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RESEARCH PAPER

Development of Cupcake from Jackfruit Seed and Finger Millet Flour

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ABSTRACT

In this paper the effect of incorporation of Jackfruit seed flour and finger millet flour (8:16%, 10:14%, 12:12%, 14:10%, 16:8%) and baking temperature i.e., 170°C, 180°C and 190°C on the various physico-chemical quality characteristics and sensory score of cupcake was evaluated. The cupcake was prepared by replacing the refined wheat flour with the Jackfruit seed flour and finger millet flour. The various quality characteristics i.e., Moisture%, Protein%, Fat%, Fibre%, Ash%, Carbohydrates%, Browning index, Hardness (g), Gumminess, Chewiness, Cohesiveness, Adhesiveness, Springiness along with the sensory attributes i.e. color, flavor, texture and taste of the developed cupcake was evaluated. Response surface analysis was performed with the quality attributes indicated that cupcake prepared with Jackfruit seed flour 14% and finger millet flour 10% and baked at 170 °C results the best quality cupcake have best nutritional, textural and sensory qualities. The optimal product at quality consist of moisture content 23.830%, protein 4.723%, fat 11.820%, Fibre 2.233%, ash 1.566%, Carbohydrates 55.826%, Browning index 24.612%, Hardness 46.666g, gumminess 42g, Chewiness 24.666g, Cohesiveness 0.865g Adhesiveness 11.466g, Springiness 0.633g. The sensory score for the optimised sample were colour 7.9g, flavour 7.9g, taste 7.9g, and Texture 8.0g respectively.

Keywords: Jackfruit seed flour, Finger millet flour, physicochemical quality and sensory analysis of cupcake

Baking of bakery product can be defined as the process which transforms dough, basically made of flour and water (other ingredients such as sugars, fat egg, leavening agent, and other additives will depend on each specific product), in a food with unique sensorial features (Purlis, 2010).

Baking industry is the largest food industry in India. The annual production of bread, buns and cakes in the country is estimated around 15.2 lakh tonnes (Jyotsna *et al.* 2007). Demand for bakery product is increasing at the rate of 10.07% per annum (Khan *et al.* 2016). Among the bakery products, cakes being very popular occupy a special place in Indian bakeries. Cakes are important confectionary and are enjoyed

socially within groups. Cupcake is a small cake designed to serve one person. This may be baked in a small thin paper with aluminium cup. Cakes are chemically or mechanically leavened bakery product that is loved by all ages.

Wheat flour, eggs, sugar and fat are the major ingredients for making cakes. Among them, egg is the vital ingredient and has high nutritional value and multifunctional properties. Egg yolk provides emulsification, colouring, flavour, and egg gives

coagulation, foaming ability and foaming stability (Yang *et al*. 1995). The size distribution of foam bubbles affect the appearance and texture of foamed foods. High-quality cakes have various attributes, including tenderness, high volume, uniform crumb structure, shelf life (Gelinas *et al.* 1999).

Among different ingredient used in cake making, eggs are the most costly ingredient and significant source of cholesterol. The use of vegetable protein for partial or total substitution of eggs in cake formulations appears therefore, to be an interesting objective, and especially for the people with specific dietary needs (vegetarian, high cholesterol people etc.) The egg proteins have a very important functional role in the definition of cake characteristics, namely volume and texture. This makes it extremely difficult to replace eggs successfully by a different source of proteins, even by use of several types of additive, such as hydrocolloids, in cakes (Arozarena *et al.* 2001).The reasons for replacing egg with hydrocollides and emulsifier are related to their functional properties. Hydrocollides have good functional attributes such as water binding, viscosity, foaming, emulsifiers are known for their crumb softening and antistaling effect.

Jackfruit (*Artocarpus heterophyllus L.*) belongs to the family *Moraceae*. Jackfruit is tropical fruit native to India, Bangladesh, Thailand and Indonesia and is now found in many parts of Asia, Africa, South America and Northern Australia. It is national fruit of Bangladesh (Kirtikar *et al*. 2003). In India, the jackfruit grows in different parts of the country, including the southern states, Assam, Bihar and central Himalayas, Uttar Pradesh, Maharashtra, Kerala, Tamilnadu and Karnataka (Wangchu *et al.* 2013) and considered to be 'Poor man's food' (Jagadeesh *et al*. 2007; Prakash *et al.* 2009). In South India the jackfruit is popular food making next to Mango and Banana (Baliga *et al.* 2011; Morton 1987).The total area under jackfruit cultivation is around 32,600 ha (Butool *et al*. 2013)

The average weight of a fruit is 3.5 to 10 kg. Jackfruit consists about 29% pulp, 12% seed, and 54% rind (Eke- Ejiofor 2014; Berry and Kalra 1988). Ripe jackfruits are large sized fruits measuring between 22-90 cm in length and 13-50 cm width with weight ranging from 2-35 kg. The fruit may contain between 100 and 500 seeds (Sindhu, 2012).

A single jackfruit seed is enclosed in a white aril encircling a thin brown spermoderm, which covers the fleshy white cotyledons are fairly rich in starch and protein (Singh *et al.* 1991). Seed make up around 10-15% of the total fruit weight and have high carbohydrate contents, dietary fiber, vitamins, minerals and phyto-nutrients. The seeds are light brown in colour, oval or oblong ellipsoid or rounded shape, 2-3 cm length and 1-1.5 cm in diameter, seeds of the ripe fruit have around 55% (wb) moisture and therefore do not keep well for long duration. The Jackfruit seeds being seasonal and perishable need proper processing protocol for its increasing the shelf life. Generally seeds are utilized as boiled in sugar and eaten as dessert (Roy *et al.* 1995) or baked and restricted to domestic usage. Jackfruit seed contains Lignans, isoflavin, saponin, all phytonutrients and their health benefits are wide ranging (Swami *et al*. 2012).

Composition of Jackfruit seed flour depends on nature of the seeds, protein, carbohydrates, ash, fat, crude fibre contents 31.9% and 66.2%, 2.72%, 1.25%, 3.09% (Bobbio *et al.* 1978; Khan *et al.* 2016).

Drying is the one of the oldest and a very important unit operation, It involve the application of heat to a material which results in transfer moisture within the material to its surface then water removal from surface of the material to the atmosphere (Ekechukwu, 1999, Akpinar and Bicer, 2005). It is most frequent method of food preservation and increases shelf-life and product quality. After drying seeds can be utilised for longer duration which can utilise by converting seeds into flour. Jackfruit seed flour used for making more nutritious bakery products such as cookies, cake, bread, biscuit, also used as thickening and stabilizing agent.

Finger millet (*Eleusin coracana*) also known as *ragi, nachni, nagali* or *tamba* (Jideani *et al.* 1996), is consumed without dehulling (Gull *et al.* 2015). It is

one of important millet in India. Among the millets of the world, Finger millet ranks fourth after Pearl millet, Foxtail millet and Proso millet. Finger millet production ranks is 6th after wheat, rice, maize, sorghum and bajra in India (Prakash *et al.* 2016).

Finger millet is widely cultivated in Asia and Africa. Major finger millet producing countries are India, China, Uganda and Nepal. The major finger millet producing states include Karnataka, Andhra Pradesh, Gujarat, Maharashtra and Bihar. The world production of finger millet alone is about 4.5 million tonnes. In India annual production of finger millet is 2.8 million ton with productivity of around 1,500 kg/ha (Swami *et al.* 2013). Maharashtra accounts for millet finger area and production 10.56 per cent and 7.16 per cent (Sakamma *et al.* 2018).

Finger millet serves as a staple food for the large number of people in Konkan region. Finger millet is rich in protein, iron, calcium, phosphrous, fibre and vitamin contain. The calcium contain is higher than all cereals and iodine content is highest among all food grains. Ragi has best quality protein along with the presence of essential amino acids vitamin A vitamin B and phosphorus (Gopalan *et al.* 2004). It also contain about 72% carbohydrates, a high proportion of which is in the form of non- starchy polysaccharides and dietary fibre, which helps in constipation, and lowering of glucose in blood. Ragi provides highest level of calcium, antioxidants properties, phytochemicals, which makes it easily and slowly digestible. It is considered to be ideal food for diabetic individuals due to its low sugar content and slow release of glucose / sugar in the body (Lakshmi and Sumathi, 2002). The present investigation aim to study the effect of incorporation of Jackfruit seed flour, finger millet flour and baking temperature on the quality of cupcake.
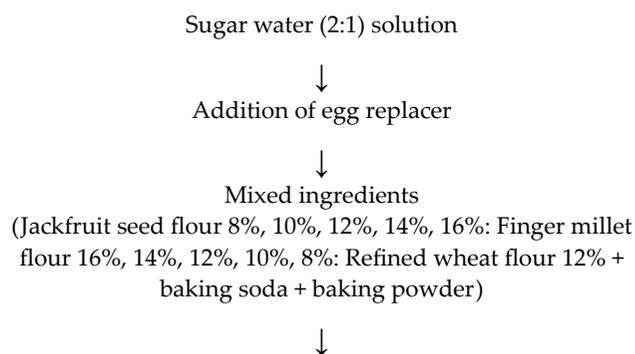
MATERIALS AND METHODS

Raw material

Fresh jackfruit seeds were purchased from Jackfruit pulp processing industry Kudal District Sindhudurga, Maharashtra, India. The Jackfruit seeds were cleaned, washed, removed fleshy white cotyledon. The seeds were dried at 50 °C in a convective hot air dryer dried time at 38 hrs and grounded to particle size 4.885 × mm were used for the preparation of cupcake.

Finger millet was purchased from Roha market. The Finger millet seeds after cleaning were used for flour preparation. The finger millet flour of 3.675×mm in hammer mill were used (Make: M/Sagar Engineering work, Kudal (India) were used for the preparation of cupcake.

Preparation of Cup cake

Fig. 1 shows the process technology for preparation of Cupcake from Jackfruit seed and Finger millet flour. The 28g of sugar and 21g of water were mixed together and prepared a (4:3) sugar solution. Then egg replacer 4g was added in the sugar solution and mixed well up to foam formation, which was defected through visual observation. The mixture was added with the refined wheat flour (12%), Jackfruit seed flour (8%, 10%, 12%, 14%, 16%) and Finger millet flour (16%, 14%, 12%, 10%, 8%), as per the treatments to make the flour composition (36%) baking powder (NaHCO3) and baking soda was added according to the treatment, and it was added into the earlier batter mass and the mixture was thoroughly mixed to a homogeneous mixture to form a dough. The dough was poured into mould with butter paper for giving shape to the cupcake. The cupcake were placed in a baking tray and baked in oven at about 170°C, 180°C and 190°C for 25-30 min, depending upon the temperature condition. The flour combination treatment T1 to T5 at varied baking temperature 170°, 180° and 190° are present in Table 1.
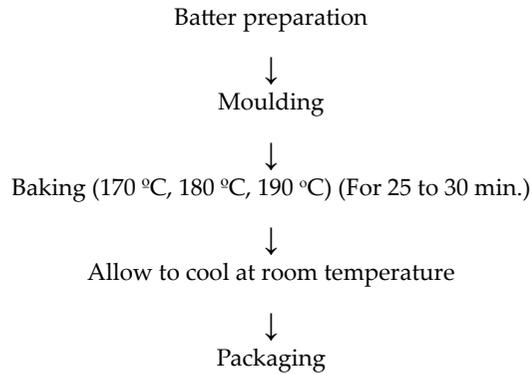
Sugar water (2:1) solution

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Addition of egg replacer

↓

Mixed ingredients
(Jackfruit seed flour 8%, 10%, 12%, 14%, 16%: Finger millet flour 16%, 14%, 12%, 10%, 8%: Refined wheat flour 12% + baking soda + baking powder)

↓

Batter preparation

↓

Moulding

↓

Baking (170 ºC, 180 ºC, 190 ºC) (For 25 to 30 min.)

