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RESEARCH PAPER

Effect of Packaging Materials on Quality Parameters of Stored Herbal Cookies from Finger Millet Malt and *Aloe vera* Powder

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ABSTRACT

In present investigation the finger millet malt: *Aloe vera* powder: wheat flour cookies were stored in both packaging material i.e., LDP pouches (gauge 393) and aluminium pouches (gauge 157). The quality parameter i.e., LDP pouches and aluminium pouches cookies were observed during each 15 days interval upto 90 days. Nutritional analysis indicates that both packaging material and storage period increases, the moisture content decreases from 2.86% to 2.23 % for P_1; 2.92 % to 2.29 % for P_2; from 3.24% to 0.52% and 4.96% to 0.24% , fat content decreases from 40.46% to 31.02% for P_1; 45.68% to 36.24% for P_2; from 30.27% to 20.91% and 35.47% to 26.12%, ash content decreases from 4.33% to 0.94% for P_1; 2.99% to 0.32% for P_2; from 3.28% to 0.38% and 4.39% to 0.97%, and the protein content increases from 0.65% to 3.18 % for P_1; 0.78 % to 3.31 % for P_2; from 0.55% to 3.07 % and 0.61% to 3.12%, fiber content increases from 1.29 % to 2.62 % for P_1; 1.86 % to 3.18 % for P_2; from 2.04 % to 3.36 % and 2.61 % to 3.93 %, carbohydrate content increases from 48.44 % to 60.01 % for P_1; 43.82 % to 54.66 % for P_2; from 58.69 % to 71.76 % and 50.02 % to 65.61%, browning index content from 9.91 % to 9.90 % for P_1; 10.25 % to 10.25 % for P_2; decreases from 13.33 % to 9.14 % and 14.48 % to 9.14 % and microbiological study depicted that microbial count was far below the permissible limit up to 3 month of storage of cookies in LDP and aluminium pouches.

Keywords: Finger millet malt, *Aloe vera* powder, wheat, LDP pouches, microbiological study

Aloe vera in synonym *Aloe barbadensis* is a cactus (leaves) like plant with green, dagger shaped leaves that are fleshy, tapering, spiny, marginated and filled with a clear viscous gel (Anonymous, 2000). The plant is rich in many natural health promoting substances. According to world health organization, medicinal plants would be the best source for obtaining a variety of drugs. *Aloe vera* contains over 75 nutrients and 200 active compounds, 20 minerals, 18 amino acid, 12 vitamins, 92 enzymes. It can be used as the source of vitamins like A, B1, B2, B6, B12, C, E, Folic acid, Niacin etc. (Bornare, 2015 and Modi *et al*. 2012).

Finger millet has gained importance because of its nutritional quality in terms of dietary fiber, functional fiber, starch pattern as well as high calcium and iron contents (Rao *et al.* 1973; Deosthale *et al*. 1970). Its grain is a potential source of carbohydrate 81.5%, protein 9.8%, crude fiber 4.3% and mineral 2.7%. It is rich source of crude fiber and mineral which remarkably higher than those of wheat (1.2% fiber, 1.5% minerals) and rice (0.2% fiber, 0.6% minerals); moreover its protein profile is comparatively well balanced; as it contains more lysine threonine and valine than other millets (Ravindra 1991; Sripriya *et al.* 1996). Malting

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of finger millet is a common technique in India and malted finger millet is considered superior to malted sorghum and malted maize (Thapliyal *et al.* 2015). The primary objective of malting is to promote the development of hydrolytic enzymes (Briggs *et al.* 2981), which are present in much lower amounts and activities in non-triticeae species (Daussant *et al.* 1994).

The cookies using the finger millet malt and *Aloe vera* powder will not only help to enrich the nutritional value to the cookies but also imparts the herbal component of various nutrients. This may help to various consumers like diabetics, hipertension, lowerly the blood pressure. Therefore an attempt has been made to develop the cookies of wheat flour incorporated with finger millet malt and the *Aloe vera* powder. The cookies were stored in polythene bags and aluminum laminated bag. The quality of the stored product after 0, 1, 2 and 3 month were also evaluated the change in product quality.

Bakery products have become more popular in India since the earlier times. Among the different bakery products, biscuits constitute the most popular group. Biscuits were first invented as a food. They could be kept for a long time because they are a dry food product. Biscuits are chemically leavened bakery products containing high percentage of fat and sugar (Nelson's Navy, 1980). The bakery industry is one of the largest organized food industries all over the world and in particular biscuits and cookies are one of the most popular products because of their convenience, ready to eat nature, and long shelf life (Sindhuja *et al*. 2005). Baking industry is considered as one of the major segments of food processing. Cookies hold an important position in snack food industry due to variety of taste, nutrition, crispiness and digestibility (Kang *et al*. 2008).

Packaging and storage are the last stages of cookie production. This stage is important in terms of its protection purpose. The time period from when the cookies are packaged to consumption is influenced by packaging and storage methods, and the flavor, taste, and appearance of the cookies should be protected during this time period. The packaging material should protect the cookies from harmful environmental effects.

The product must be protected from undue moisture change during its normal storage life as a primary requirement. When the packaging film protects against moisture transfer in an adequate manner, it likely excludes dirt, dust, mold spores, and other foreign particles, and in addition, it gives some protection against the absorption of off-odors.

The packaging material of the cookies should be appropriate for being formed into the finished package easily and fast by mechanical ways. A fundamental need for packaging films is that the structure heatseal readily. Moreover, the packaging material should not tear, crack, or stretch during the rapid transfers and folding in the wrapping equipment (Sumnu and Sahin, 2008).

MATERIALS AND METHODS

Raw materials of Finger millet (*Eleusine coracana*) and wheat flour were procured from local market, Roha dist- Raigad. And *Aloe vera* plant leaves were procured from the farmers' field at Sangli. The study was carried out in the Department of Post Harvest Engineering, post Graduate Institute of Post Harvest Management, Killa-Roha.

Preparation of Finger millet malt-*Aloe vera* powder and wheat flour based cookies

Fig. 1 shows the process technology for preparation of finger millet malt-*Aloe vera* powder and wheat flour based cookies. The 50g sugar and 50g (%) vegetable oil were creamed and creaming was continued till it become light and fluffy mass. The mixture was added with the finger millet malt 48.5% Mc (% db) prepared as per Swami *et al.* (2013), *Aloe vera* powder prepared at 45°C temperature as 1.5% and 50% wheat flour to make the flour composition according to the treatment, and it were added into the earlier creamed mass and they were thoroughly mixed to a homogeneous mixture to form dough. The dough was sheeted thickness 6.6 mm in a plate and

cut into the uniform size of cookies (round shape *d* = 52 mm). The cookies were placed in the oven (Make: M/s L. G. Electronics India Pvt. Ltd., India. Model: MC-8083MLR) and baked at 170˚C up to the colour of cookies changes into brown.

