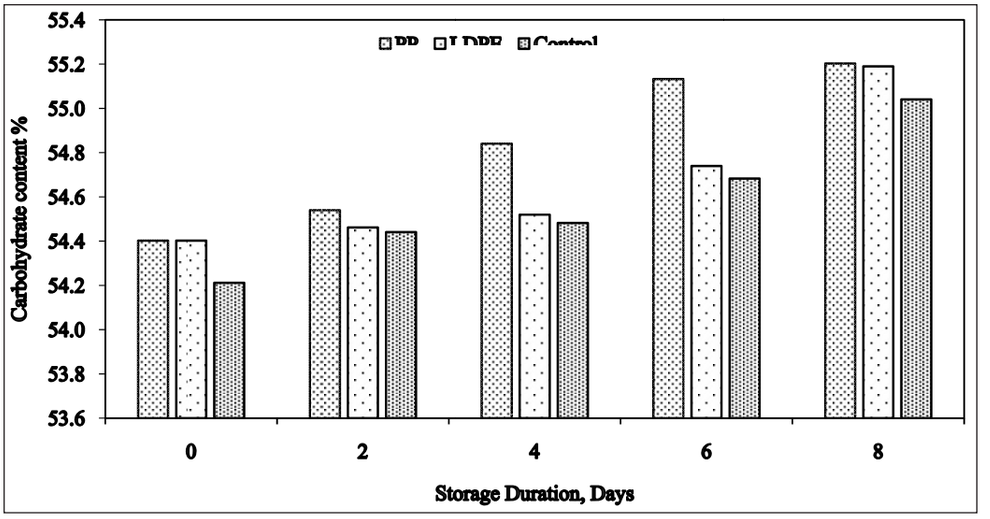

Fig. 8: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on carbohydrate content % of dried cashew apple flour breads during eight days storage duration

Table 7: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on carbohydrate content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B)					
	Carbohydrate Content%					
	0	2	4	6	8	Mean A
PP	54.403±0.06	54.540±0.07	54.841±0.03	55.133±0.05	55.203±0.02	54.824
LDPE	54.403±0.04	54.462±0.04	54.520±0.07	54.740±0.03	55.190±0.09	54.663
Control	54.212±0.07	54.441±0.03	54.482±0.04	54.683±0.01	55.041±0.03	54.571
Mean B	54.339	54.481	54.614	54.852	55.144	
Factors	**C.D.**				**SE(m)**	
Factor (A)	0.117				0.039	
Factor (B)	0.146				0.050	
Factor (A × B)	0.261				0.087	

prepared from dried cashew apple flour packed in PP bag and LDPE bag increases.

Table 7 Shows the ANOVA for the effect of packaging material and storage duration on carbohydrate content (%) of breads prepared from dried cashew apple flour w.r.t packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on carbohydrate content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on carbohydrate content of bread prepared from dried cashew apple flour.

Similarly, Patyal (2019) reported that the bread prepared from the mushroom fortified bread the carbohydrate content was significantly decreasing with increasing storage period i.e. 54.22 to 55.45 % (Up to 4 days). According to Mugasundari and Anandakumar, 2022. The bread sample was stored polypropylene (PP) the carbohydrate content of the bread samples significantly increased and it ranged from 81.05 % to 83.87 % (upto14 days storage period).

Tiimub (2013) reported that the unlevend bread prepare from sugar, butter and wheat increase the carbohydrate content during 10 days period. Similarly, Upsen and Wattanachai, 2018 reported that the bread was stored in LDPE film the carbohydrate content of bread increased from 57.13 to 61.09 % from 10 days storage period.

Effect of different packaging material and storage duration on whitening index of dried cashew apple flour breads during 8 days storage duration.