↓

Allow to cool at room temperature

↓

Packaging

Fig. 1: Process flow chart for preparation of cupcake from Jackfruit seed flour and Finger millet flour

Table 1: Experimental level of Jackfruit seed flour and Finger millet flour in Cupcake

Treatment	Baking Temp.	Jackfruit seed flour	Finger millet flour	Refined wheat flour
T_1	170°C	8 %	16 %	12 %
T_2	170°C	10 %	14 %	12 %
T_3	170°C	12 %	12 %	12 %
T_4	170°C	14 %	10 %	12 %
T_5	170°C	16 %	8 %	12 %
T_6	180°C	8 %	16 %	12 %
T_7	180°C	10%	14 %	12 %
T_8	180°C	12 %	12 %	12 %
T_9	180°C	14 %	10 %	12 %
T_{10}	180°C	16 %	8 %	12 %
T_{11}	190°C	8 %	16 %	12 %
T_{12}	190°C	10 %	14 %	12 %
T_{13}	190°C	12 %	12 %	12 %
T_{14}	190°C	14 %	10 %	12 %
T_{15}	190°C	16 %	8 %	12 %

Physico chemical analysis of Cupcake from Jackfruit seed and Fingermillet flour

1. Moisture Content

The moisture content of cupcake for treatment T1 – T15 were determined by AOAC (2010). 10 g sample of the cupcake was taken for determination of moisture content in to each three different moisture boxes. The initial weight of moisture box was recorded. The samples 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 the sample were determined by equation (1). The experiment was repeated three times and average ready was reported.

$$Moisture\ content\ \%\ (db) = \frac{W_1 - W_2}{W_2} \times 100 \qquad …(1)$$

Where,

W_1 = weight of sample before drying, gm.

W_2 = weight of sample after drying, gm.

2. Protein

Protein content in the Cupcake was for treatment $T_1 – T_{15}$ determined by a micro-Kjeldahl distillation method (AOAC 1990). The samples 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 were released ammonia which was collected in 4% boric acid solution and titrated again with standard HCL. The percent nitrogen content of the sample was calculated the formula given below equation (2). The experiment was repeated three times and average reading was reported.

$$\% (N) = 1.4 \times (ml\ HCl – ml\ blank) \times Conc.\ of$$
$$\frac{HCL}{Weight}\ of\ sample\ (g) \qquad … (2)$$

% Protein = % N × Factor (6.25).

3. Fat (%)

Fat contain of sample cupcake was for treatment $T_1 – T_{15}$ determined using soxhlet fat extraction system (AOAC, 2010). In this method, initially weight of empty flask was weighed. 2g of sample was wrapped in filter paper. It was kept in siphoning tube and condenser was fixed above it and siphoned for 9 to 12 times with the petroleum ether in soxhlet apparatus. After removing assembly, evaporation of petroleum ether was allowed by heating round bottom flask.

Residue reminder at the bottom of the flask and was reweighed with flask. The quantity of residue was determined as fat content of cupcake. Fat content was calculated by using equation (3). The experiment was repeated three times and average ready was reported.

$$\% \ Fat = \frac{Final \ weigh - Initial \ weight}{Weight \ of \ sample} \times 100 \quad …(3)$$

4. Fibre (%)

Fibre contain of cupcake for treatment $T_1 - T_{15}$ was determined using about 2 – 5 g of moisture and fat free sample was weighed into a 500 ml beaker and a 200 ml of boiling 0.25 N sulphuric acid was added to the mixture and boiled for 30 min keeping the volume constant by addition of water at frequent intervals. The mixture was filtered through a muslin cloth and then transferred to the same beaker and 200 ml of boiling 0.313 N (1.25 %) NaOH was added, after boiling for 30 min, the mixture was filtered through muslin cloth. The residue was washed with hot water till it is free from alkali, followed by washing with alcohol and ether. It was then transferred to crucible, dried overnight at 80ºC to 100ºC and weighed. The crucible was heated in muffle furnace at 525ºC for 2 – 3 hrs, cooled and weighed again. The difference in the weights represented the weight of crude fibre equation (4) Rangana (1986). The experiment was repeated three times and average reading was reported.

$$Crude \ Fiber \left(\frac{g}{100g}\right) =$$

$$\frac{100 - (Moisture + Fat) \times Weight \ of \ Fiber \ Weight}{Weight \ of \ sample \ taken} \times 100 \quad … (4)$$

(Moisture + Fat free sample)

5. Ash (%)

Ash content of sample Cupcake for treatment T1 – T15 was calculated using muffle furnance. 5 g of Cupcake sample was taken in crucible. Weight of crucible and sample was recorded and kept in muffle furnace at 525 ºC for 4 -5 h till constant weight was

achieved. The crucible was cooled in desiccators and final weight of ash and crucible was recorded. Ash content was calculated by using equation (4). The experiment was repeated three times the average ash content was reported.

$$Ash \ content \ (\%) = \frac{(W_2 - W_1)}{(Weight \ of \ sample)} \times 100 \quad … (4)$$

Where,

W_2 = weight of crucible + ash,

W_1 = weight of empty crucible.

6. Carbohydrates (%)

The carbohydrate content of cupcake were calculated from protein, fat, fibre, ash and moisture content (Adegunwa *et al*. 2012).

Carbohydrates = 100 – (protein + fat + fiber + ash+ moisture content) … (5)

7. Texture

The Hardness, Gumminess, Chewiness, Cohesiveness, Adhesiveness and Springiness of the Cupcake from Jackfruit seed and Finger millet flour was determined by Texture Analyser (Make: M/s Food Technology Corporation; Model: TMS Touch). in Dept. of Fish Processing Technology and Microbiology, College of Fisheries, Shiragaon Dist. Ratnagiri. A cylindrical probe with 5mm/sec of pre-test speed and post-test speed was 0.5 mm/s and 4mm compression and 5 g trigger force was taken for TPA analysis is two- bite test, which includes the first and second compression cycle. The force vs. time data during the first and second compression of the product by instrumental probe was recorded by the instrument parameter obtained for each test through the equipment were hardness, gumminess, chewiness, cohesiveness, adhesiveness and springiness. The experiment was performed 3 times for the replication and average data was presented for cupcake of each combination Jackfruit seed 8, 10, 12, 14, 16% and Finger millet flour 16, 14, 12, 10, 8 %). (Baking temperature 170, 180 and 190°C).

8. Colour

The Cupcake were used to measure the colour value using a colorimeter (M/s Konica Minolta, Japan Model- Meter CR-400). The equipment was calibrated against standard white tile. Cupcake were taken in the petri dish, the petri dish was placed at the aperture of the instrument. The colour was recorded in terms of L = lightness (100) to darkness (0); a = Redness (+60) to Greeness (-60); b = yellowness (+60) to blueness (-60). The browning index of the cupcake was determined from the L, a and b values as per the equation (7) reported by (Perez *et al.* 2006). The brown index (BI) was determined using the following equation:

$$B_I = \left(\frac{100 \times (x - 0.31)}{0.172} \right) \qquad \ldots(7)$$

$$x = \frac{a*+1.75L}{5.645L + a - 3.012b} \qquad \ldots(8)$$

Where,

L = lightness (100) to darkness (0)

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

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

9. Optimization of Cupcake

10. Sensory Evaluation

The sensory attribute of cupcake for treatment T_1 – T_{15} was evaluated with semi-trained panelists. The panelists were trained for the product testing and were familiar with product sensory evaluation. Cupcake samples were placed in plates. The cupcake prepared from all the treatments were coded from A to P there were around 15 different samples out of which 15 were from the different treatments and one treatment was of control. Which were made from various treatment combinations T1 and T15 as given in Table 1. The sensory parameters i.e. colour, flavour, taste and texture were evaluated based on the nine-point hedonic scale and the attribute were summed up for total score of each panelist the data were analyzed statistically for the significant of each attribute by ANOVA.

11. Correlation of the quality parameter i.e. subjective and objective tests

The optimum product quality of cupcake was determined based on the desirable quality attribute i.e. cupcake should have more protein, low fat, more fibre, more ash, more carbohydrate moderate hardness, moderate browning index, moderate chewiness, moderate gumminess, moderate springiness, and moderate adhesiveness with optimum zone was compared with the best sensory attribute, the best treatment were judged by the sensory panellist. The best treatment was decided based on two and correlated the optimum product quality with the subjective quality evaluation.

RESULTS AND DISCUSSION

This chapter includes results of experimental observations and discussion based on these results. It includes Development of cupcake from jackfruit seed flour and finger millet flour with levels and incorporation as (8:16%, 10:14%, 12:12%, 14:10%, 16:8%) with different baking temperature (170°C, 180°C, 190°C). Physico-chemical properties of cupcake from Jackfruit seed and finger millet flour are reported.

Moisture Content (M_c)

Fig. 2 (a) shows the surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking temperature (°C) on the moisture content (%) of the cupcake. The moisture content for cupcake for all the treatments were in the range of 18.44% to 26.61%. As the Jackfruit seed flour increases from 8% to 16% the moisture content of cupcake decreases. Similarly as the baking temperature increases from 170 °C to 190 °C the moisture content of the cupcake decreases. As both the Jackfruit seed flour (%) and baking temperature (°C) increases the combined effect of these two shows that the moisture content of the cupcake decreases which can be seen from the contour plot Fig. (2b).

Table 2 (a) shows the ANOVA for effect of Jackfruit seed flour (%) and baking temperature (°C) on the

moisture content of the cupcake. Incorporation of Jackfruit seed flour had significant effect at p≤0.01 on the moisture content (%). Similarly, the baking temperature (°C) has significant effect at p≤0.01 on the moisture content (%) of the cupcake. The interaction effect of both Jackfruit seed flour (%) and baking temperature has non-significant effect on moisture content of cupcake with baking temperature 170°C, 180°C, 190°C in cupcake. The interaction of incorporation of Jackfruit seed flour (%) and baking temperature (°C) in cupcake shows non-significant effect on moisture content (%) in cupcake. The effect of incorporation of Jackfruit seed flour and the baking temperature (°C) on moisture content was determined by the second order polynomial equation (9) the equation is well fitted to the experiment data with R² = 0.97; MSE = 0.227

$$M_c = (X,Y) = 285.655 - 2.543Y + 6.17 \times 10^{-3}\, Y^2 - 1.378X + 3.40 \times 10^{-3}\, XY + 0.184X^2 \quad \dots (9)$$

Where,

Z = Moisture content,

X = Jackfruit seed flour,

Y = Baking temperature.

Lin *et al.* (2017) reported 27.33±0.37% moisture content in eggless cakes using isolated pea protein, xanthathan gum, mono- diglycerides and soy lecithin the cake was baked at temperature 180°C. Anu *et al.* (2008) reported that the moisture content in cupcake 28.02 to 28.13% were Banana cupcake prepared from pearl millet flour, refined wheat flour and green gram flour in ratio of 20:70:10, 30:60:10 baked at 170°C. Shrivastva *et al.* (2015) reported the moisture content 19.13% to 22.20% in cupcake prepared from Jackfruit seed flour upto 5-15 % with replacement of wheat flour and cake was baked at 190°C. Salunke *et al.* (2015) reported the moisture content ranges from 19.55 % to 19.92 % in cake formulated by Ragi flour and wheat flour with peanut butter combination ratios was (10:90, 20:80, 30:70) and 20.15% in wheat flour cake. Desai *et al.* (2009) was reported that the 21.05 to 20.82 % moisture content in cake prepared with malted ragi flour. Mohammad- Taghi (2015)

reported that the 19 % moisture content cinnamon and Spirulina cupcake and moisture content decreases from 23.8% to 22.8% Spirilina proportion increases 0.5 to 2.6%. David (2016) reported the moisture content in cupcake was ranges from 19.13 to 22.20 % with increase incorporation of jackfruit seed flour 5% to 15% which was baked at 190°C.
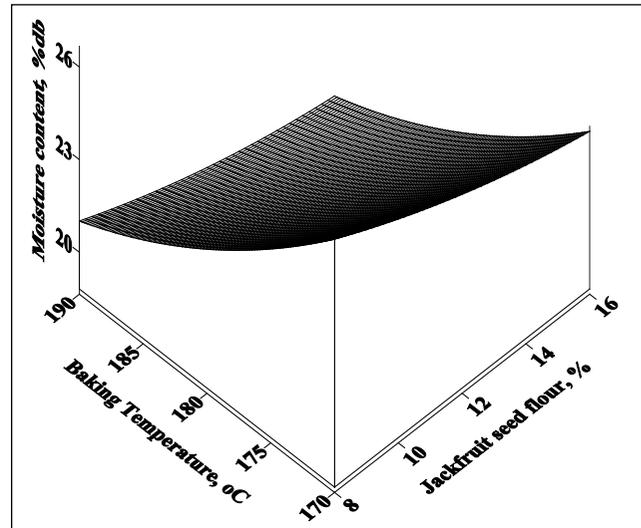