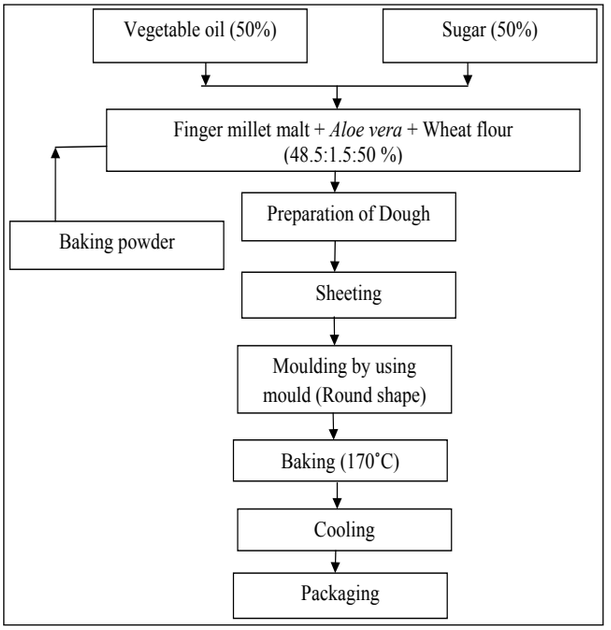

Fig. 1: Process technology for herbal cookies of finger millet malt and *Aloe vera* powder

Preparation of wheat flour based cookies for control sample

Fig. 2 shows the process technology for preparation control sample cookies (wheat flour cookies). The 50g sugar and 50g (%) vegetable oil were creamed and creaming was continued till it become light and fluffy mass. The mixture was added with the 100% wheat flour and it were added into the earlier creamed mass and they were thoroughly mixed to a homogeneous mixture to form dough. The dough was sheeted thickness 6.6 mm in a plate and cut into the uniform size of cookies (round shape *d* = 52 mm). The cookies were placed in the oven (Make: M/s L. G. Electronics India Pvt. Ltd., India. Model: MC-8083MLR) and baked at 170˚C up to the colour of cookies changes into brown.

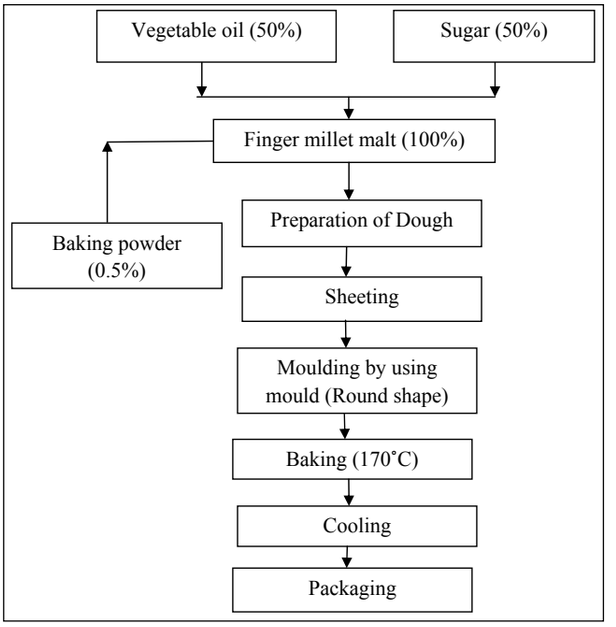

Fig. 2: Process technology for sample cookies (wheat flour cookies)

Packaging and storage study of finger millet malt and *Aloe vera* powder cookies

The finger millet malt and *Aloe vera* powder cookies of 1.5% *Aloe vera* powder was prepared and was used for the packaging and storage study. 100 g of finger millet malt and *Aloe vera* powder cookies was prepared as discussed in earlier such and taken in two different packaging material i.e. polythene and aluminum laminated pouches. The details of the packaging material are given in Table 1.

Table 1: Specifications of packaging material for storage of cookies

Sl. No.	Packaging material	Size	Gauge	Capacity
1	Polythene pouches	15 cm × 9 cm	393	50 g
2	Aluminium laminated pouches	13 cm × 9 cm	157	50 g

Fig. 3 (a), (b), (c) and (d) shows the packaging material i.e. polythene and aluminum laminated pouches

Fig. 3: Packaging material used for packaging of finger millet malt and Aloe vera powder cookies. **(a)** and **(c)** Polythene pouch **(b)** and **(d)** Aluminum laminated pouch

used for packaging and storage of finger millet malt and *Aloe vera* powder cookies and the control sample i.e. whole wheat flour cookies for 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days duration.

Table 2: Treatment Combinations of cookies

Sl. No.	Treatments	Combination	Packaging materials	Combinations
1	T_1	FM: AVP: WF	Polythene bag (P_1)	T_1P_1
2	T_1	FM: AVP: WF	Aluminum laminated bag (P_2)	T_1P_2
3	T_2	Control (WF 100%)	Polythene bag (P_1)	T_2P_1
4	T_2	Control (WF 100%)	Aluminum laminated bag (P_2)	T_2P_2

FM-Finger millet malt, AVP- Aloe vera powder and WF- Wheat flour.

100 g of finger mille malt and *Aloe vera* powder cookies sample was filled separately in polythene (T_1, P_1) and aluminum laminated pouches (T_2, P_2) and sealed properly. Similarly, the control sample was fitted in polythene laminated pouches (T_1, P_1) and aluminum laminated pouches (T_2, P_2). The details of treatments are given in Table 2. These packets were kept at ambient temperature up to 12 weeks. The stored samples both finger millet malt: *Aloe vera* powder cookies and the wheat flour cookies were analyzed at every 15 days interval up to 3 months. The observations for the sensory analysis, moisture, protein, fat, ash, fiber, carbohydrate, colour and microbial analysis of stored sample were taken during 7 duration (0, 15, 30, 45, 60, 75 and 90 days) i.e. total no. of samples for all the trials were, 7 duration × 2 packaging material × 3 replication = 42 samples of finger millet malt and *Aloe vera* powder cookies were kept for storage study. The sensory analysis i.e. colour, flavor, texture, taste and overall acceptability and microbial analysis i.e. colony forming unit (CFU/g of sample) for the stored samples were determined for each storage duration i. e. 0, 15, 30, 45, 60, 75 and 90 days.