Fig. 9 Shows the effect of packaging material and storage duration (0, 2, 4, 6, 8) and on whitening index (%) of breads from dried cashew apple flour. The WI (%) of breads prepared from dried cashew apple flour and which was packed in Polypropylene bag increase from 51.721±0.01 to 48.031±0.01 % for 0 to 8 days of storage period and Low-density polyethylene for WI (%) decreases from 51.721±0.23 to 48.781±0.02 % for 0 to 8 days of storage period respectively. And breads which was control sample decrease from 52.007±0.35 to 48.903±0.12 %. From Fig. 9 it is clear that as storage period increases, the Whitening index (%) of bread prepared from dried cashew apple flour packed in PP bag and LDPE bag decreases.

Table 8 Shows the ANOVA for the effect of packaging material and storage duration on WI of breads prepared from dried cashew apple flour w.r.t

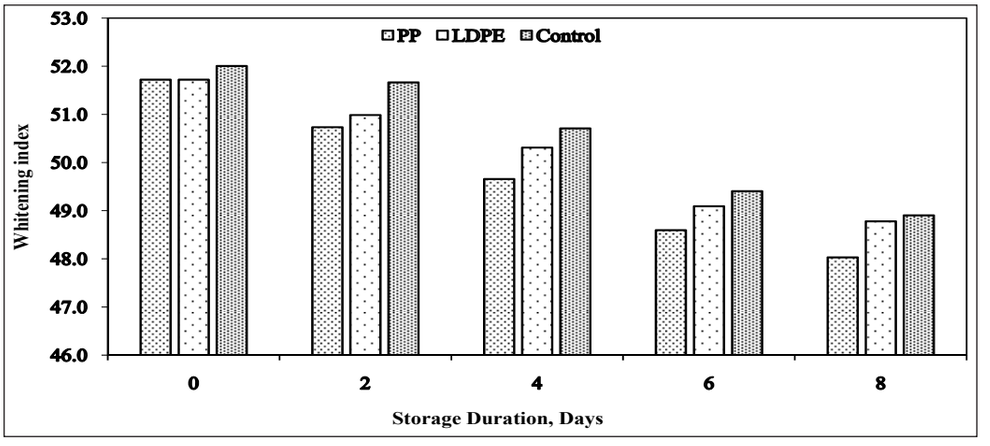

Fig. 9: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on Whitening index% of dried cashew apple flour breads during eight days storage duration

Table 8: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on whitening index content (%) of stored dried cashew flour breads, during 8 days of storage duration

Packaging Material (A)	Storage Duration (Days) (B) Whitening index					
	0	2	4	6	8	Mean A
PP	51.721±0.01	50.734±0.02	49.658±0.01	48.596±0.03	48.031±0.01	49.748
LDPE	51.721±0.23	50.988±0.07	50.312±0.02	49.091±0.15	48.781±0.02	50.178
Control	52.007±0.35	51.665±0.09	50.711±0.01	49.407±0.02	48.903±0.12	50.538
Mean B	51.816	51.129	50.227	49.031	48.571	
Factors		**C.D.**			**SE(m)**	
Factor (A)		0.06			0.02	
Factor (B)		0.12			0.04	
Factor (A × B)		0.18			0.06	

packaging material, storage duration and their interaction. From Table 2 shows breads prepared from dried cashew apple flour at $p \leq 0.05$. Similarly, the effect of storage duration on WI content % of breads was significantly different at $p \leq 0.05$. The interaction of packaging material and storage duration showed the significantly at $p \leq 0.05$ on WI content of bread prepared from dried cashew apple flour.

Karuppasamy *et al.* 2012 reported that the bread stored at 4 days the whitening index of bread was decreased with increased storage period. Similarly, Patel (2019) reported that the bread prepared from the mushroom fortified bread the whitening index was significantly decreasing with increasing storage period i.e. 51.26 to 48.65 % (Up to 4 days).

According to badaje *et al.* 2018 Bread prepared from wheat and defatted cashew kernel flour. As concentration increases 10 to 40%. The whitening index of bread was decreased from 67.01 to 59.22%.