Fig. 2(a) Surface plot of effect of incorporation of Jackfruit seed flour(%) and baking temperature (°C) on the Moisture content of the Jackfruit seed flour: Finger millet flour: Refined wheat flour Cup cake
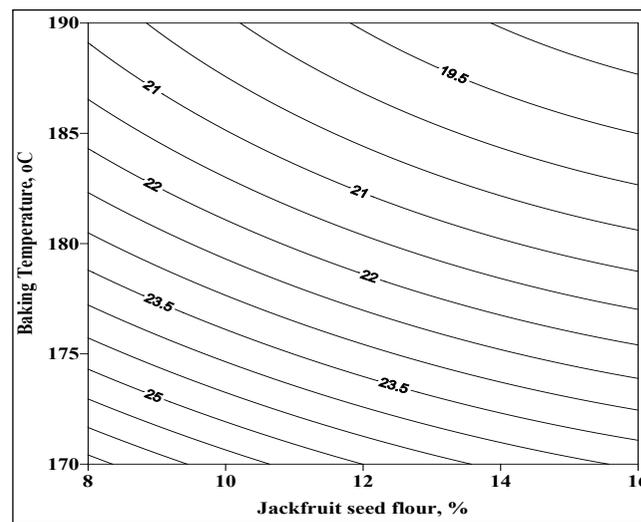

Fig. 2 (b) Contour plot showing the effect of incorporation of Jackfruit Seed Flour (%) and Baking Temperature (°C) on Moisture content of Cupcake

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Protein (P_r)

Fig. 3 (a) shows the surface plot showing the effect of Jackfruit seed Flour (%) and baking temperature (°C) on the protein contain of Cupcake. The protein varies in the range of 3.02 to 5.25%. As the Jackfruit seed flour (%) incorporation increases in the cupcake from 8 to 16% the protein content from cupcake increases. As the baking temperature increases from 170°C to 190°C the protein content from cupcake decreases. As both the Jackfruit seed flour (%) and Baking temperature (°C) increases the protein content increases. This can be seen from contour plot Fig. 3 (b) which is showing effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on protein. As both the and incorporation of Jackfruit seed flour (%) and baking temperature (°C) increases protein content from cupcake increases.

Table 2(b) shows the ANOVA for effect of Jackfruit seed flour (%) and baking temperature (°C) on the protein content of the cupcake. Incorporation of Jackfruit seed flour has significant effect at p≤0.01 on the protein content (%) Similarly, the baking temperature (°C) has significant effect at p≤0.01 on the protein content (%) of the cupcake. The interaction effect of both Jackfruit seed flour (%) and Baking temperature has also significant effect at on the protein content (%) of cupcake. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on protein was determined by the second order polynomial equation (10) the equation is well fitted to the experiment data with R^2 =0.964; MSE = 0.025.

$$P_r = 13.6488 - 0.09250Y + 1.9 \times 10^{-4}\ Y^2 - 0.2768X + 7.0 \times 10^{-4}\ XY + 1.678 \times 10^{-4}\ X^2 \qquad \ldots(10)$$

Where,

P_r = Protein (%); X is Jackfruit seed flour (%); Y is the Baking temperature (°C)

Khan *et al.* (2016) reported the protein content in jackfruit seed flour increased from 6.21 to 8.32 with increased in level of jackfruit seed flour in cupcake. This might be due to presence of higher protein content in jackfruit seed flour. David (2016) reported the protein content in cupcake ranged from 7.71 to 8.48 % with increase incorporation of jackfruit seed flour 5% to 15% which was baked at 190°C. Yildiz *et al.* 2014 reported the protein content of wheat and chestnut flours based cupcake was found 5.40 and 9.38 % which was baked at 175°C to 180°C. Majzoobi *et al.* (2016) reported the 5.52±0.07 % protein from cupcake prepared using rice and corn flour mixture. Mohammad- Taghi (2015) reported the protein content 7.32 % in Cinnamon and Spirulina cupcake.
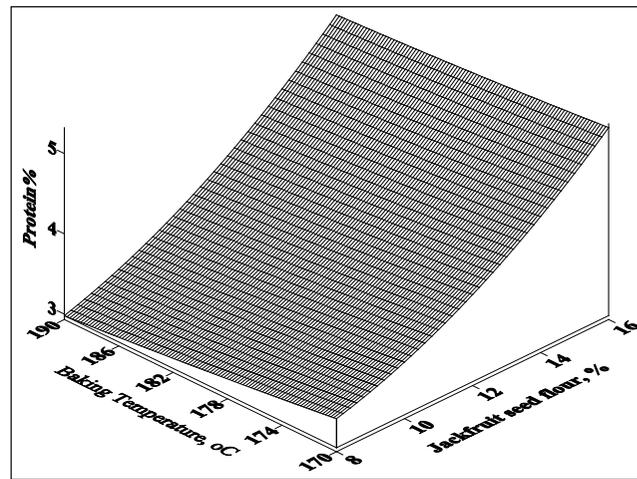

Fig. 3 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on Protein of Cupcake
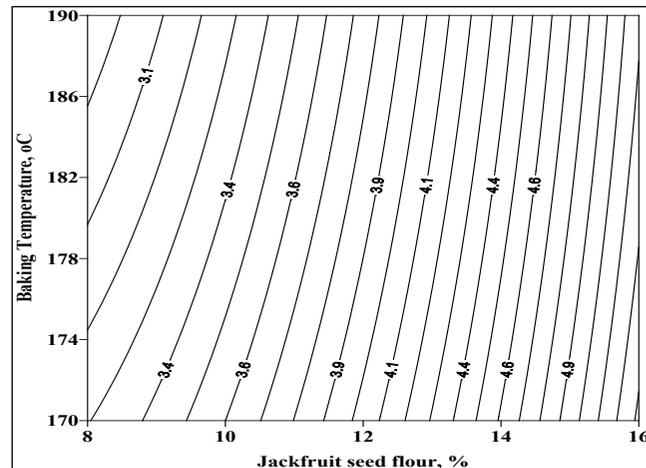

Fig. 3 (b): Contour plot showing the effect of incorporation of Jackfruit Seed Flour (%) and Baking Temperature (ºC) on Protein content of Cupcake

Fat (F_{at})

Fig 4 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the fat content (%) from cupcake. The fat varies in the range of 9.62 to 14.73 %. As the Jackfruit seed flour increases fat content of cupcake decreases the cupcake from 14.73 to 9.62%. Similarly as the baking temperature increases fat content decreases up to 190ºC of baking temperature. Fig. 4 (b) shows the contour plot of effect of incorporation of Jackfruit seed flour (%) and baking temperature on fat content of cupcake. As both the incorporation of Jackfruit seed flour (%) and baking temperature (°C) increases fat from cupcake descreases.

Table 2 (c) shows the ANOVA for effect of and incorporation of Jackfruit seed flour (%) and baking temperature (°C) on the fat content of the cupcake. Incorporation of Jackfruit seed flour has significant effect at p≤0.01 on the fat content in cupcake. Similarly, the baking temperature (°C) has significant effect at p≤0.01 on the fat content (%)of the cupcake. The interaction effect of both Jackfruit seed flour (%) and baking temperature has significant effect at p≤0.01 on the fat content (%) of cupcake. The effect of incorporation of Jackfruit seed flour (%) and the baking temperature (°C) on fat content was determined by the second order polynomial equation (11) the equation is well fitted to the experiment data with R^2 = 0.93121; MSE = 0.248.

$$F_{at} = 204.57 - 2.028Y + 5.39 \times 10^{-3}\, Y^2 - 0.810X + 5.7 \times 10^{-3}\, XY - 0.033X^2 \qquad \ldots (11)$$

F_{at} = Fat (%); X is Jackfruit seed flour (%); Y is the Baking temperature (°C)

David (2016) reported the fat content in cupcake was ranges from 14.86 to 12.57% with increase in incorporation of jackfruit seed flour 5% to 15% which was baked at 190 ºC. Khan *et al.* (2016) reported that the fat contents of cake samples decreased with increasing the percentage of jackfruit seed flour. Amin (2009) reported that the cakes substituted with jackfruit seed flour, that fat content decreased compared to control cake. Shrivastva *et al.* (2015)

reported the fat content decrease from 14.86 to 12.57% in cake prepared from Jackfruit seed flour with replacement 5-15 % of wheat flour and baked at 190°C. Aigal *et al.* (2017) reported that the fat content in cake prepared by various composition foxtail millet, Rice flakes, Oat flakes which was 0.53%, 1.39% and 8.41 % respectively.
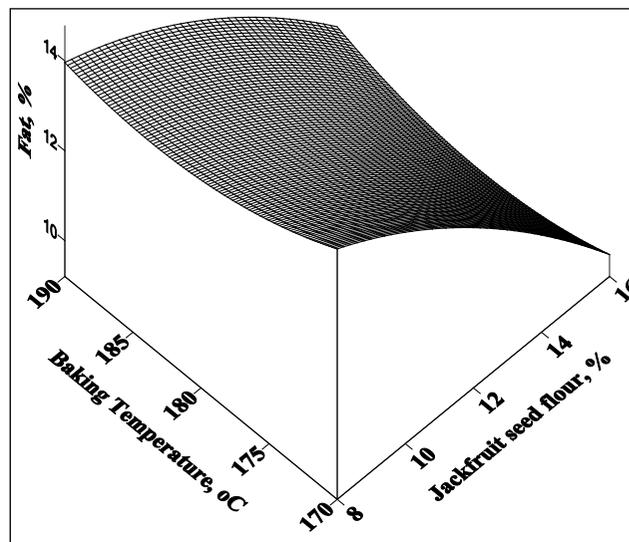

Fig. 4(a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on Fat (%) of Jackfruit seed flour
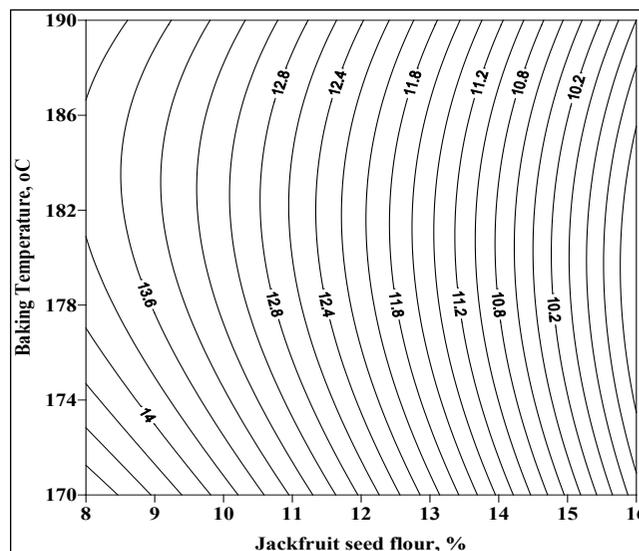

Fig. 4 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour(%) and Baking Temperature (ºC) on the Fat (%) of cupcake

Fibre (F_{ib})

Fig 5 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the fibre content from cupcake. The fibre content varies in the range of 1.67 to 2.42 % as the increase in incorporation of Jackfruit seed flour (%) from 8 to 16 %. Fibre content increases of the cupcake from 1.67 to 2.42% and showing increasing trend as the Jackfruit seed flour increases. Similarly as the baking temperature increases from 170°C to 190°C the fibre content (%) of cupcake decreases. Fig 5 (b) shows the contour plot of effect of and incorporation of Jackfruit seed flour (%) and baking temperature (°C) on fibre content (%) of cupcake. As both the incorporation of Jackfruit seed flour (%) and baking temperature (°C) increases fibre content from cupcake increases.