Quality analysis of cookies

1. Moisture

The initial moisture content of 0, 15, 30, 45, 60, 75 and 90 days stored cookies of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was determined by using hot air oven method (AOAC, 2000). The 5 g cookies sample taken in the moisture box. The moisture box was kept in hot air oven at 110°C±1 for 24 h the final weight of cookies sample after 24 h were recorded. The moisture content of the cookies was replicated 3 times. The average value of moisture content is

reported. The moisture content was calculated by using following formula (1);

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

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. Protein

Crude protein of the 0, 15, 30, 45, 60, 75 and 90 days stored cookies of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was determined using the Kjedahl method according to AOAC (1990). One gram of the cookies sample was taken into the digestion flask. Kjedahl catalyst (Selenium tablets) was added to the sample. Twenty milliliter of concentrated sulphuric acid was added to the sample and fixed to the digester flask for eight hours until a clear solution was obtained. The cooled digester mass was transferred into one hundred mils volumetric flask and made up to the mark with distilled water. The distillation apparatus was set and rinsed for ten minutes after boiling. Twenty milliliter of 4% boric acid was pipetted into conical flask. Five drops of methyl red was added to the flask as indicator and the sample was diluted with seventy five milliliter distilled water. Ten milliliter of the digest was made alkaline with twenty miles of NaOH (20%) and distilled. The steam exit of the distillatory was closed and the change of color of boric acid solution to green was timed. The mixture was distilled for fifteen minutes. The filtrate was then titrated against 0.1 N HCL. The experiments were repeated three times and average reading was reported.

$$\%N = \frac{(Sample\ titre - Blank\ titre) \times N\ HCL \times 1.4 \times 100}{Weight\ of\ sample} \times 100 \quad \ldots(2)$$

$$\text{\% protein} = \text{\% nitrogen} \times \text{conversion factor (6.25)} \quad \ldots(3)$$

3. Fat

Fat content of 0, 15, 30, 45, 60, 75 and 90 days stored cookies of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was determined by soxhlet fat extraction system (AOAC, 2010) by Soxhlet apparatus (Make: Elico, Hyderabad). In this method, initially weight of empty flask was weighted. 2 g cookies sample were wrapped in filter paper. The cookies sample with filter paper was kept in siphoning tube and condenser was fixed above it and siphoned for 9-12 times with the petroleum ether in soxhlet apparatus. After removing assembly, evaporation of petroleum ether was allowed by heating round bottom flask. Residue remained at the bottom of the flask and was reweighted with flask. The quantity of residue was determined as fat content of cookies. The experiment was replicated for 3 times. The average value of fat content is reported. The fat content was calculated by using following formula (4);

$$\text{\% Fat content} = \frac{\text{Final wt.} - \text{Initial wt}}{\text{Wt.of sample}} \times 100 \quad \ldots(4)$$

4. Ash

Ash content of the 0, 15, 30, 45, 60, 75 and 90 days stored cookies of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was determined by using muffle furnace. 5 g of cookies sample was taken in a crucible. Weight of crucible and sample was recorded kept in muffle furnace at 650°C for 4-5 h till constant weight was achieved. It was observed for their constant readings. The crucible was cooled in desiccators and final weight of ash and crucible was recorded. The experiment was replicated for 3 times. The average value of ash content is reported. The ash content was calculated by using following formula (5);

$$\text{Ash} = \frac{W_2 - W}{W_1 - W} \times 100 \quad \ldots(5)$$

Where,

W = weight of crucible, *g*;

W_1 = weight of crucible and sample, *g*; and

W_2 = weight of crucible with ash, *g*

5. Fiber

The fiber content of the 0, 15, 30, 45, 60, 75 and 90 days stored cookies of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material were determined by the fat free sample available in filter paper from fat extraction method (Ranganna, 1986). The filter paper and fat free residue was kept in the oven for 105°C for 5-6 hours. Around 2 g sample from oven was taken into 600 ml beaker and boiled, 200 ml 1.25 % H_2SO_4 was added to it. The beaker containing solution was placed on hot plate for 30 min. After heating residue from beaker was filtered through filter paper and rinsed beaker with 50 to 75 ml boiling water for three times. The filtered residue from filter paper was dried by convective hot air drying for 2-3 h at 130°C. The dried residue from convective hot air dryer was transferred to 600 ml beaker and boiled, 200 ml 1.25 % NaOH was added to it and boiled for 30 more minutes on hot plate.

After heating residue from beaker was filtered through filter paper and rinsed beaker with 50 to 75 ml boiling water for three times. The filtered residue from filter paper was dried by convective hot air drying at 130°C for 2h. The dried residue was weighted after cooling and weight was noted. The weighed residue was transferred to crucible in hot air oven and ignited for 30 minutes at 600°C and reweighed after cooled in desiccators' and weight was recorded. The experiment was replicated for 3 times. The average value of crude fiber content is reported. The crude fiber content was calculated by using following formula (6);

$$\% \text{ Fiber} = \frac{\text{Weight of residue with crucible} - \text{Weight of ash with crucible}}{\text{Weight of sample}} \times 100 \quad \ldots(6)$$

6. Carbohydrates

Carbohydrate content of the 0, 15, 30, 45, 60, 75 and 90 days stored cookies samples of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was determined by subtracting the total sum of protein, fiber, ash and fat from the total dry matter (Vengaiah *et al*. 2013). The carbohydrate was calculated by using following formula (7);

$$\% \text{ Carbohydrate} = 100 - (\%\text{protein} + \% \text{ fat} + \% \text{ fiber} + \% \text{ ash} + \% \text{ moisture content}) \quad \ldots (7)$$

7. Hardness

The Hardness of the 0, 15, 30, 45, 60, 75 and 90 days stored of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material cookies measured with texture analyzer. The texture analyzer (Make: M/s Perten Instrument, USA. Model-TexVol TVT-300 XP). The above mentioned cookies of 4 mm were exposed to compression test with probe no-6, size 0.5 mm and pre-test speed was 60 mm/s, compression depth was 70 % and trigger load was 5 g for cookies. The equipment gives the value of hardness.

8. Browning index

Colour of the 0, 15, 30, 45, 60, 75 and 90 days stored cookies sample of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material was measured by using Konica Minolta colour Reader. (Make: Minolta Camera Co. Ltd. Japan Model: (R-10). The colour of the Samples was measured in dark room. The cookies sample was placed on white surface and placing colour reader on the cookies sample in a Petri dish and the colour was measured in L, a, b were reported. Where L value

indicates degree of lightness or darkness, '*a*' value indicates redness or greenness and '*b*' value indicates the yellowness or blueness.