Effect of different packaging material and storage duration on standard plate count of dried cashew apple flour breads during 8 days storage duration

Microbial analysis is the perfect quality assessment protocal performed in food products quality. In the study of microbial quality of bread from dried cashew apple flour, the study was undertaken examination of the total plate count (TPC). The effect of packaging material Polypropylene (P1), Low Density Polyethylene (P2) and control and storage duration on microbial characteristics of breads prepared from dried cashew apple flour stored at ambient temperature were recorded and presented in Table 9, out of total storage duration i.e. 0,2,4,6 and 8 days, the microbial analysis was carried out two days intervals. Bacterial growth was detected for 8th day of analysis for all packaging material i.e., Polypropylene (P1), Low Density Polyethylene (P2) and control. At 8 days analysis the standard plate count observed for bread packed in., Polypropylene (P1), Low Density Polyethylene (P2) and control. 2.17×10^5 CFU/g, 2.18×10^5 CFU/g and 2.30×10^5 CFU/g respectively.

Table 9: Effect of different packaging material and storage duration on standard plate count of dried cashew apple flour breads during 8 days storage duration

Packaging Material (A)	Storage Duration (Days) (B)				
	Standard Plate Count (CFU/g)				
	0	2	4	6	8
PP	ND	ND	ND	ND	2.17×10^5 CFU/g
LDPE	ND	ND	ND	ND	2.18×10^5 CFU/g
Control	ND	ND	ND	ND	2.30×10^5 CFU/g

Effect of different packaging material and storage duration on sensory colour of dried cashew apple flour breads during 8 days storage duration

Fig. 10 shows the effect of different packaging material PP= Polypropylene; LDPE=Low Density Polyethylene; C= Control and storage duration (0, 2, 4,6 and 8 days) on sensory colour of dried cashew apple flour breads stored for 8 days storage duration. Highest colour score was observed at PP bag and lowest was control sample. The average colour scores for dried cashew apple flour breads stored in PP bag for 0, 2, 4, 6 and 8 days was 8.400±0.13 8.233±0.12, 8.133±0.16, 8.033±0.18, 7.902±0.13, respectively and LDPE for 0, 2, 4, 6 and 8 days were 8.200±0.11, 8.132±0.08, 8.073±0.07, 7.933±0.05, 7.821±0.15 and control sample for 0, 2, 4, 6 and 8 days were 7.967±0.13, 7.946±0.13, 7.750±0.08, 7.650±0.16, 7.600±0.11 respectively.

Table 9 shows ANOVA for colour of sensory analysis. It was observed that as the storage duration increases the sensory score for colour goes on decreasing. The range of sensory colour was from 7.600±0.11 to 8.400±0.13 for all storage duration of 8th days storage. The highest colour score was observed 8.40 for PP bag. And lowest colour score was observed 7.60 for control sample. The effect of packaging treatment had significant effect on colour of the breads at $p \leq 0.05$. The effect of storage duration also had significant effect on colour of the breads at $p \leq 0.05$. The interaction of packaging material and storage duration had also a significant effect and the colour of breads prepared from dried cashew apple flour.

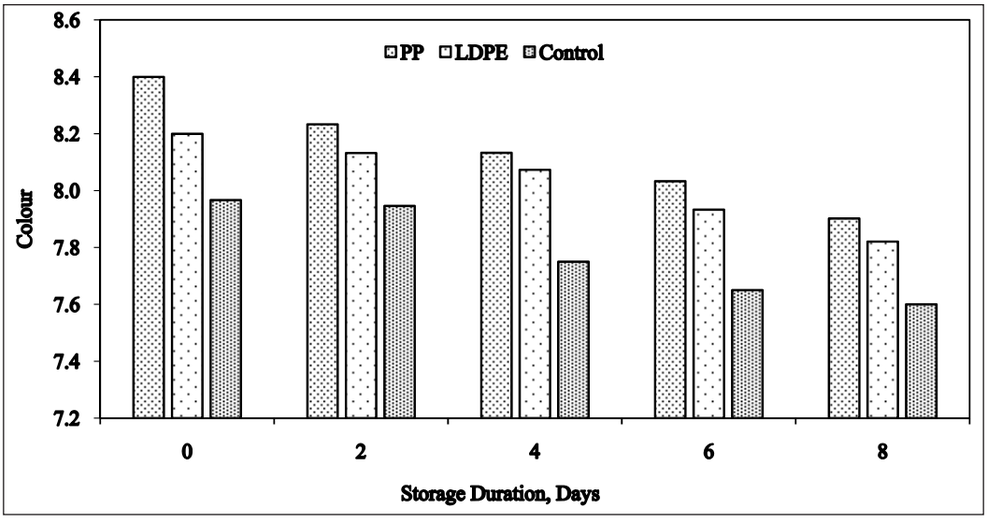

Fig. 10: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on sensory colour of dried cashew apple flour breads during eight days storage duration