Table 2 (d) shows the ANOVA for effect of Incorporation of Jackfruit seed flour has significant effect at p on the fibre content in cupcake similarly the baking temperature (°C) has significant effect at p≤0.01 on the fibre content (%) of the cupcake. The interaction effect of both Jackfruit seed flour (%) and baking temperature (°C) has significant effect at p≤0.01 as the fibre content (%) of cupcake. As both the incorporation of Jackfruit seed flour (%) and baking temperature (°C) increases fibre content increases from cupcake. The effect of incorporation of Jackfruit seed flour (%) and the baking temperature (°C) on fibre content was determined by the second order polynomial equation (12) the equation is well fitted to the experiment data with $R^2 = 0.931$; $MSE = 0.248$

$$F_{ib} = 204.57 - 2.028Y + 5.39 \times 10^{-3}\ Y^2 - 0.810X + 5.75 \times 10^{-3}\ XY - 3.35 \times 10^{-2}\ X^2 \qquad \ldots(12)$$

F_{ib} = Fibre (%); X = Jackfruit seed flour (%); Y = the Baking temperature (°C)

Khan *et al.* (2016) reported that the fibre contents of cake samples increases with increasing the percentage of jackfruit seed flour from 0.2 to 1.27 % respectively. Amal *et al.* (2015) reported the fibre content in gluten free and casein free cupcake from corn which was 2.10± 0.11%. Salunke *et al.* (2015) reported the fibre content in cake formulated by Ragi flour and wheat flour with peanut butter combination ratios was (10:90, 20:80, 30:70) and 1.13 % ranges from 2.03 % to 4.13 % in wheat flour cake.
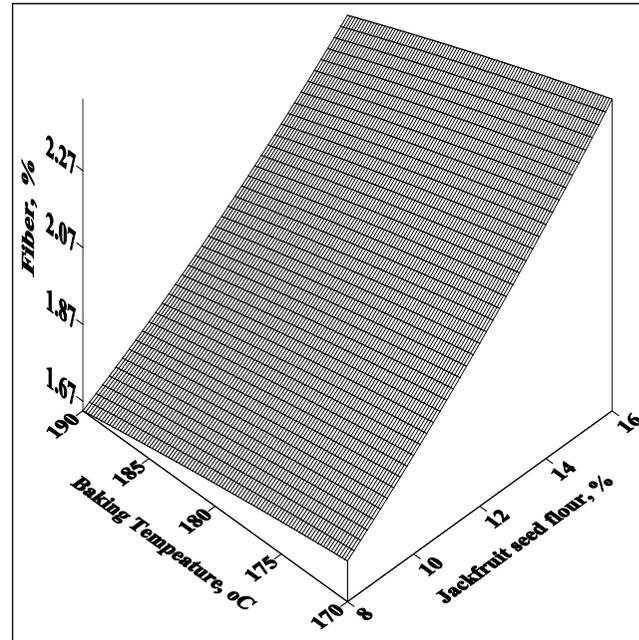

Fig. 5 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on Fibre (%) of Jackfruit seed flour
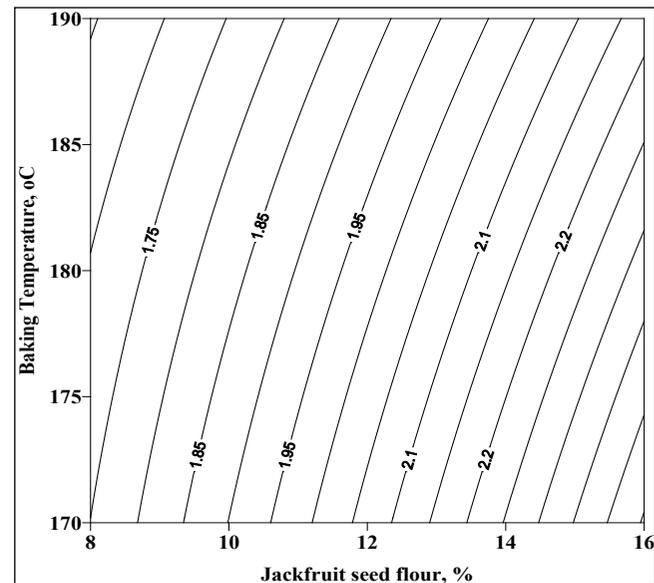

Fig. 5 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour(%) and Baking Temperature (°C) on the Fibre (%) of cupcake

Ash (A_{sh})

Fig 6 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the ash content from cupcake. The ash content of the cupcake varies in the range of 0.69 to 1.97 % as the incorporation of Jackfruit seed flour (%) increases from 8 to 16 % increases. Similarly as the baking temperature increases from 170°C to 190°C ash content decreases. Fig. 6 (b) shows the contour plot of effect of incorporation of Jackfruit seed flour (%) and baking temperature in cupcake on ash content. As both the incorporation of Jackfruit seed flour (%) and baking temperature (°C) ash content % increases from cupcake.

Table 2 (e) shows the ANOVA for effect of Jackfruit seed flour (%) have significant effect on the ash content of the cupcake at p ≤0.01. The effect of baking temperature (°C) has significant effect on the ash content of the cupcake at p ≤0.01. The interaction of both Jackfruit seed flour incorporation (%) and baking temperature has significant effect on the ash content of the cupcake at p ≤0.01. The effect of incorporation of Jackfruit seed flour (%) and the baking temperature (°C) was determined by the second order polynomial equation (13) the equation is well fitted to the experiment data with R^2 = 0.931; MSE = 0.248

$$A_{sh} = 45.224 - 0.467Y + 1.2 \times 10^{-3}\, Y^2 - 0.810X + 1.2 \times 10^{-3}\, XY + 1.94 \times 10^{-3}\, X^2 \quad ...(13)$$

Where,

A_{sh} = Ash (%); X = Jackfruit seed flour (%); Y = the Baking temperature (°C)

David (2016) reported the ash content in cupcake was in the range of 1.43 to 2.43 % with increase incorporation of jackfruit seed flour 5% to 15% which was baked at 190°C. Pertuzatti *et al.* (2015) reported that the 1.55± 0.2 and 1.23± 0.1% ash contain in incorporation of oat in cupcake prepared with banana and apple, and oat cupcake with pineapple and mint. Khalifa *et al.* (2015) reported the ash content as 1.45± 0.24 to 1.72±0.15% in Cupcake from potato peels residue with wheat flour. Srivastava *et*

al. (2012) reported 0.5± 0.03 to 0.76± 0.02 % range of ash content in fenugreek seed husk Muffins with 5 to 15% replacement of wheat flour. Salunke *et al.* (2015) reported the fibre content ranges from 1.54 % to 1.87 % in cake formulated by Ragi flour and wheat flour with peanut butter combination ratios was (10:90, 20:80, 30:70) and 1.47 % ash content in wheat flour cake. Mohammad- Taghi (2015) observed the ash content 0.85 % in cinnamon and Spirulina cupcake. Aigal *et al.* (2017) reported that the ash content in cake prepared by various composition of foxtail millet, Rice flakes, Oat flakes which was 1.23 %, 2.47 % and 2.29 % respectively.
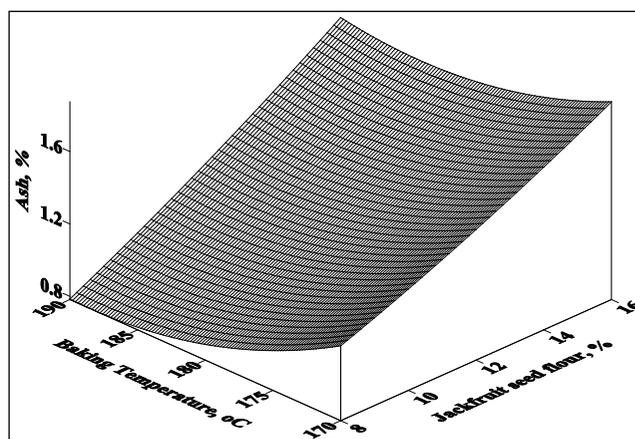

Fig. 6 (a) Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ᵒC) on Ash (%) of Jackfruit seed flour
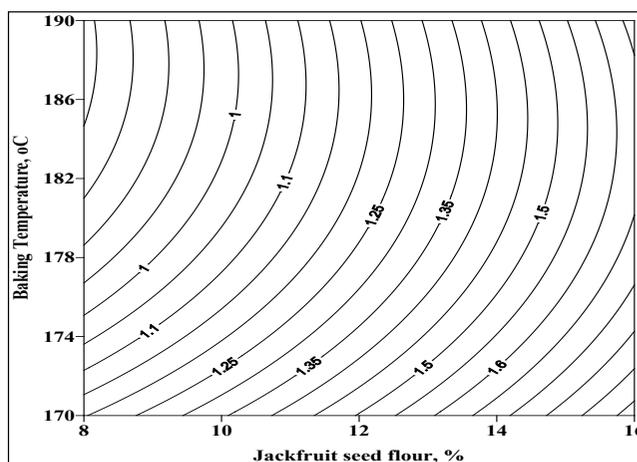

Fig. 6 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour(%) and Baking Temperature (ᵒC) on the Ash (%) of cupcake

Carbohydrates (C_{ar})

Fig. 7 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the carbohydrate content of cupcake. The carbohydrate varies in the range of 52.46 to 61.07. As the incorporation of Jackfruit seed flour increases from 8 to 16(%) the carbohydrate content increases. Similarly as the baking temperature increases from 170°C to 190°C carbohydrates content increases. Fig 7 (b) shows the contour plot of effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on carbohydrates. As both the incorporation of jackfruit seed flour (%) baking temperature (°C) increases carbohydrates increases.

Table 2 (f) shows the ANOVA for effect of incorporation of Jackfruit seed flour (%) has significant effect on the ash content of the cupcake at p ≤0.01. The effect of baking temperature (°C) has significant effect on the ash content of the cupcake at p≤0.01. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has non-significant effect on the ash content of the cupcake. The effect of incorporation of Jackfruit seed flour (%) and the baking temperature (°C) on carbohydrates was determined by the second order polynomial equation (14) the equation is well fitted to the experiment data with $R^2 = 0.820$; $MSE = 1.642$.

$$C_{ar} = -703.547 + 8.018Y - 0.0213Y^2 + 2.656X - 0.00555XY - 0.0499X^2 \qquad \ldots (14)$$

Where,

C_{ar} = Carbohydrate (%); X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Shrivastva *et al.* (2015) reported the carbohydrate content was 50.73% in cupcake from oat with banana and apple. Shrivastva *et al.* (2015) reported the carbohydrate content 56.87 to 54.31% in cake prepared from Jackfruit seed flour upto 5-15 % with replacement of wheat flour and cake was baked at 190°C. David (2016) reported the carbohydrate content in cupcake was ranges from 54.31 to 56.87 % with increase incorporation of jackfruit seed flour 5% to 15% which was baked at 190°C. Pertuzatti

et al. (2015). Salunke *et al.* (2015) reported the carbohydrate content ranges from 33.7 % to 33.1% in cake formulated by Ragi flour and wheat flour with peanut butter combination ratios was (10:90, 20:80, 30:70) and 34.27 % in wheat flour cake. Aigal *et al.* (2017) was reported that the carbohydrate content in cake prepared by various composition of foxtail millet, Rice flakes, Oat flakes which was 53.40 %, 56.78 % and 52.09 % respectively.
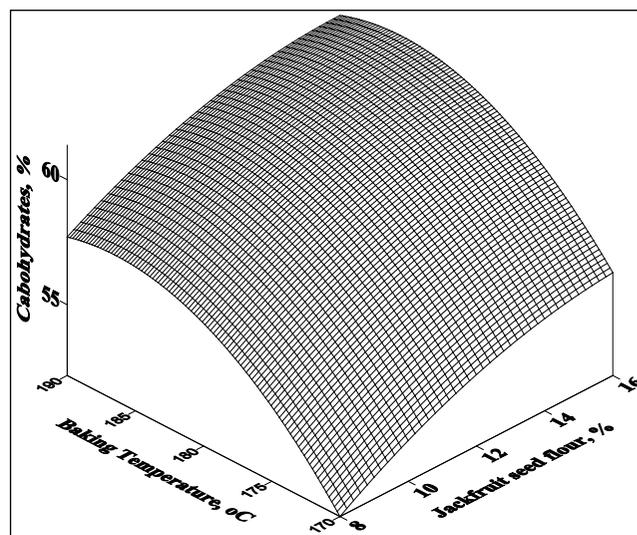

Fig. 7 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on Carbohydrates (%) of Jackfruit seed flour
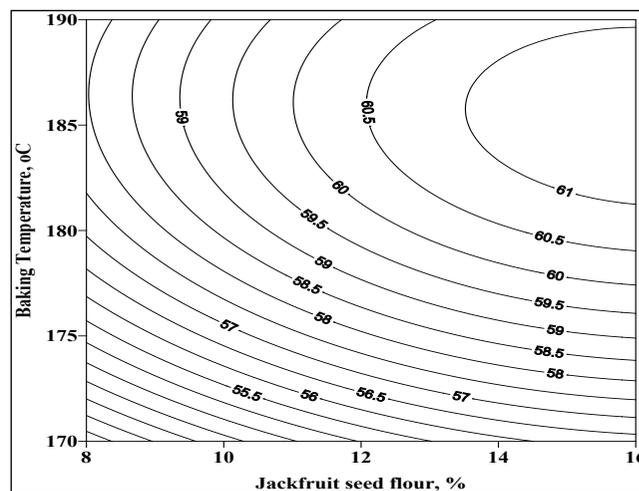

Fig. 7 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour(%) and Baking Temperature (°C) on the Carbohydrates (%) of cupcake

Browning Index (B_I)

Fig. 8 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the browning index of cupcake. The browning index varies in the range of 16.76 to 24.61. As the incorporation of Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the browning index increases. As the baking temperature (°C) increases browning index decreases. Fig. 8 (b) shows the contour plot of effect incorporation of Jackfruit seed flour (%) and of baking temperature (°C) in cupcake on browning index. As both the jackfruit seed flour (%) and baking temperature increases browning index increases. Browning Index (B_I) of cupcake increased with increase in incorporation of jackfruit seed flour from 8 % to 16% and baking temperature from 170°C, 180°C, 190°C respectively, because the baking process alters the surface properties of the food and subsequently changes light reflection and product colour. Moreover, heat and oxidation that occur during the baking procedure causes chemical changes. It means the changes in colour parameters from lighter yellow to darker yellow (Croguennec, 2016; Horuz *et al.* 2017).