This index indicates the brown color purity which can be calculated in this way (Perez-Gago *et al.* 2006).

$$BI = \frac{100 \times (\chi - 0.31)}{0.172} \quad \ldots(8)$$

$$\chi = \frac{a* + 1.75L*}{5.645L* + a* - 3.012b*} \quad \ldots(9)$$

9. Microbial analysis

The 0, 15, 30, 45, 60, 75 and 90 days stored of finger millet malt: *Aloe vera* powder: wheat flour (T_1) and control sample (T_2) packed in polythene (P_1) and aluminum (P_2) packaging material cookies sample was crushed finely in mortar and pestle. 1gm of sample was mixed thoroughly in 10ml autoclaved distilled water and mixed thoroughly by vortexing. Serial dilutions from the above suspension were prepared up to 10^{-6}. 1 ml serially diluted sample was plated by pour plate technique on nutrient agar (for total viable count), Potato Dextrose Agar (for yeast and mold count. All plates were incubated at 37°C for 24-48 hrs. After 24-48 hours of incubation the plates were observed for typical colonies of each microorganism and colonies were counted with the help of colony counter. The results were recorded as CFU/g methods prescribed by Bureau of Indian Standards, (1999). Formula for calculating CFU/g;

$$\text{CFU} = \frac{\text{Average platecount} \times \text{Dilution}}{\text{Weight of sample}} \quad \ldots(10)$$

Sensory analysis

The finger millet malt and *Aloe vera* powder cookies packed in polythene and aluminium laminated pouches was determined for each storage period 0, 15, 30, 45, 60, 75 and 90 days with trained panelists as per nine point hedonic scale. The finger millet malt and *Aloe vera* powder cookies packed in polythene and aluminium laminated pouches were coded as A, B. the control sample (Wheat flour cookies) was packed in polythene laminated pouches and aluminum laminated pouches were coded as C and D for evaluation of sensory parameter i.e. colour, flavor, texture and taste attributes. The rating was based on nine- point hedonic scales. 09 scales for colour, 09 scales for flavor attribute 09 scales for texture attribute and 09 scales for Taste. The attribute were summed up for total score 36 for each panelist for each treatment.

Statistical Analysis

The statistical analysis was performed using FCRD design for stored samples properties like moisture, protein, fat, ash, fiber, carbohydrate, hardness, browning index, sensory attributes like i.e. colour, flavor, texture and taste and microbial analysis of stored cookies of finger millet malt: *Aloe vera* powder: wheat flour and the control sample packed in polythene and aluminum pouches for 0, 15, 30, 45, 60, 75 and 90 days was carried out by Microsoft Excel 2007.

RESULTS AND DISCUSSION

The best treatment of finger millet malt and *Aloe vera* powder cookies obtained in microwave oven was used for the packaging and storage study.

Quality evaluation for cookies

1. Moisture

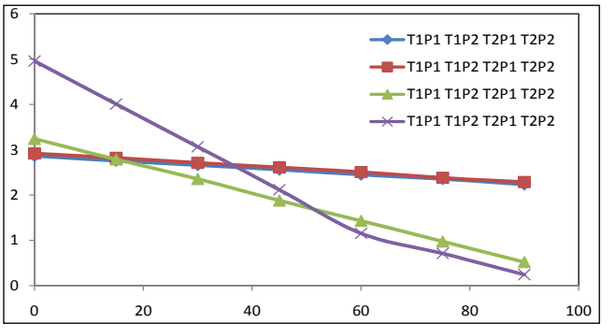

Fig. 4: Moisture versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

Fig. 4 shows the effect of packaging material and storage duration on the moisture content of finger

millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene (P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the moisture of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period. The moisture content decreases from 2.86% to 2.23 % for T_1P_1; 2.92 % to 2.29 % for T_1P_2; from 3.24% to 0.52% and 4.96% to 0.24% during storage period increases from 0 days to 90 days. Lowest protein content was retained in T_1P_2 in aluminium pouches followed by T_1P_2 as compared with control sample T_2P_1 and T_2P_2 respectively. Table 3 shows the f -test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days moisture content of cookies. The packaging material has significant effect on the moisture content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the moisture content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the moisture content of cookies at $p \leq 0.05$. Devi *et al.* 2012 also reported the similar result on moisture. Metallised polyester polyethylene Laminated pouches moisture is higher than polythene pouches and plastic container, as the storage period increases moisture decreases.

2. Protein

Fig. 5 shows the effect of packaging material and storage duration on the protein content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene (P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the protein of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period.

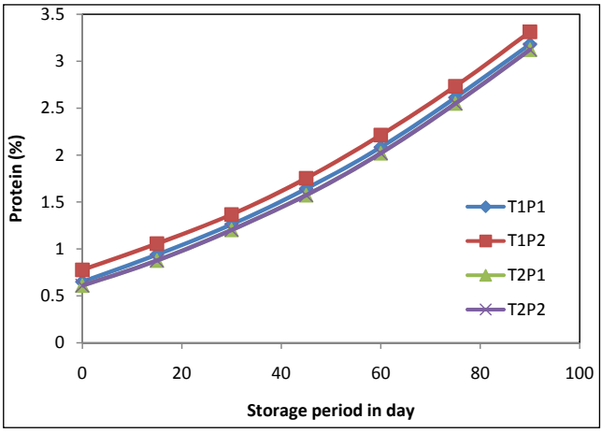

Fig. 5: Protein versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

The protein content increases from 0.65% to 3.18 % for T_1P_1; 0.78 % to 3.31 % for T_1P_2; from 0.55% to 3.07 % and 0.61% to 3.12% during storage period increases from 0 days to 90 days. Highest protein content was retained in T_1P_2 in aluminium pouches followed by T_1P_2 as compared with control sample T_2P_1 and T_2P_2 respectively. Table 4 shows the f -test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days

Table 3: f– test for effect of moisture on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	15 day	30 day	45 day	60 day	75 day	90 day	Average
T_1P_1	2.86±0.01	2.76±0.02	2.66±0.01	2.56±0.01	2.45±0.02	2.35±0.00	2.23±0.02	2.55
T_1P_2	2.92±0.01	2.82±0.01	2.71±0.01	2.61±0.01	2.51±0.00	2.38±0.01	2.29±0.00	2.60
T_2P_1	3.24±0.03	2.79±0.02	2.35±0.01	1.88±0.01	1.43±0.01	0.97±0.01	0.52±0.01	1.88
T_2P_2	4.96±0.03	4.01±0.01	3.06±0.01	2.12±0.02	1.15±0.01	0.71±0.01	0.24±0.00	2.32
Mean	3.49	3.09	2.31	2.29	1.88	1.60	1.32	2.33
	SEm ±				$CD_{at\ 5\%}$			
Packaging(P)	0.003				0.010			
Storage (S)	0.004				0.013			
Interaction (P×S)	0.009				0.026			

Table 4: f– test for effect of Protein on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	**15 day**	**30 day**	**45 day**	**60 day**	**75 day**	**90 day**	**Average**
T_1P_1	0.65±0.01	0.94±0.06	1.26±0.01	1.64±0.00	2.08±0.07	2.61±0.00	3.18±0.01	1.76
T_1P_2	0.78**±0.05**	1.06**±0.00**	1.37**±0.02**	1.75**±0.01**	2.21**±0.00**	2.73**±0.01**	3.31±0.00	1.88
T_2P_1	0.55±0.01	0.82±0.01	1.15**±0.01**	1.52±0.01	1.97±0.01	2.48±0.01	3.07±0.01	1.65
T_2P_2	0.61**±0.01**	0.88**±0.00**	1.30**±0.00**	1.57**±0.01**	2.02**±0.01**	2.55**±0.00**	3.12±0.00	1.72
Mean	0.64	0.92	1.27	1.62	2.07	2.59	3.17	
	SEm ±				$CD_{at\ 5\%}$			
Packaging(P)	0.001				0.005			
Storage (S)	0.002				0.006			
Interaction (P×S)	0.004				0.013			

protein content of cookies. The packaging material has significant effect on the protein content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the protein content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the protein content of cookies at p≤0.05.