Table 10: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on sensory colour of stored dried cashew flour breads, during 8 days of storage duration

Packaging	**Days (B)**					
Material (A)	**0**	**2**	**4**	**6**	**8**	**Mean A**
PP	8.400±0.13	8.233±0.12	8.133±0.16	8.033±0.18	7.902±0.13	8.140
LDPE	8.200±0.11	8.132±0.08	8.073±0.07	7.933±0.05	7.821±0.15	8.031
Control	7.967±0.13	7.946±0.13	7.750±0.08	7.650±0.16	7.600±0.11	7.782
Mean B	8.189	8.103	7.985	7.872	7.774	
Factors		**C.D.**		**SE(m)**		
Factor (A)		0.099		0.033		
Factor (B)		0.126		0.042		
Factor (A× B)		0.219		0.073		

Effect of different packaging material and storage duration on sensory flavour of dried cashew apple flour breads during 8 days storage duration

Fig. 11 shows the effect of different packaging material PP= Polypropylene; LDPE=Low Density Polyethylene; C= Control and storage duration (0, 2, 4,6 and 8 days) on sensory flavour of dried cashew apple flour breads stored for 8 days storage duration. Highest flavour score was observed at PP bag and lowest was control sample. The average flavour scores for dried cashew apple flour breads stored in PP bag for 0, 2, 4, 6 and 8 days was 8.241±0.08, 8.132±0.13 7.903±0.14, 7.713±0.13,7.630±0.11 respectively and LDPE for 0, 2, 4, 6 and 8 days were 8.000±0.11, 7.901±0.16, 7.784±0.10, 7.709±0.08, 7.609±0.15 and control sample for 0, 2, 4, 6 and 8 days were 7.987±0.11, 7.900±0.13, 7.609±0.12, 7.601±0.10, 7.589±0.13 respectively.

Table 10 shows ANOVA for flavour of sensory analysis. It was observed that as the storage duration increases the sensory score for flavour goes on decreasing. The range of sensory flavour was from 7.589±0.13 to 8.241±0.08 for all storage duration of 8th days storage. The highest flavour score was