Table 2 (g) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have significant effect on the carbohydrates content of the cupcake at p ≤0.01. The effect of baking temperature (°C) has significant effect on the carbohydrates content of the cupcake at p≤0.01. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has significant effect on the carbohydrates content of the cupcake at≤0.01. The effect of incorporation of Jackfruit seed flour (%) and the baking temperature (°C) on browning index was determined by the second order polynomial equation (15) the equation is well fitted to the experiment data with R^2 = 0.735; *MSE* = 1.77

B_I = 300.594 − 3.141Y + 8.17 × 10^{-3} Y^2 + 4.2 × 10^{-2} X + 1.5 × 10^{-2} XY − 8.94 × 10^{-2} X^2 … (15)

Where, B_I = Browning Index, X = Jackfruit seed flour (%) Y = Baking temperature (°C)

Aigal *et al.* (2017) reported that the value for the browning index for cake prepared by various composition foxtail millet, Rice flakes, Oat flakes which was 31.39%, 12.79% and 13.73 % respectively.
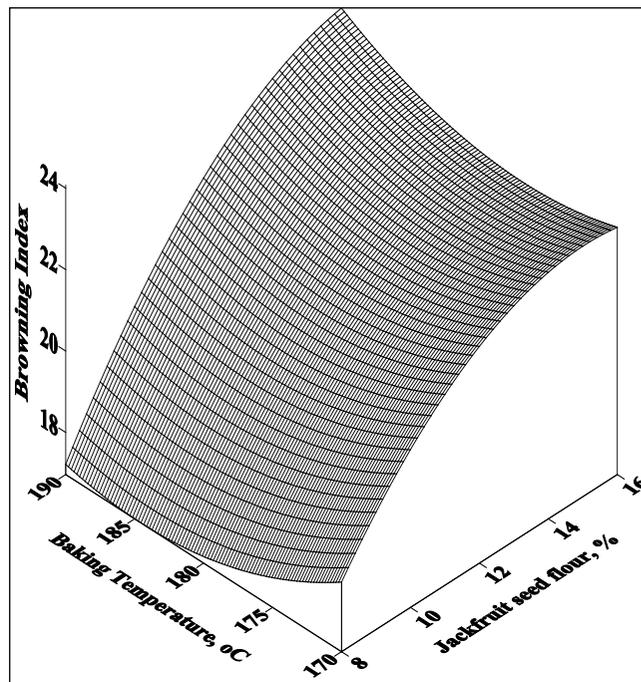

Fig. 8 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on Browning Indexof Jackfruit seed flour
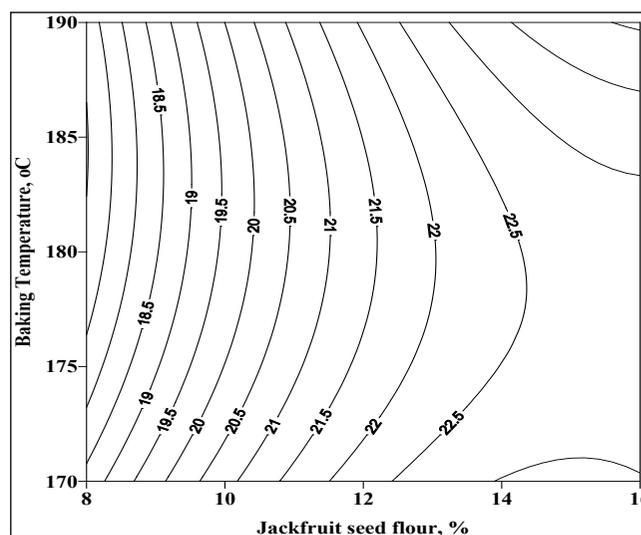

Fig. 8 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on the Browning Index of cupcake

Hardness (H_d)

Fig. 9 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) on the hardness (g) of cupcake. The hardness varies in the range of 46.67 to 279.33 g. As the Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the hardness increases. Hardness increases from 8% to 12% of Jackfruit seed flour followed by the decreasing trend up to 16 (%). As the baking temperature increases hardness decreases up to 185 °C followed by slightly increasing at 190°C. Fig. 9 (b) shows the contour plot of effect of Jackfruit seed flour (%) and baking temperature in cupcake on hardness. As both the Jackfruit seed flour (%) and baking temperature increases hardness increases initially followed by decreasing trend.

Table 2 (h) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have significant effect on the hardness content of the cupcake at p ≤0.01. The effect of baking temperature (°C) has significant effect on the hardness (g) of the cupcake at p≤0.01. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has significant effect on the hardness content of the cupcake at p≤0.01. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on hardness was determined by the second order polynomial equation (16) the equation is well fitted to the experiment data with R^2 = 0.82187; MSE = 55944.90

$$H_d = 31279.69 - 353.515Y + 0.961Y2 + 261.857X - 0.192XY - 9.557X^2 \quad \ldots(16)$$

Where, H_d = Hardness; X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Movahhed *et al.* (2016) reported the hardness decreases with different emulsifiers in the eggless cake. Yildiz *et al.* (2014) reported that the 469.0 and 1,005.1 (N) hardness for the cake produced using Potato starch and chestnut flour. Mohammad- Taghi (2015) obtained the hardness 489.50 g in cinnamon and Spirulina cupcake, 560.50 g hardness in cinnamon without Spirulina cupcake, Spirilina precent

increases 0.5 to 2.6 % the hardness increases ranges from 417.50 to 483 (N) hardness. Soleimanifard *et al.* (2018) reported the hardness values of the cupcake are 50.87, 17.14, 15.05 and 13.46 (N) respectively.

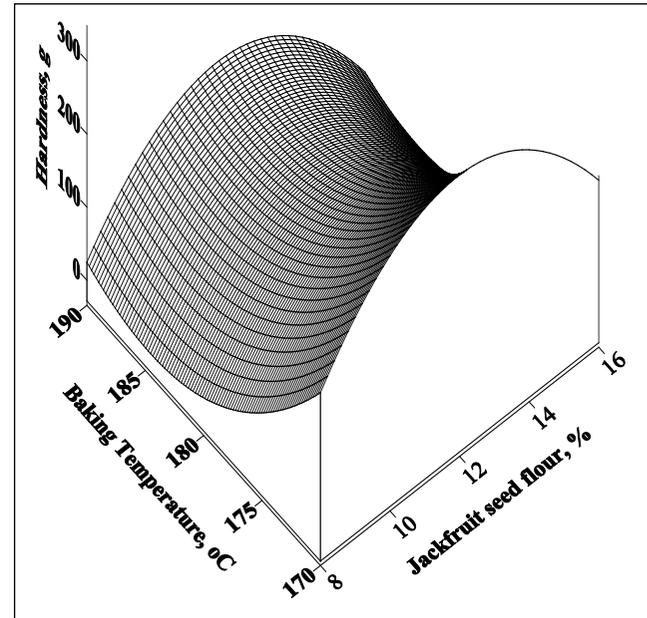**Fig. 9(a):** Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on Hardness of Jackfruit seed flour
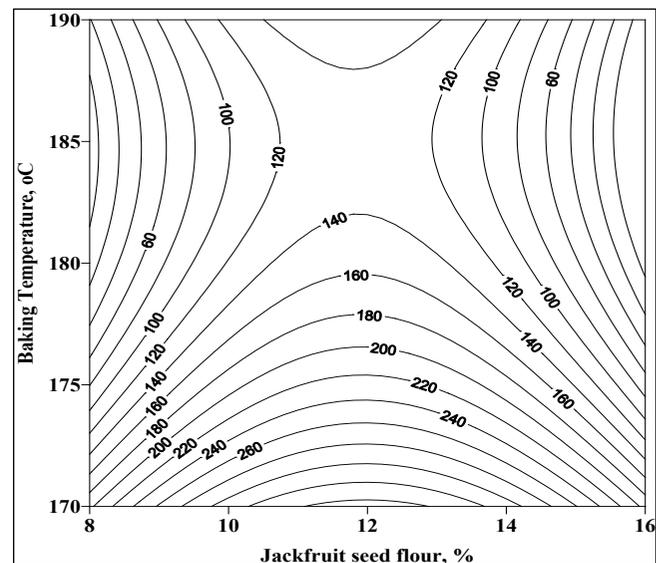

Fig. 9 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on the Hardness of cupcake

Gumminess (G_m)

Fig 10 (a) shows the surface plot showing the effect of Jackfruit Seed flour (%) and baking temperature (°C) on the gumminess (g) of cupcake. The gumminess varies in the range of 34.6 to 187.6. As the Jackfruit seed flour (%) increases in the cupcake from 8 to 16 % the gumminess increases. As the baking temperature increases from 170°C to 190°C gumminess increases up to 190°C. Fig 10 (b) shows the contour plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on gumminess. As both the baking temperature and jackfruit seed flour (%) increases gumminess decreases.

Table 2 (i) show the ANOVA for effect incorporation of jackfruit seed flour (%) have significant effect on the gumminess of the cupcake at p≤0.01. The effect of baking temperature (°C) has significant effect on the gumminess of the cupcake at p≤0.01. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has significant effect on the gumminess of the cupcake at p≤0.01. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on gumminess was determined by the second order polynomial equation (17) the equation is well fitted to the experiment data with R^2 = 0.096; MSE = 2356.95

$$G_m = 8661.629 - 100.3904Y + 0.299Y^2 + 92.670X - 0.732XY + 1.504X^2 \qquad \ldots(17)$$

Where, G_m = Gumminess; X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Shao *et al.* (2015) reported the value for the eggless cake from three types of wheat flours and two types of hydrocolloids including carboxymethyl cellulose (CMC) and xanthan gum were ranges from 161.41 to 510.05 with different combination of flours and gum. Mohammad- Taghi (2015) reported the gumminess 294.70g in cinnamon and Spirulina cupcake 306.10 gumminess in cinnamon without Spirulina cupcake. As the Spirulina precent increases 0.5 to 2.6. % gumminess decreases from 261.20 to 236.70g respectively.

Fig. 10 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on Gumminess of Jackfruit seed flour

Fig. 10 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on the Gumminess of cupcake

Chewiness (C_{he})

Fig. 11 (a) shows the surface plot showing the effect of Jackfruit seed flour (%) and baking temperature (⁰C) on the chewiness (g) of cupcake. Chewiness varies in the range of 11.63 to 107.33 (g) as the incorporation of Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the chewiness increases. Chewiness decreases from 8 % to 12 % of Jackfruit seed flour followed by increasing trend up to 16 (%). As the baking temperature increases chewiness increases from 170°C to 190°C. Fig. 11 (b) shows the contour plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on chewiness. As both the jackfruit seed flour (%) and baking temperature increases chewiness increases.