3. Fat

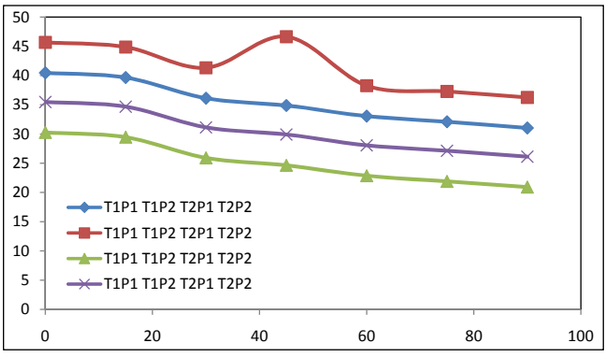

Fig. 6: Fat versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

Fig. 6 shows the effect of packaging material and storage duration on the fat content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene (P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the fat of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period. The fat content decreases from 40.46% to 31.02% for T_1P_1; 45.68% to 36.24% for T_1P_2; from 30.27% to 20.91% and 35.47% to 26.12% during storage period increases from 0 days to 90 days. Highest fat content was retained in T_1P_2 in aluminium pouches followed by T_1P_2 as compared with control sample T_2P_1 and T_2P_2 respectively. Table 5 shows the f-test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days fat content of cookies. The packaging material has significant effect on the fat content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the fat content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the fat content of cookies at p≤0.05. Devi *et al.* (2012) also reported the similar result on fat. Metallised polyester polyethylene Laminated pouches fat is higher than polythene pouches and plastic container, as the storage period increases fat decreases

4. Ash

Fig. 7 shows the effect of packaging material and storage duration on the ash content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene

Table 5: f– test for effect of Fat on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	**15 day**	**30 day**	**45 day**	**60 day**	**75 day**	**90 day**	**Average**
T_1P_1	40.46±0.05	39.66±0.04	36.12±0.01	34.87±0.05	33.05±0.04	32.09±0.05	31.02±0.05	35.32
T_1P_2	45.68±0.04	44.87±0.04	41.32±0.01	46.64±0.05	38.26±0.04	37.27±0.05	36.24±0.05	41.46
T_2P_1	30.27±0.05	29.45±0.04	25.91±0.05	24.63±0.04	22.86±0.04	21.89±0.05	20.91±0.01	25.13
T_2P_2	35.47±0.04	34.67±0.05	31.13±0.04	29.91±0.05	28.05±0.05	27.13±0.05	26.12±0.04	30.35
Mean	37.97	37.16	33.62	34.01	30.55	29.59	28.59	
	SEm ±			$CD_{at\ 5\%}$				
Packaging(P)	0.004			0.014				
Storage (S)	0.006			0.018				
Interaction (P×S)	0.013			0.037				

(P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the ash of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period.

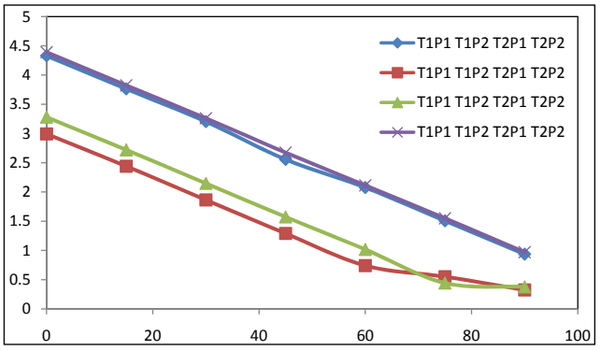

Fig. 7: Ash versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

The ash content decreases from 4.33% to 0.94% for T_1P_1; 2.99% to 0.32% for T_1P_2; from 3.28% to 0.38% and 4.39% to 0.97% during storage period increases from 0 days to 90 days. Lowest ash content was retained in T_1P_2 in aluminium pouches followed by T_1P_2 as compared with control sample T_2P_1 and T_2P_2 respectively. Table 6 shows the t-test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days ash content of cookies. The packaging material has significant effect on the ash content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the ash content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the ash content of cookies at $p \leq 0.05$. Devi *et al.* 2012 also reported the similar result on ash. Metallised polyester polyethylene Laminated pouches ash is higher than polythene pouches and plastic container, as the storage period increases ash decreases.

5. Fiber

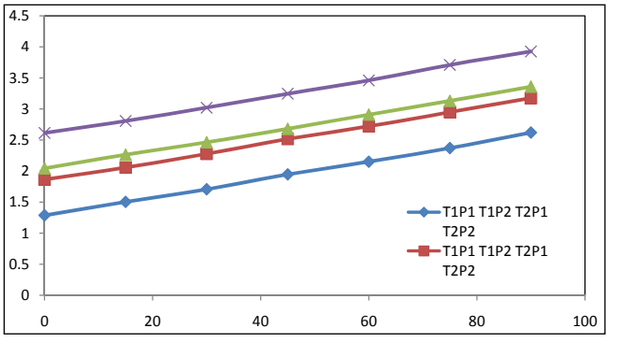

Fig. 8: Fibre versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

Fig. 8 shows the effect of packaging material and storage duration on the fiber content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene

Table 6: f– test for effect of Ash on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	**15 day**	**30 day**	**45 day**	**60 day**	**75 day**	**90 day**	**Average**
T_1P_1	4.33±0.01	3.76±0.01	3.20±0.01	2.56±0.02	2.08±0.02	1.51±0.01	0.94±0.01	2.62
T_1P_2	2.99±0.02	2.44±0.01	1.86±0.00	1.29±0.01	0.74±0.02	0.55±0.01	0.32±0.00	1.45
T_2P_1	3.28±0.03	2.72±0.00	2.15±0.01	1.57±0.01	1.02±0.02	0.44±0.01	0.38±0.00	1.65
T_2P_2	4.39±0.02	3.82±0.01	3.26±0.01	2.67±0.01	2.11±0.01	1.55±0.01	0.97±0.01	2.68
Mean	3.74	3.18	2.61	2.02	1.48	1.01	0.65	
	SEm ±			$CD_{at\ 5\%}$				
Packaging(P)	0.002			0.007				
Storage (S)	0.003			0.009				
Interaction (P×S)	0.006			0.018				