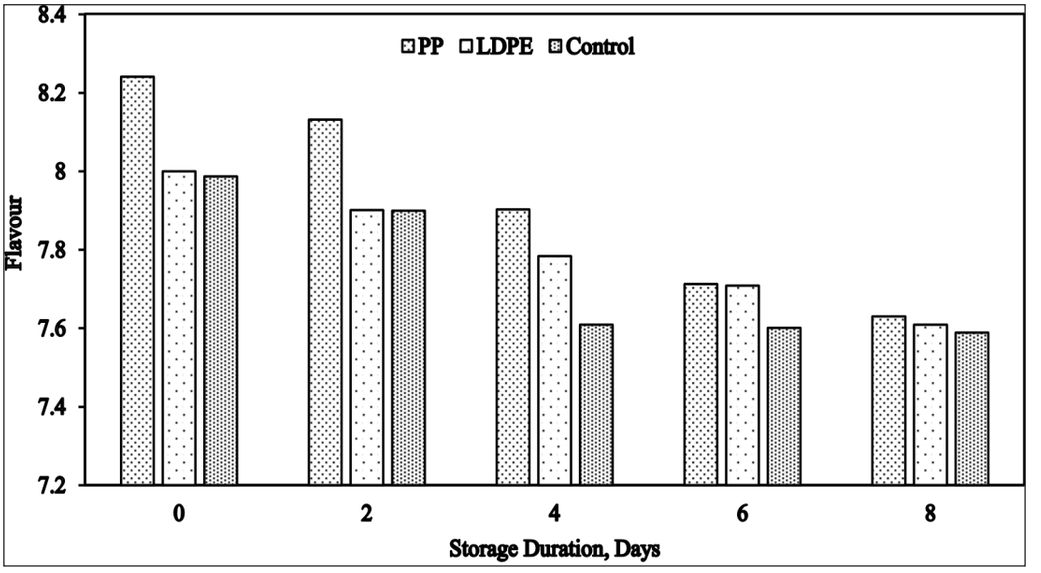

Fig. 11: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on sensory flavour of dried cashew apple flour breads during eight days storage duration

Table 11: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on sensory flavour of stored dried cashew flour breads, during 8 days of storage duration

Packaging	**Days (B)**					
Material (A)	**0**	**2**	**4**	**6**	**8**	**Mean A**
PP	8.241±0.08	8.132±0.13	7.903±0.14	7.713±0.13	7.630±0.11	7.923
LDPE	8.000±0.11	7.901±0.16	7.784±0.10	7.709±0.08	7.609±0.15	7.800
Control	7.987±0.11	7.900±0.13	7.609±0.12	7.601±0.10	7.589±0.13	7.732
Mean B	8.076	7.977	7.765	7.674	7.609	
Factors		**C.D.**			**SE(m)**	
Factor (A)		0.072			0.025	
Factor (B)		0.099			0.033	
Factor (A×B)		0.168			0.056	

observed 8.24 for PP bag. And lowest flavour score was observed 7.58 for control sample. The effect of packaging treatment had significant effect on flavour of the breads at $p \leq 0.05$. The effect of storage duration also had significant effect on flavour of the breads at $p \leq 0.05$. The interaction of packaging material and storage duration had also a significant effect and the flavour of breads prepared from dried cashew apple flour.

Effect of different packaging material and storage duration on sensory taste of dried cashew apple flour breads during 8 days storage duration

Fig. 12 shows the effect of different packaging material PP= Polypropylene; LDPE=Low Density Polyethylene; C= Control and storage duration (0, 2, 4,6 and 8 days) on sensory taste of dried cashew apple flour breads stored for 8 days storage duration. Highest taste score was observed at PP bag and lowest

was control sample. The average taste scores for dried cashew apple flour breads stored in PP bag for 0, 2, 4, 6 and 8 days was 7.980±0.08,7.880±0.10 7.706±0.11, 7.699±0.08, 7.500±0.13 respectively and LDPE for 0, 2, 4, 6 and 8 days were 7.800±0.19, 7.780±0.12, 7.700±0.10, 7.640±0.12, 7.489±0.16 and control sample for 0, 2, 4, 6 and 8 days were 7.789±0.12, 7.660±0.15, 7.600±0.11, 7.517±0.13, 7.402±0.07 respectively.

Table 11 shows ANOVA for taste of sensory analysis. It was observed that as the storage duration increases the sensory score for taste goes on decreasing. The range of sensory taste was from 7.402±0.07 to 7.980±0.08 for all storage duration of 8th days storage. The highest taste score was observed 7.98 for PP bag. And lowest taste score was observed 7.40 for control sample. The effect of packaging treatment had significant effect on taste of the breads at $p \leq 0.05$. The effect of storage duration also had significant effect on taste of the breads at $p \leq 0.05$. The interaction of packaging material and storage duration had also a significant effect and the taste of breads prepared from dried cashew apple flour.