Table 2 (j) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have significant effect on the chewiness of the cupcake at p≤0.01. The effect of baking temperature (°C) has non-significant effect on the gumminess of the cupcake. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has significant effect on the chewiness of the cupcake at p≤0.01. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on chewiness was determined by the second order polynomial equation (18) the equation is well fitted to the experiment data with $R^2 = 0.812$; $MSE = 55944.90$

C_{he} = 3393.69 − 38.891Y + 0.118Y^2 + 40.926X − 0.399XY + 1.165X^2 ...(18)

Where, C_{he} = Chewiness; X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Shao *et al.* (2015) reported the value of chewiness () for the eggless cake from three types of wheat flours and two types of hydrocolloids including carboxymethyl cellulose (CMC) and xanthan(Xan) were ranges from 105.04 to 417.22 with different combination of flours and gum. Mohammad- Taghi (2015) obtained the chewiness 263.50 in Cinnamon and Spirulina cupcake, 275.50 chewiness in cinnamon without Spirulina cupcake. As the Spirilina present in cupcake

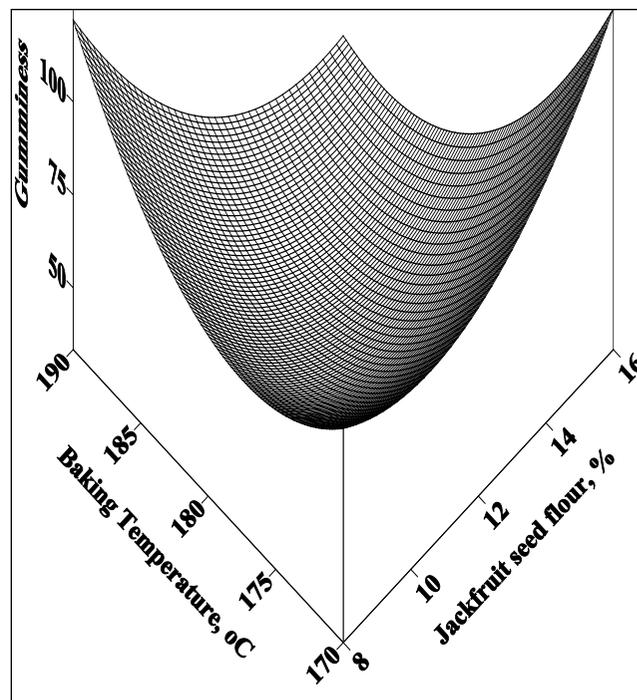increases 0.5 to 2.6 % the chewiness increases from 226.22 to 207.20 g respectively.

Fig. 11 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (⁰C) on Gumminess of Jackfruit seed flour

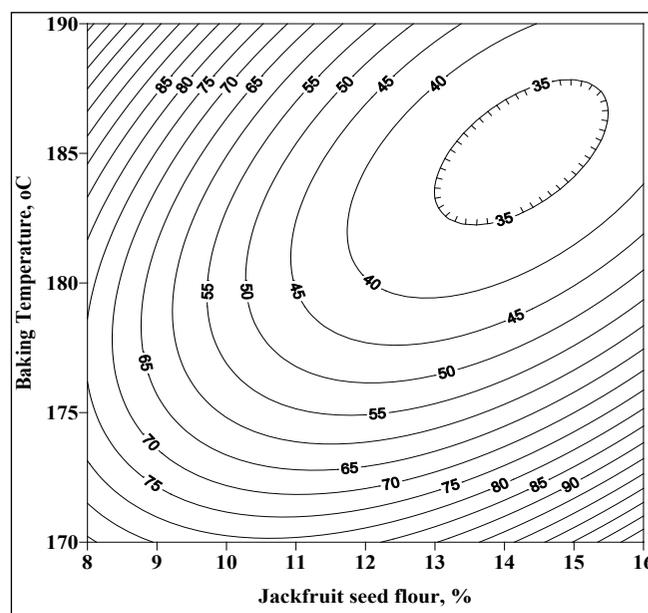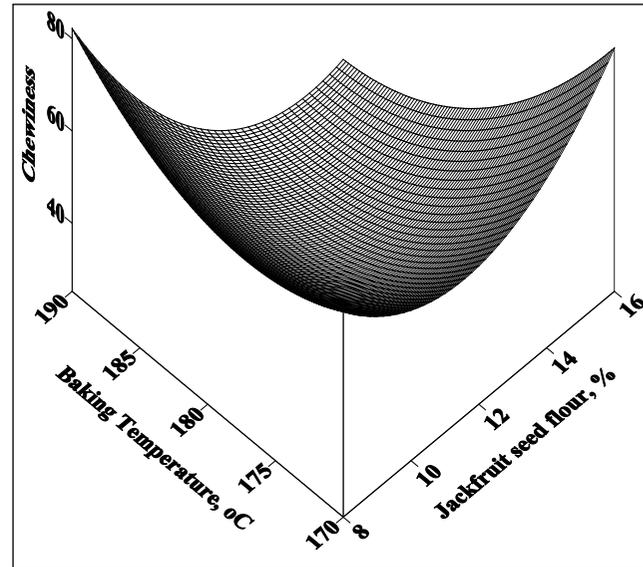**Fig. 11 (b):** Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (⁰C) on the Chewiness of cupcake

Cohesiveness (C_{oh})

Fig. 12 (a) shows the surface plot showing the effect of Jackfruit Seed flour (%) and on the cohesiveness of cupcake. Cohesiveness varies in the range of 0.73 to 1.14 g. As the Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the cohesiveness decreases. As the baking temperature increases from 170 °C to 190 °C cohesiveness decreases and. Fig. 12 (b) shows the contour plot showing the effect of incorporation Jackfruit seed flour (%) and baking temperature (°C) in cupcake on cohesiveness. As both the jackfruit seed flour (%) and baking temperature (°C) increases cohesiveness decreases.

Table 2 (k) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have non-significant effect on the cohesiveness of the cupcake. The effect of baking temperature (°C) has non-significant effect on the cohesiveness of the cupcake. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has non-significant effect on the cohesiveness of the cupcake. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on cohesiveness was determined by the second order polynomial equation (19) the equation is well fitted to the experiment data with $R^2 = 0.754$; $MSE = 42.550$

$$C_{oh} = 1266.18 - 11.588Y + 0.027Y^2 - 32.514X + 0.132XY + 0.319X^2 \qquad …(19)$$

Where, C_{oh} = Cohesiveness, X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Rodriguez- Garcia *et al.* (2013) reported the cohesiveness was 0.69 to 0.72 in cake prepared from wheat flour. Mohammad- Taghi (2015) reported the cohesiveness value 0.60 in cinnamon and Spirulina cupcake, 0.55 cohesiveness in cinnamon without Spirulina cupcake. As the Spirilina precent increases 0.5 to 2.6 % the cohesiveness increases from 0.54 to 0.57 cohesiveness. Al- Muhtaseb *et al.* (2013) reported the different level of baking temperature of cupcake on cohesiveness values for Maderia cake which was ranged from 0.613- 0.730 for cake baked at 250°C;

0.595- 0.681 for cake baked at 250°C and 0.592 -0.691 for cake baked at 200°C.

Fig. 12 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on cohesiveness of Jackfruit seed flour
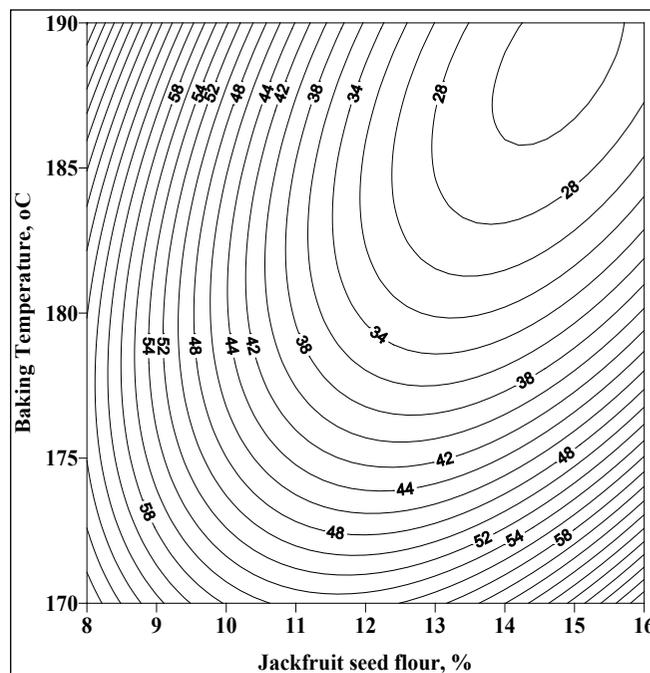

Fig. 12 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (°C) on the Cohesiveness of cupcake

Adhesiveness (A_d)

Fig. 13 (a) shows the surface plot showing the effect of Jackfruit Seed flour (%) and baking temperature (°C) on the adhesiveness of cupcake. Adhesiveness varies in the range of 0.586 to 63. As the Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the adhesiveness increases. As the baking temperature increases adhesiveness decreases up to 180°C followed by slightly increasing trend up to 190°C. Fig. 13 (b) shows the contour plot of effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on adhesiveness. As jackfruit seed flour (%) and increases adhesiveness Baking temperature °C increases.

Table 2 (l) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have non-significant effect on the adhesiveness of the cupcake at P≤ 0.01. The effect of baking temperature (°C) has non-significant effect on the adhesiveness of the cupcake at P≤.0.01 The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has non-significant effect on the adhesiveness of the cupcake at P≤.0.01. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on adhesiveness was determined by the second order polynomial equation (20) the equation is well fitted to the experiment data with R^2 = 0.8203; MSE = 286.62

$$A_d = 2071.22 - 23.17Y + 0.066Y^2 - 10.348X - 0.102XY + 0.430X^2 \quad \dots(20)$$

Where, A_d = Adhesiveness (J), X = Jackfruit seed flour (%) Y = Baking temperature (°C)

Roy and Guha (2014) reported the comparative adhesiveness value with the cake produced from beetel leaf oil 41.77, 31.81, 61.09, 25.32, 42.39, 11.84 and 34.29 for the cupcake namely Cream delight, Cupcake Choco Cup, Jig Jag Cake, Take 2 and developed cake respectively.
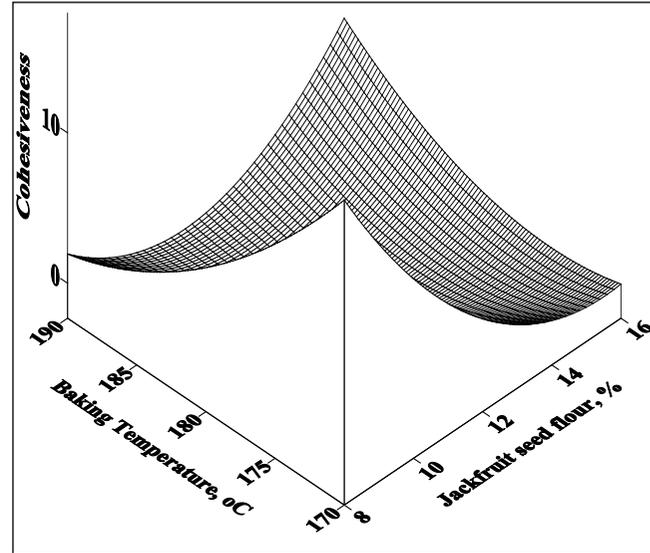

Fig.13 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on Adhesiveness of Jackfruit seed flour
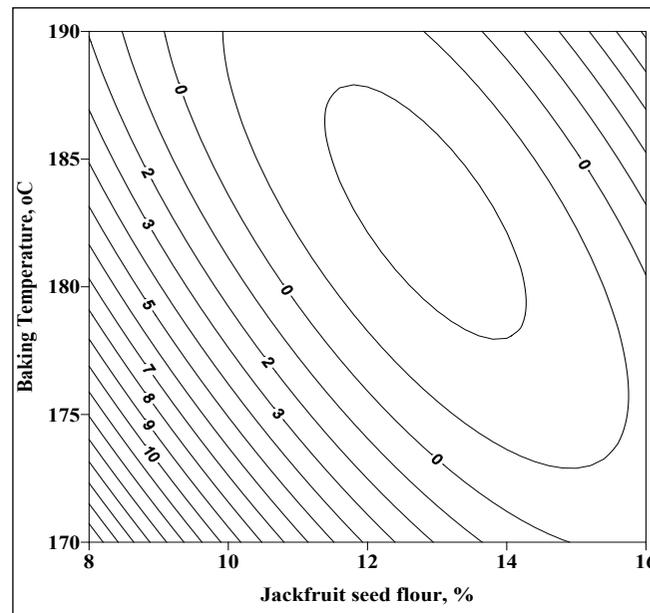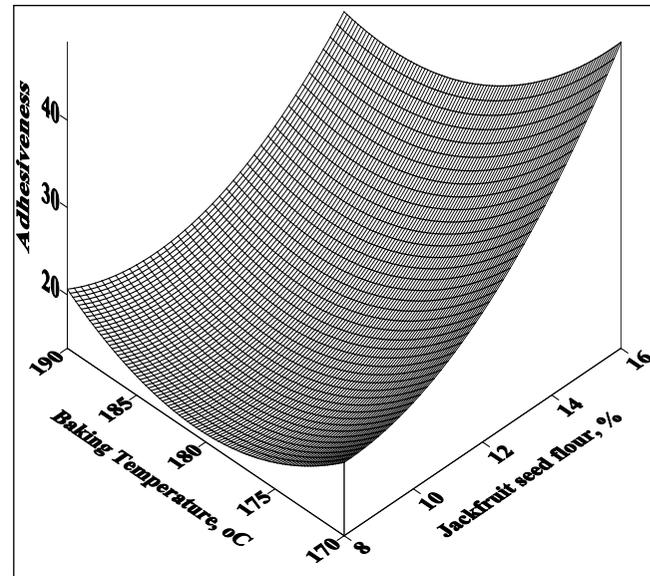

Fig. 13 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on the Cohesiveness of cupcake

Springiness (S_p)

Fig. 14 (a) shows the surface plot showing the effect of Jackfruit Seed flour (%) and baking temperature (°C) on the springiness (g) of cupcake. The springiness varies in the range of 0.45 to 0.86. As the Jackfruit seed flour (%) increases in the cupcake from 8 to 16% the springiness decreases. Springiness decreases from 12% to 14% and followed by again increasing trend up to 16%. As the baking temperature increases springiness increases from 170 to 190°C. Fig. 14 (b) shows the contour plot showing the effect of Jackfruit seed flour (%) and baking temperature (°C) in cupcake on springiness. As both the jackfruit seed flour (%) and baking temperature (°C) increases springiness decrease followed by increasing trend.