Table 7: f– test for effect of Fiber on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	**15 day**	**30 day**	**45 day**	**60 day**	**75 day**	**90 day**	**Average**
T_1P_1	1.29±0.01	1.50±0.01	1.71±0.00	1.95±0.01	2.15±0.01	2.37±0.01	2.62±0.01	1.94
T_1P_2	1.86±0.00	2.06±0.01	2.28±0.01	2.52±0.02	2.72±0.02	2.95±0.00	3.18±0.00	2.51
T_2P_1	2.04±0.01	2.26±0.02	2.46±0.02	2.68±0.01	2.91±0.01	3.13±0.00	3.36±0.01	2.69
T_2P_2	2.61±0.01	2.81±0.01	3.02±0.01	3.25±0.01	3.46±0.02	3.71±0.01	3.93±0.01	3.25
Mean	1.95	2.15	2.36	1.48	2.81	3.04	3.27	
	SEm ±			$CD_{at\ 5\%}$				
Packaging(P)	0.002			0.007				
Storage (S)	0.003			0.010				
Interaction (P×S)	0.007			0.019				

(P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the fiber of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period. The fiber content increases from 1.29 % to 2.62 % for T_1P_1; 1.86 % to 3.18 % for T_1P_2; from 2.04 % to 3.36 % and 2.61 % to 3.93 % during storage period increases from 0 days to 90 days. Highest fiber content was retained in T_1P_2 in aluminium pouches followed by T_1P_2 and control sample T_2P_2 in aluminium pouches followed by T_2P_1 respectively. Table 7 shows the f-test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days fiber content of cookies. The packaging material has significant effect on the fiber content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the fiber content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the protein content of cookies at $p \leq 0.05$.

6. Carbohydrates

Fig. 9 shows the effect of packaging material and storage duration on the carbohydrate content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene (P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the carbohydrate of

cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period. The carbohydrate content increases from 48.44 % to 60.01 % for T_1P_1; 43.82 % to 54.66 % for T_1P_2; from 58.69 % to 71.76 % and 50.02 % to 65.61% during storage period increases from 0 days to 90 days.

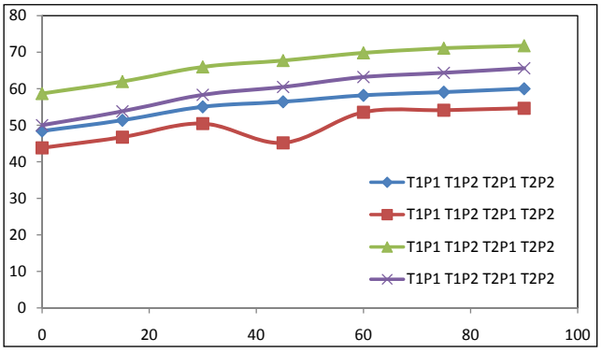

Fig. 9: Carbohydrate versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

Highest carbohydrate content was retained in control sample T_2P_1 in aluminium pouches followed by T_2P_2 respectively. Table 8 shows the f -test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days carbohydrate content of cookies. The packaging material has significant effect on the carbohydrate content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the carbohydrate content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the carbohydrate content of cookies at $p \leq 0.05$.

7. Browning Index

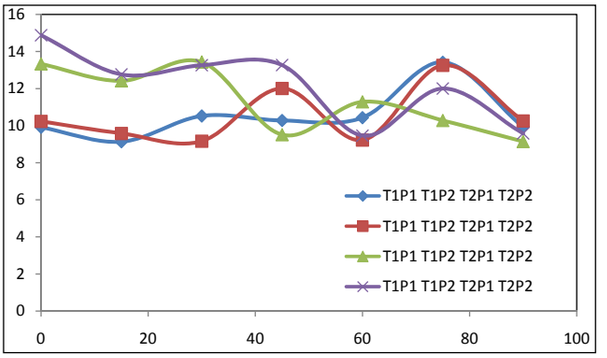

Fig. 10: Browning index versus storage period of polythene pouches and aluminium pouches of finger millet and control cookies

Fig. 10 shows the effect of packaging material and storage duration on the browning index content of finger millet malt: *Aloe vera*: wheat flour (T_1) packed in polythene (P_1) and aluminium pouches (P_2) and control sample (T_2) packed in polythene (P_1) and aluminium porches (P_2) on the browning index of cookies studied during storage period 0 days, 15 days, 30 days, 45 days, 60 days, 75 days and 90 days period. The browning index content from 9.91 % to

Table 8: f– test for effect of Carbohydrate on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	**15 day**	**30 day**	**45 day**	**60 day**	**75 day**	**90 day**	**Average**
T_1P_1	48.44±0.02	51.38±0.02	55.05±0.01	56.43±0.05	58.19±0.01	59.07±0.01	60.01±0.01	55.51
T_1P_2	43.82±0.01	46.75±0.01	50.46±0.02	45.19±0.00	53.56±0.01	54.12±0.06	54.66±0.03	49.79
T_2P_1	58.69±0.02	61.96±0.02	65.97±0.01	67.71±0.08	69.81±0.02	71.08±0.00	71.76±0.01	66.71
T_2P_2	50.02±0.01	53.82±0.03	58.33±0.01	60.48±0.03	63.20±0.03	64.35±0.05	65.61±0.02	59.40
Mean	50.25	53.47	57.45	57.45	61.19	62.15	63.01	
	SEm ±			$CD_{at\ 5\%}$				
Packaging(P)	0.006747			0.019284				
Storage (S)	0.008925			0.025511				
Interaction (P×S)	0.017851			0.05057				

Table 10: f– test for effect of Browning index on storage life of cookies packed in different packaging material

Treatment	Storage period							
	0 day	15 day	30 day	45 day	60 day	75 day	90 day	Average
T_1P_1	9.91±0.01	9.14±0.01	10.52±0.00	10.28±0.01	10.43±0.00	13.42±0.01	9.91±0.03	10.55
T_1P_2	10.25±0.02	9.59±0.03	9.16±0.01	12.0±0.00	9.21±0.00	13.25±0.01	10.25±0.02	10.53
T_2P_1	13.33±0.01	12.41±0.00	13.42±0.00	9.50±0.01	11.28±0.02	10.28±0.01	9.14±0.02	11.33
T_2P_2	14.48±0.00	12.76±0.01	13.25±0.01	13.27±0.01	9.46±0.02	12.00±0.00	9.59±0.01	12.08
Mean	11.99	10.97	11.58	11.26	10.09	12.23	9.72	
	SEm ±			$CD_{at\ 5\%}$				
Packaging(P)	3.70			12.06				
Storage (S)	3.91			12.75				
Interaction (P×S)	3.78			12.34				

9.90 % for T_1P_1; 10.25 % to 10.25 % for T_1P_2; decreases from 13.33 % to 9.14 % and 14.48 % to 9.14 % during storage period increases from 0 days to 90 days. Lowest browning index content was retained in T_1P_1 in polythene bag followed by T_1P_2 as compared with control sample T_2P_1 and T_2P_2 respectively. Table 9 shows the f -test for the effect of packaging material (T_1P_1, T_1P_2, T_2P_1, T_2P_2) and storage duration 0, 15, 30, 45, 60, 75 and 90 days browning index content of cookies. The packaging material has significant effect on the browning index content of cookies both for T_1 and T_2. Similarly the storage duration has also the significant influence on the browning index content of cookies for T_1P_1, T_1P_2, T_2P_1, and T_2P_2 respectively. Interaction effect of both the packaging material (P_1 and P_2) of both cookies (Treatments T_1 and T_2) on the storage duration has also the significant effect on the browning index content of cookies at $p \leq 0.05$.