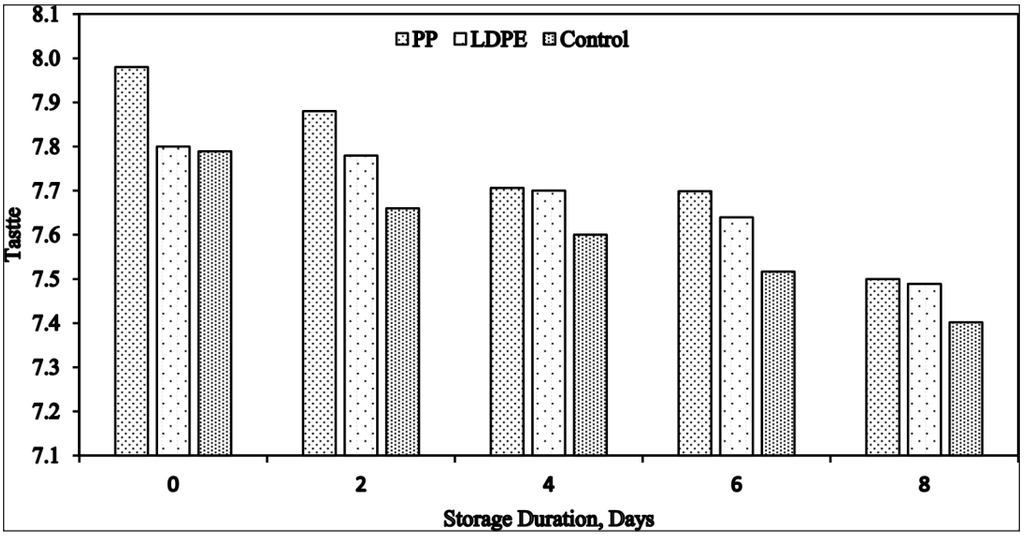

Fig. 12: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on sensory taste of dried cashew apple flour breads during eight days storage duration

Table 12: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on sensory taste of stored dried cashew flour breads, during 8 days of storage duration

Packaging	**Days (B)**					
Material (A)	**0**	**2**	**4**	**6**	**8**	**Mean A**
PP	7.980±0.08	7.880±0.10	7.706±0.11	7.699±0.08	7.500±0.13	7.753
LDPE	7.800±0.19	7.780±0.12	7.700±0.10	7.640±0.12	7.489±0.16	7.681
Control	7.789±0.12	7.660±0.15	7.600±0.11	7.517±0.13	7.402±0.07	7.593
Mean B	7.856	7.773	7.668	7.498	7.463	
Factors		**C.D.**		**SE(m)**		
Factor (A)		0.078		0.026		
Factor (B)		0.099		0.033		
Factor (A×B)		0.174		0.058		

Effect of different packaging material and storage duration on sensory texture of dried cashew apple flour breads during 8 days storage duration

Fig. 13 shows the effect of different packaging material PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control and storage duration (0, 2, 4,6 and 8 days) on sensory texture of dried cashew apple flour breads stored for 8 days storage duration. Highest texture score was observed at PP bag and lowest was control sample. The average texture scores for dried cashew apple flour breads stored in PP bag for 0, 2, 4, 6 and 8 days was 8.032±0.08, 7.957±0.15, 7.800±0.11, 7.740±0.12, 7.660±0.18 respectively and LDPE for 0, 2, 4, 6 and 8 days were 8.003±0.13, 7.904±0.14, 7.789±0.15, 7.700±0.20, 7.640±0.12 and control sample for 0, 2, 4, 6 and 8 days were 7.981±0.17, 7.877±0.18, 7.701±0.12, 7.677±0.12,7.620±0.11 respectively.

Table 12 shows ANOVA for texture of sensory analysis. It was observed that as the storage duration increases the sensory score for texture goes on decreasing. The range of sensory texture was from 7.620±0.11 to 8.032±0.08 for all storage duration of 8th days storage. The highest texture score was observed 8.03 for PP bag. And lowest texture score was observed 7.62 for control sample. The effect of packaging treatment had significant effect on texture of the breads at $p \leq 0.05$. The effect of storage duration also had significant effect on texture of the breads at $p \leq 0.05$. The interaction of packaging material and storage duration had also a significant effect and the texture of breads prepared from dried cashew apple flour.