Table 2 (m) shows the ANOVA for effect incorporation of jackfruit seed flour (%) have non-significant effect on the springiness of the cupcake. The effect of baking temperature (°C) has non-significant effect on the springiness of the cupcake. The interaction of both Jackfruit seed flour (%) incorporation and of baking temperature (°C) has non-significant effect on the springiness of the cupcake. The effect of incorporation of jackfruit seed flour (%) and the baking temperature (°C) on springiness was determined by the second order polynomial equation (21).

The equation is well fitted to the experiment data with $R^2 = 0.867$; $MSE = 0.014$

$$S_p = -3.807 + 0.067Y - 1.9 \times 10^{-4}\ Y^2 - 0.323X + 6.6 \times 10^{-4}\ XY + 7.9 \times 10^{-3}\ X^2 \qquad \ldots(21)$$

Where, S_p = Springiness; X = Jackfruit seed flour (%); Y = Baking temperature (°C)

Shao *et al.* (2015) reported the springiness value for the eggless cake from three types of wheat flours and two types of hydrocolloids including carboxymethyl cellulose (CMC) and xanthan gum (X_{an}) were in the range from 0.818 to 0.973 with different combination of flours and gum. Mohammad- Taghi (2015) obtained the springiness content 0.912 in cinnamon and Spirulina cupcake had 0.918 springiness in cinnamon without Spirulina cupcake. As the Spirulina precent increases 0.5 to 2.6% springiness increases from 0.54

to 0.57 springiness. Al-Muhtaseb *et al.* (2013) reported different level of baking time and temperature of cupcake, the springiness values for Maderia cake which was ranged from 0.764 to 0.914 for cake baked at 250°C, 0.711 to 0.861 for cake baked at 250°C, and 0.781 to 0.876 for cake baked at 200°C.
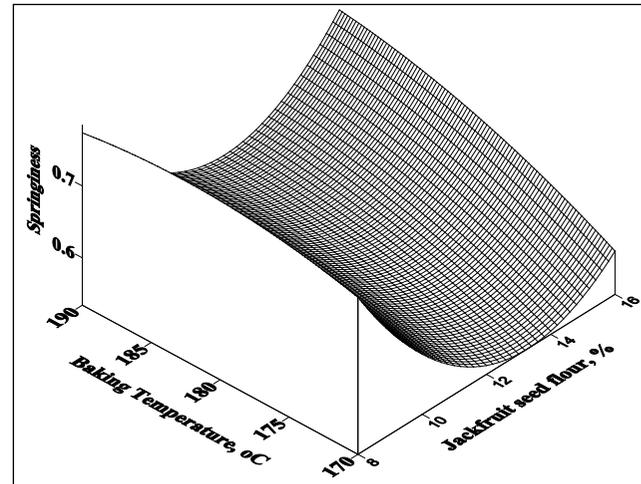
Fig. 14 (a): Surface plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on Springinessof Jackfruit seed flour
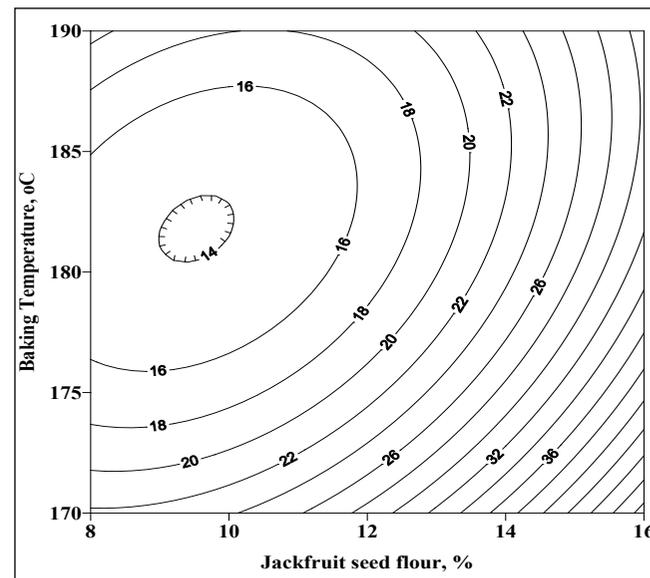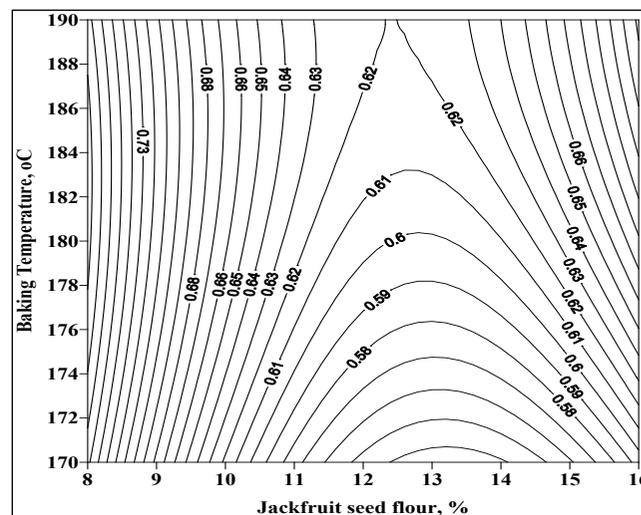

Fig. 14 (b): Contour plot showing the effect of incorporation of Jackfruit seed flour (%) and Baking Temperature (ºC) on the Springiness of cupcake

Optimization of cupcake parameters

Fig 4.30 shows that superimposed contour plot showing the optimum zone of Jackfruit seed

flour 13.8 to 14.2 % and Baking Temperature 170 to 172°C of cupcake. The desirable properties of cupcake should have more Protein %, fibre %, fat %, ash %, carbohydrates % and moderate browning index, hardness(N), gumminess, chewiness (g), cohesiveness(g), adhesiveness (J), springiness. The contour plots of all the responses were superimposed to get desirable Protein, Fat, fibre, ash, carbohydrate, browning index, hardness, gumminess, chewiness, cohesiveness, adhesiveness, and springiness. The desirable property occurs at (13.8- 14.2%) incorporation of Jackfruit seed flour in cupcake and baked at (170 -172 °C) baking temperature. The properties at the zone are Protein (4.723%) , fat (11.820%), fibre (2.233%), ash (1.56%), carbohydrates (55.82%), browning index (24.61%), hardness (46.66), gumminess (4), chewiness(24.67), cohesiveness(0.86), adhesiveness (11.46), and springiness (0.63).
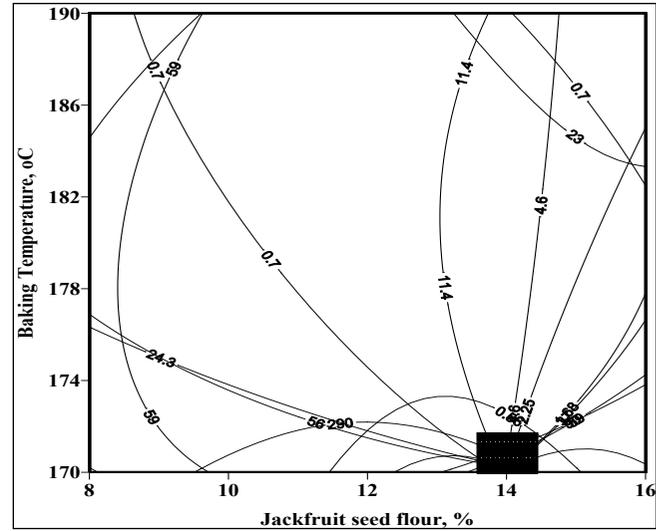
Fig. 15: Superimposed contour plots of desirable properties

Table 2: Statistical analysis of Jackfruit seed and Finger millet flour Cupcake parameters

Table 2(a): ANOVA for Moisture content of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Moisture			
D_1	26.613±0.320	25.983±0.120	25.133±0.570	23.830±0.170	24.176±0.920	25.147
D_2	23.366±0.560	21.913±1.790	21.760±1.101	20.786±0.301	20.956±0.531	21.756
D_3	20.540±0.514	20.340±0.811	19.760±0.645	18.900±0.405	18.440±0.163	19.596
Mean	23.506	22.745	22.217	21.172	21.172	22.166
		S.Em±		**CD at 1%**		
Treatment (T)		0.239		0.912		
Temperature (D)		0.1848		0.707		
Interaction (T×D)		0.413		1.607		

Table 2 (b): ANOVA for Protein of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Protein			
D_1	3.323±0.015	3.566±0.015	4.020±0.020	4.723±0.015	5.250±0.020	4.176
D_2	3.163±0.015	3.216±0.015	3.960±0.010	4.530±0.010	5.160±0.02	4.0005
D_3	3.016±0.020	3.166±0.010	3.710±0.010	4.463±0.015	5.023±0.020	3.875
Mean	3.167	3.316	3.896	4.572	5.144	4.018
		S.Em±		**CD at 1%**		
Treatment (T)		0.005		0.020		
Temperature (D)		0.0042		0.016		
Interaction (T×D)		0.009		0.036		

Table 2(c): ANOVA for Fat of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Fat			
D_1	14.730±0.157	13.583±0.109	12.766±0.174	11.820±0.060	9.616±0.055	12.503
D_2	14.256±0.035	13.306±0.094	11.556±0.035	10.823±0.050	9.650±0.260	11.918
D_3	13.610±0.55	13.456±0.260	12.530±0.460	11.236±0.180	9.870±0.140	12.140
Mean	14.198	13.448	12.284	11.293	9.712	12.187

	S.Em±	CD at 1%
Treatment (T)	0.076	0.290
Temperature (D)	0.058	0.225
Interaction (T×D)	0.132	0.511

Table 2(d): ANOVA for Fibre of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Fibre			
D_1	1.726±0.015	1.923±0.015	2.140±0.02	2.233±0.030	2.423±0.015	2.089
D_2	1.713±0.015	1.856±0.035	1.946±0.025	2.163±0.020	2.326±0.010	2.000
D_3	1.673±0.010	1.753±0.020	1.876±0.010	2.016±0.010	2.213±0.015	1.906
Mean	1.704	1.844	1.987	2.137	2.320	1.732

	S.Em±	CD at 1%
Treatment (T)	0.007	0.026
Temperature (D)	0.005	0.021
Interaction (T×D)	0.012	0.047

Table 2(e): ANOVA for Ash of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Ash			
D_1	1.240±0.020	1.363±0.020	1.463±0.030	1.566±0.032	1.966±0.015	1.516
D_2	0.804±0.059	1.109±0.020	1.256±0.020	1.390±0.010	1.676±0.047	1.247
D_3	0.693±0.041	1.130±0.02	1.220±0.020	1.350±0.030	1.670±0.010	1.212
Mean	0.912	1.200	1.202	1.435	1.770	1.304

	S.Em±	CD at 1%
Treatment (T)	0.010	0.037
Temperature (D)	0.0077	0.029
Interaction (T×D)	0.017	0.066