Microbial analyses

1. Standard Plate Count

The effect of packaging treatments (polythene pouches and aluminum pouches) and storage duration on microbial characteristics of finger millet malt and *Aloe vera* powder cookies stored at ambient temperature were recorded. Out of total storage duration i.e. 0, 15, 30, 45, 60, 75 and 90 days, the microbial analysis was carried out after 15 days interval. Bacterial growth was detected for forth analysis of 45 days for both the packaging material i.e. polythene pouches and aluminum pouches. At 90 days analysis the standard plate count observed for cookies packed in polythene and aluminum pouches were and 71×10^3CFU/ g and 70×10^3 CFU/ g respectively. It was seen from Table 11 shows the ANOVA for the effect of packaging treatments and storage duration on standard plate count of finger millet malt and *Aloe vera* powder cookies. It indicated that packaging treatments and storage had significant influence on standard plate count of cookies at finger millet malt and *Aloe vera* powder cookies $p \leq 0.05$.

Table 11: Table Effect of packaging material and storage duration of finger millet malt and *Aloe vera* powder cookies on standard plate count

Duration	Polythene Pouch	Aluminum Pouch
0 Days	Not Detected	Not detected
15 Days	Not Detected	Not Detected
30 Days	Not Detected	Not Detected
45 Days	Not Detected	Not Detected
60 Days	Not Detected	Not Detected
75 Days	Not Detected	Not Detected
90 Days	71×10^2 CFU/g	70×10^2 CFU/g

	Treatment	Storage	Interaction
SEm ±	0.403	0.940	1.330
$CD_{at\ 5\%}$	1.440	2.611	3.851

2. Yeast and Mold Count

The effect of packaging treatments (polythene pouches and aluminum pouches) and storage

duration on microbial characteristics of dried SFP, stored at ambient temperature were recorded. Out of total storage duration i.e. 0, 15, 30, 45 and 60 days, the microbial analysis was carried out after 30 days interval. No yeast and mold growth was detected for first analysis of 90 days for both the packaging material i.e. polythene pouches and aluminum pouches. At 90 days analysis the yeast and mold count observed for finger millet malt and *Aloe vera* powder cookies packed in polythene and aluminum pouches were 17×10^5 and 71×10^5 (CFU/ g) respectively.

It can be seen from Table 12 shows the ANOVA for the effect of packaging treatments and storage duration on yeast and mould count of finger millet malt *Aloe vera* powder cookies. It indicated that packaging treatments and storage duration had significant influence on yeast and mould count of finger millet and *Aloe vera* powder cookies at p≤0.05.

Table 12: Effect of packaging material and storage duration of finger millet malt and *Aloe vera* powder cookies on yeast and mold count

Duration	Polythene Pouch	Aluminum Pouch
0 Days	Not Detected	Not detected
15 Days	Not Detected	Not Detected
30 Days	Not Detected	Not Detected
45 Days	Not Detected	Not Detected
60 Days	Not Detected	Not Detected
75 Days	Not Detected	Not Detected
90 Days	71×10^5 CFU/ g	17×10^5 CFU/ g

	Treatment	Storage	Interaction
SEm ±	0.333	0.505	0.856
$CD_{at\ 5\%}$	0.921	0.924	2.472

Sensory analysis

The data obtained for sensory properties viz. colour, flavor, texture, and taste of finger millet and *Aloe vera* powder cookies and control cookies stored for 0, 15, 30, 45, 60, 75 and 90 days as per the nine point hedonic scale determined by trained panel for two packaging treatment polythene pouches (P1) and aluminum pouches (P) are given in Table 13. Sensory analysis was conducted at 15 days interval. The average colour scores for cookies stored for 0, 15, 30, 45, 60, 75 and 90 days was 7.41, 8.0, 7.33, 7.73, 7.50, 8.00, 7.47 for T_1P_1;7.59, 9.0, 7.33, 7.83, 7.43, 9.0, 7.33 for T_1P_2;. 7.24, 8.17, 7.50, 7.90, 7.03, 8.17, 6.93 for T_2P_1 and 7.61, 8.33, 7.17, 7.37, 6.60, 8.33, 6.50 for T_2P_2. It can be seen from Table 13 (a) that ANOVA for the effect of packaging treatments and storage duration on colour of finger millet malt and *Aloe vera* powder cookies. It indicated that packaging treatments and storage duration had significant influence on colour of finger millet malt and *Aloe vera* powder cookies p≤0.05. The interaction also showed the significant influence on colour of finger millet malt and *Aloe vera* powder cookies at p≤0.05.

The average flavour score for finger millet malt and *Aloe vera* powder cookies stored for 0, 15, 30, 45, 60, 75 and 90 days was 6.6, 7.7, 7.2, 7.7, 6.9, 7.7, 8.2 for T_1P_1; 6.7, 8.2, 7.4, 8.3, 6.6, 7.4, 7.1 for T_1P_2; 6.9, 7.1, 7.2, 7.4, 6.7, 7.3, 6.7 for T_2P_1 and 7.2, 7.3, 6.7, 7.1, 7.3, 7.2, 7.3 for T_2P_2. It indicated that packaging treatments and storage duration had significant influence on flavour of cookies at p≤0.05. It can be seen from Table 13 (b) that ANOVA for the effect of packaging treatments and storage duration on flavour of finger millet malt and *Aloe vera* powder cookies. The interaction also showed the significant influence on flavor of cookies at p≤0.05. The average texture score for cookies stored for 0, 15, 30, 45, 60, 75 and 90 days was 6.6, 7.4, 7.5, 7.6, 6.5, 7.6, 7.5 for T_1P_1; 6.8, 8.2, 7.6, 7.9, 7.0, 7.9, 7.3 for T_1P_2; 7.0, 7.8, 7.0, 7.7, 6.8, 7.6, 6.7 for T_2P_1 and 7.1, 7.5, 7.0, 7.6, 6.8, 7.7, 7.7 for T_2P_2. It indicated that packaging treatments and storage duration had significant influence on texture of cookies at p≤0.05. The interaction also showed the significant influence on texture of cookies at p≤0.05. It can be seen from Table 13 (c) that ANOVA for the effect of packaging treatments and storage duration on texture of finger millet malt and *Aloe vera* powder cookies. The average taste score for cookies stored for 0, 15, 30, 45, 60, 75 and 90 days was 7.5, 7.9, 7.3, 7.6, 7.0, 7.7, 7.9 for T_1P_1; 7.3, 8.2, 7.4, 7.8, 7.1, 7.8, 7.7 for T_1P_2; 7.4, 7.3, 7.0, 8.1, 6.7, 8.2, 8.1 for T_2P_1 and 8.0, 7.2, 6.7, 7.6, 6.8, 8.0, 7.4 for T_2P_2. It indicated that packaging treatments and