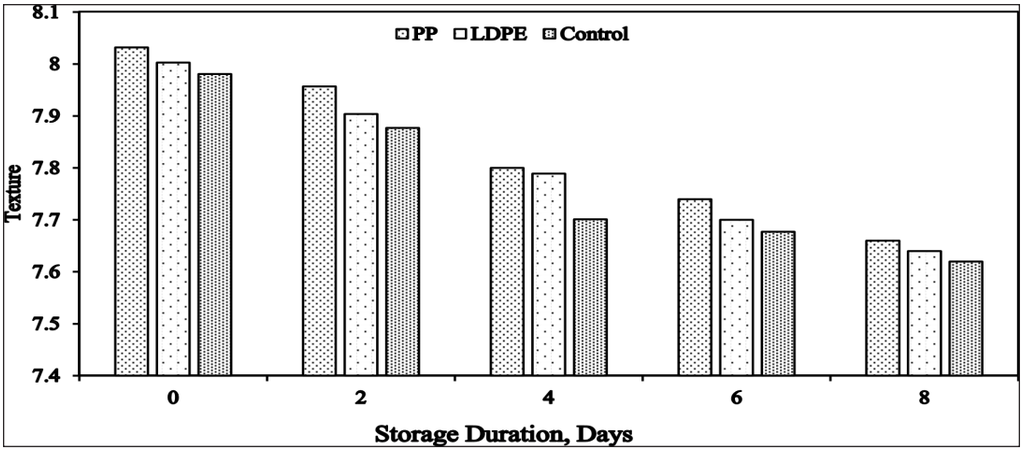

Fig. 13: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on sensory texture of dried cashew apple flour breads during eight days storage duration

Table 13: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on sensory texture of stored dried cashew flour breads, during 8 days of storage duration

Packaging			**Days (B)**			
Material (A)	**0**	**2**	**4**	**6**	**8**	**Mean A**
PP	8.032±0.08	7.957±0.15	7.800±0.11	7.740±0.12	7.660±0.18	7.837
LDPE	8.003±0.13	7.904±0.14	7.789±0.15	7.700±0.20	7.640±0.12	7.807
Control	7.981±0.17	7.877±0.18	7.701±0.12	7.677±0.12	7.620±0.11	7.771
Mean B	8.005	7.912	7.763	7.705	7.640	
Factors		**C.D.**		**SE(m)**		
Factor (A)		0.086		0.030		
Factor (B)		0.117		0.039		
Factor (A×B)		0.216		0.072		

Effect of different packaging material and storage duration on sensory overall acceptability of dried cashew apple flour breads during 8 days storage duration

Fig. 14 shows the effect of different packaging material PP= Polypropylene; LDPE=Low Density Polyethylene; C= Control and storage duration (0, 2, 4,6 and 8 days) on sensory overall acceptability of dried cashew apple flour breads stored for 8 days storage duration. Highest overall acceptability score was observed at PP bag and lowest was control sample. The average overall acceptability scores for dried cashew apple flour breads stored in PP bag for 0, 2, 4, 6 and 8 days was 8.032±0.11, 7.921±0.15, 7.821±0.14, 7.800±0.16 7.789±0.18 respectively and LDPE for 0, 2, 4, 6 and 8 days were 7.987±0.10, 7.809±0.18 7.700±0.15, 7.654±0.08, 7.602±0.13 and control sample for 0, 2, 4, 6 and 8 days were 7.893±0.16, 7.800±0.13, 7.677±0.12, 7.640±0.07, 7.550±0.11 respectively.

Table 13 shows ANOVA for overall acceptability of sensory analysis. It was observed that as the storage duration increases the sensory score for overall acceptability goes on decreasing. The range of sensory overall acceptability was from 7.550±0.11