Table 13: Effect of packaging material and storage duration of Finger millet malt and *Aloe vera* powder cookies on sensory attribute and its ANOVA

Parameter	Source of Variance	Storage duration (days)							
		0 days	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**	**90 days**	**Mean**
a) Colour	T_1P_1	7.41±**0.38**	8.00±**0.00**	7.33±**0.76**	7.73±**0.46**	7.50±**0.5**	8.00±**0.00**	7.47±**0.40**	7.634
	T_1p_2	7.59±**0.43**	9.00±**0.00**	7.33±**0.76**	7.83±**0.28**	7.43±**0.51**	9.00±**0.00**	7.33±**0.51**	7.93
	T_2P_1	7.24±**0.18**	8.17±**0.76**	7.50±**1.32**	7.90±**0.36**	7.03±**0.95**	8.17±**0.76**	6.93±**0.95**	7.562
	T_2p_2	7.61±**0.46**	8.33±**0.57**	7.17±**1.44**	7.37±**1.18**	6.60±**0.69**	8.33±**0.57**	6.50±**0.69**	7.415
	Mean	7.462	8.375	7.332	7.707	7.14	8.375	7.057	
		Treatment		**Storage**			**Interaction (TxS)**		
	SEm(±)	0.148477		0.196416			0.392833		
	$CD_{at\ 5\%}$	0.424381		0.561404			1.112899		
Parameter	**Source of Variance**	**Storage duration (days)**							
		0 days	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**	**90 days**	**Mean**
b) Flavour	T_1P_1	6.6±**0.76**	7.7±**0.53**	7.2±**0.88**	7.7±**0.55**	6.9±**0.85**	7.7±**0.57**	8.2±**0.28**	7.428
	T_1p_2	6.7±**0.28**	8.2±**0.69**	7.4±**0.75**	8.3±**0.63**	6.6±**0.25**	7.4±**0.69**	7.1±**0.75**	7.385
	T_2P_1	6.9±**0.63**	7.1±**0.25**	7.2±**0.69**	7.4±**0.94**	6.7±**0.39**	7.3±**0.53**	6.7±**0.50**	7.042
	T_2p_2	7.2±**0.65**	7.3±**0.29**	6.7±**0.57**	7.1±**0.50**	7.3±**0.23**	7.2±**0.58**	7.3±**0.23**	7.157
	Mean	6.85	7.575	7.125	7.625	6.875	7.4	7.325	
		Treatment		**Storage**			**Interaction (TxS)**		
	SEm(±)	0.126697		0.167604			0.335208		
	$CD_{at\ 5\%}$	0.362129		0.479051			0.949648		
Parameter	**Source of Variance**	**Storage duration (days)**							
		0 days	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**	**90 days**	**Mean**
c) Texture	T_1P_1	6.6±**0.47**	7.4±**0.25**	7.5±**0.60**	7.6±**0.37**	6.5±**0.35**	7.6±**0.38**	7.5±**0.17**	7.242
	T_1p_2	6.8±**0.75**	8.2±**0.44**	7.6±**0.33**	7.9±**0.56**	7.0±**0.81**	7.9±**0.48**	7.3±**0.01**	7.528
	T_2P_1	7.0±**0.60**	7.8±**0.38**	7.0±**0.67**	7.7±**0.25**	6.8±**0.72**	7.6±**0.09**	6.7±**0.86**	7.228
	T_2p_2	7.1±**0.58**	7.5±**0.28**	7.0±**0.75**	7.6±**0.15**	6.8±**0.75**	7.7±**0.00**	7.7±**0.00**	7.342
	Mean	6.875	7.725	7.275	7.7	6.775	7.7	7.3	
		Treatment		**Storage**			**Interaction (TxS)**		
	SEm(±)	0.110137		0.145698			0.291396		
	$CD_{at\ 5\%}$	0.314798		0.416439			0.825529		
Parameter	**Source of Variance**	**Storage duration (days)**							
		0 days	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**	**90 days**	**Mean**
d) Taste	T_1P_1	7.5±**0.50**	7.9±**0.19**	7.3±**0.75**	7.6±**0.15**	7.0±**0.45**	7.7±**0.30**	7.9±**0.19**	7.557
	T_1p_2	7.3±**0.52**	8.2±**0.69**	7.4±**0.68**	7.8±**0.38**	7.1±**0.41**	7.8±**0.42**	7.7±**0.57**	7.614
	T_2P_1	7.4±**0.63**	7.3±**0.63**	7.0±**0.93**	8.1±**0.80**	6.7±**0.62**	8.2±**0.71**	8.1±**0.76**	7.54
	T_2p_2	8.0±**0.45**	7.2±**0.58**	6.7±**0.57**	7.6±**0.55**	6.8±**0.73**	8.0±**0.18**	7.4±**0.63**	7.385
	Mean	7.55	7.65	7.1	7.775	6.9	7.925	7.775	
		Treatment		**Storage**			**Interaction (TxS)**		
	SEm(±)	0.228606		0.302417			0.604833		
	$CD_{at\ 5\%}$	0.653408		0.864377			1.713499		

storage duration had significant influence on tastes of cookies at p≤0.05. It can be seen from Table 13 (d) that ANOVA for the effect of packaging treatments and storage duration on texture of finger millet malt and *Aloe vera* powder cookies. The interaction also showed the significant influence on taste of cookies at p≤0.05.

CONCLUSION

The cookies incorporated with 1.5% *Aloe vera* powder and backed at 170°C was selected for packaging and storage. 100 g of finger millet malt and *Aloe vera* powder cookies sample was filled separately in polythene and aluminum laminated pouches and sealed properly. These packets were kept at ambient temperature up to 12 weeks. The stored samples were analyzed at every 15 days interval up to 3 months. The observations for the moisture, protein, ash, fat, fiber, carbohydrate, browning index, sensory attributes and microbial analysis of stored sample were taken during 0, 15, 30, 45, 60, 75 and 90 days. The moisture, protein, ash, fat, fiber, carbohydrate, browning index, sensory attributes and microbial analyses for the stored sample were determined for each of the storage duration.

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