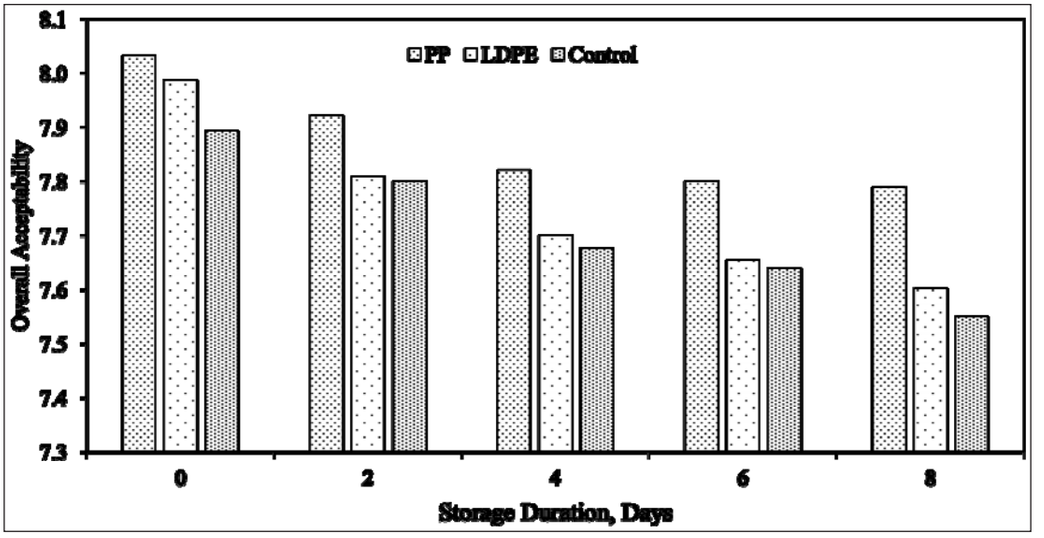

Fig. 14: Effect of various Packaging materials (PP=Polypropylene; LDPE=Low Density Polyethylene; C= Control) on sensory overall acceptability of dried cashew apple flour breads during eight days storage duration

Table 14: Effect of different packaging material PP (Polypropylene), LDPE (Low Density Polyethylene), (C= Control) and storage duration (0, 2, 4, 6 and 8 Days) on sensory overall acceptability of stored dried cashew flour breads, during 8 days of storage duration

Packaging			**Days (B)**			
Material (A)	**0**	**2**	**4**	**6**	**8**	**Mean A**
PP	8.032±0.11	7.921±0.15	7.821±0.14	7.800±0.16	7.789±0.18	7.872
LDPE	7.987±0.10	7.809±0.18	7.700±0.15	7.654±0.08	7.602±0.13	7.750
Control	7.893±0.16	7.800±0.13	7.677±0.12	7.640±0.07	7.550±0.11	7.712
Mean B	7.970	7.843	7.732	7.698	7.647	
Factors		**C.D.**		**SE(m)**		
Factor (A)		0.095		0.033		
Factor (B)		0.129		0.043		
Factor (A×B)		0.225		0.075		

to 8.032±0.11 for all storage duration of 8th days storage. The highest overall acceptability score was observed 8.03 for PP bag. And lowest texture score was observed 7.55 for control sample. The effect of packaging treatment had significant effect on overall acceptability of the breads at $p \leq 0.05$. The effect of storage duration also had significant effect on overall acceptability of the breads at $p \leq 0.05$. The interaction of packaging material and storage duration had also a significant effect and the overall acceptability of breads prepared from dried cashew apple flour.

CONCLUSION

1. The breads incorporated with 5% dried cashew apple flour and 95% refined wheat flour baked at 230°C packed in Polypropylene breads can be stored upto 8 days in good condition safely.
2. In comparison to all the packaging materials it was observed that PP (Polypropylene) contains best physicochemical properties followed by other packaging material during the 8th days of storage studies. It contains less amount of Moisture content is 33.270±0.02 %, and better retention of Fat content 1.680±0.04%, Protein content 7.680±0.01 is %, Ash content is 0.960±0.01 %, Fiber content is 2.000±0.07 % and Carbohydrate content is 55.203±0.02 %, Whitening index is as compare to other packaging material. And it also gives the best sensory properties i.e., Colour 7.902±0.13, Flavour 7.630±0.11, Taste 7.500±0.13, Texture 7.660±0.18. Overall acceptability 7.789 ± 0.18 during 8th days of storage studies.

GENERATIVE AI DECLARATION

The author(s) confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI. The authors developed and verified all scientific content, data analysis, interpretation of results, and conclusions. The authors take full responsibility for the accuracy, integrity, and originality of the work presented, and no AI tool was listed as an author.

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