Table 2(f): ANOVA for Carbohydrates of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Carbohydrates			
D_1	52.456±0.47	53.580±0.27	54.476±0.52	55.826±0.070	56.803±0.85	54.63
D_2	56.696±0.06	59.676±0.19	59.520±1.12	60.440±0.37	60.230±0.88	59.31
D_3	57.386±0.99	59.413±1.30	59.996±0.23	60.750±0.28	61.070±0.183	59.72
Mean	55.512	57.556	57.005	59.367	59.367	57.887

	S.Em±	CD at 1%
Treatment (T)	0.224	0.855
Temperature (D)	0.173	0.663
Interaction (T×D)	0.388	1.150

Table 2(g): ANOVA for Browning Index of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Browning Index			
D_1	19.151±0.047	20.276±0.061	21.986±0.922	24.612±0.188	21.841±0.036	21.57
D_2	16.763±0.064	18.377±0.061	22.241±0.48	23.416±0.56	22.445±0.09	20.65
D_3	18.369±0.12	18.977±0.06	22.375±0.02	22.484±0.19	24.591±0.09	21.36
Mean	18.094	19.210	22.200	23.504	22.959	21.19

	S.Em±	CD at 1%
Treatment (T)	0.106	0.406
Temperature (D)	0.082	0.315
Interaction (T×D.)	0.184	0.716

Table 2 (h): ANOVA for Hardness of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Hardness			
D_1	86.666±6.027	125.666±2.081	279.33±107.9	46.666±11.676	118.0±14.730	271.27
D_2	74.333±1.527	59.333±2.081	139.333±14.153	55.333±9.018	66.0±27.874	78.87
D_3	138.667±23.459	47.666±7.371	67.333±13.576	49.0±6.082	91.333±7.220	78.80
Mean	99.888	77.555	395.332	50.333	91.777	142.977

	S.Em±	CD at 5%
Treatment (T)	10.179	38.931
Temperature (D.)	7.884	30.157
Interaction (T×D.)	17.637	68.567

Table 2 (i): For Gumminess of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Gumminess			
D_1	87.666±4.163	34.666±1.572	187.66±71.00	42.0±24.758	128.0±16.357	95.998
D_2	71.666±15.373	55.333±13.860	42.100±58.949	52.666±19.730	39.666±18.583	52.286
D_3	155.660±29.360	44.666±14.970	45.666±15.143	41.666±7.500	54.666±8.320	68.454
Mean	104.997	44.888	91.808	45.444	74.110	72.249

	S.Em±	CD at 1%
Treatment (T)	9.464	36.197
Temperature (D)	7.3309	28.038
Interaction (T×D)	16.392	47.345

Table 2 (j): ANOVA for Chewiness of Cupcake from Jackfruit seed and Finger millet Flour

Treatments	T_1	T_2	T_3	T_4	T_5	Mean
			Chewiness			
D_1	76.0±15.394	15.666±5.507	124.0±99.141	24.666±21.548	82.333±23.288	64.533
D_2	52.666±8.0829	35.666±4.0441	74.0±62.353	25.0±8.544	27.333±9.712	42.935
D_3	107.33±21.733	36.666±14.294	11.633±4.473	26.0±7.211	43.666±9.073	45.059
Mean	78.665	29.332	69.877	25.222	51.110	50.841

	S.Em±	CD at 1%
Treatment (T)	10.911	41.730
Temperature (D)	8.451	32.324
Interaction (T×D)	18.898	73.495

Table 2(k): ANOVA for Cohesiveness of Cupcake from Jackfruit seed and Finger millet Flour

Cohesiveness						
Treatments	T_1	T_2	T_3	T_4	T_5	Mean
D_1	0.73±0.53	0.87±0.125	1.04±0.072	0.865±0.388	1.113±0.030	0.923
D_2	1.06±0.121	1.126±0.005	0.936±0.104	1.145±0.049	0.756±0.120	1.004
D_3	1.143±0.011	1.040±0.192	1.166±0.025	0.930±0.175	0.810±0.165	1.017
Mean	0.976	1.012	1.047	0.980	0.893	0.982
		S.Em±		CD at 1%		
Treatment (T)		0.094		0.357		
Temperature (D)		0.0725		0.277		
Interaction (T×D)		0.162		0.630		

Table 2 (l): ANOVA for Adhesiveness of Cupcake from Jackfruit seed and Finger millet Flour

Adhesiveness						
Treatments	T_1	T_2	T_3	T_4	T_5	Mean
D_1	17.633±3.842	10.533±13.843	63.0±49.173	11.466±4.049	58.200±54.046	32.166
D_2	18.633±3.490	16.433±3.786	27.733±15.421	11.600±3.149	28.700±4.490	20.619
D_3	24.700±3.592	13.900±4.143	0.586±0.057	40.666±37.005	31.933±8.381	22.357
Mean	20.322	13.622	30.439	21.244	39.611	25.047
		S.Em±		CD at 1%		
Treatment (T)		9.022		34.506		
Temperture (D)		6.988		26.739		
Interaction (T×D)		15.627		60.774		

Table 2(m): ANOVA for Springiness of Cupcake from Jackfruit seed and Finger millet Flour

Springiness						
Treatments	T_1	T_2	T_3	T_4	T_5	Mean
D_1	0.863±0.145	0.453±0.147	0.503±0.241	0.633±0.090	0.630±0.09	0.616
D_2	0.766±0.221	0.603±0.106	0.773±0.302	0.483±0.056	0.710±0.080	0.667
D_3	0.686±0.066	0.813±0.164	0.586±0.070	0.630±0.085	0.706±0.120	0.684
Mean	0.771	0.623	0.620	0.582	0.682	0.655
		S.Em±		CD at 1%		
Treatment (T)		0.057		0.217		
Temperature (D)		0.044		0168		
Interaction (T×D)		0.098		0.382		

SENSORY ANALYSIS

The data obtained for sensory properties viz. colour, flavour, taste, and texture of cupcake as per the nine point hedonic scale were obtained from semi-trained panel for treatment T_1 to treatment T_{15} are given in Table 3. The average score of cupcake ranged between 6.144 to 8.022.

Table 4 (a) shows the sensory colour score. The sensory colour score was in the range of 6.73±1.49 to 7.91±0.63. Highest colour score was observed at T_4 it was 7.911 and lowest colour score 6.73 was observed at T_1. The control sample had 7.74 colour score. Table 4 (a) shows ANOVA for the colour of sensory analysis. The effect of Jackfruit seed and Finger millet flour (%) shows non-significant at P≤0.01 effect. Similarly Baking Temperature (°C) has non-significant effect at P≤0.01 on the colour score, the interaction effect of Jackfruit seed flour (%) and Baking Temperature (°C)

also has non-significant effect on colour of cupcake at P≤0.01.

Table 4 (b) shows the sensory flavour score. The sensory colour score was in the range of 7±1.31 to 7.95±0.923. Highest colour score was observed at T$_4$ it was 7.95 and lowest flavour score 7 was observed at T$_{15}$. The control sample had flavour scale of 7.85.

Table 4 (b) shows ANOVA for the flavour of sensory analysis. The effect of Jackfruit seed and Finger millet flour (%) shows non-significant effect at P≤ 0.01 on of sensory flavour. Similarly Baking Temperature (°C) has non-significant effect at P≤0.01 on the flavour score. The interaction effect of incorporation of Jackfruit seed flour and Baking Temperature (°C) has non-significant effect on flavour of cupcake at P≤0.01.

Table 4 (c) shows the sensory texture score. The sensory colour score was in the range of 6.27 ±1.319 to 8.02±0.690. Highest texture score was observed at T$_4$ 8.02 and lowest texture scale 6.278 was observed at T$_{15}$. Control sample had taste scale of 8.12.

Table 4 (d) shows ANOVA for the of sensory analysis. The effect of Jackfruit seed flour (%) shows non-significant effect on texture of the cupcake at P≤0.01. Similarly Baking Temperature (°C) has non-significant effect on the texture score at P≤0.01. The interaction effect of Jackfruit seed flour (%) and Baking Temperature (°C) has non-significant effect at P≤0.01 on texture of cupcake.

Table 4 (d) shows the sensory taste score. The sensory taste score was in the range of 6.14 ±1.427to 7.94±0.92. Highest taste score was observed at T$_4$ 7.94 and lower score was 6.14 was observed at T$_{15}$. Control sample had taste scale of 8.13

Table 4 (d) shows ANOVA for the of sensory analysis. The effect of incorporation Jackfruit seed (%) and Finger millet flour (%) shows non-significant effect at P≤0.01 on taste. Similarly Baking Temperature (°C) has non-significant effect on the flavour score at P≤0.01. The interaction effect of Jackfruit seed flour and Baking Temperature (°C) has non-significant effect on taste of cupcake.

Table 3: Sensory quality of cupcake from Jackfruit seed and finger millet flour

Treatment	Flour combination (JSF:FMF:RWF)	Sample code	Baking temperature	Colour	Flavour	Texture	Taste	Total
T$_1$	8:16:12	A	170 °C	6.73	7.23	7.25	7.47	28.68
T$_2$	10:14:12	B	170 °C	6.96	7.45	7.48	7.28	29.17
T$_3$	12:12:12	C	170 °C	7.36	7.22	7.24	7.41	29.23
T$_4$	14:10:12	D	170 °C	7.91	7.95	8.02	7.94	31.82
T$_5$	16:8:12	E	170 °C	7.51	7.61	7.53	7.9	30.55
T$_6$	8:16:12	F	180 °C	7.28	7.63	7.54	7.67	30.12
T$_7$	10:14:12	G	180 °C	7.72	7.46	7.61	7.38	30.17
T$_8$	12:12:12	H	180 °C	7.88	7.86	7.67	7.78	31.19
T$_9$	14:10:12	I	180 °C	7.47	7.54	7.64	7.6	30.25
T$_{10}$	16:8:12	J	180 °C	7.66	7.68	7.96	7.8	31.1
T$_{11}$	8:16:12	K	190 °C	7.72	7.63	7.57	7.65	30.57
T$_{12}$	10:14:12	L	190 °C	7.64	7.35	7.13	7.04	29.16
T$_{13}$	12:12:12	M	190 °C	7.48	7.3	6.91	7.11	28.8
T$_{14}$	14:10:12	N	190 °C	7.28	7.41	7.18	7.52	29.39
T$_{15}$	16:8:12	O	190 °C	6.78	7.02	6.27	6.14	26.21
Control	12:12:12	P	170 °C	7.74	7.85	8.12	8.13	31.84

Table 4: ANOVA of sensory

(a) Sensory colour

	T$_1$	T$_2$	T$_3$	T$_4$	T$_5$	Mean
D$_1$	6.733±1.494	6.967±1.586	7.367±1.116	7.911±0.416	7.511±1.136	7.297
D$_2$	7.289±1.015	7.722±0.910	7.889±0.571	7.444±0.820	7.667±0.969	7.800
D$_3$	7.722±0.81	7.644±0.524	7.489±1.14	7.289±0.925	6.789±1.546	7.386
Mean	7.248	7.444	7.578	7.548	7.322	7.427

	SE			CD		
T	1.431			4.09		
D	1.108			3.169		
T×D	2.479			7.160		

(b) Flavour

	T$_1$	T$_2$	T$_3$	T$_4$	T$_5$	Mean
D$_1$	7.233±0.823	7.456±0.812	7.222±1.291	7.956±0.620	7.611±0.691	7.495
D$_2$	7.633±0.585	7.467±0.951	7.867±0.676	7.544±0.748	7.689±0.797	7.640
D$_3$	7.622±0.805	7.356±0.782	7.367±1.386	7.411±0.718	7.00 ±0.691	7.351
Mean	7.496	7.426	7.485	7.637	7.433	7.495

	SE			CD		
T	1.443			4.123		
D	1.117			3.194		
T×D	2.499			7.217		

(c) Taste

	T$_1$	T$_2$	T$_3$	T$_4$	T$_5$	Mean
D$_1$	7.478±0.798	7.289±1.067	7.411±1.246	7.944±0.654	7.900±0.719	7.604
D$_2$	7.678±0.706	7.389±1.142	7.789±0.592	7.600±0.517	7.800±0.714	7.654
D$_3$	7.656±0.930	7.044±0.897	7.111±1.112	7.522±1.018	6.144±1.427	7.095
Mean	7.604	7.240	7.437	7.688	7.281	7.450

	SE			CD		
T	1.434			4.100		
D	1.111			3.176		
T×D	2.484			7.175		

(d) Texture

	T$_1$	T$_2$	T$_3$	T$_4$	T$_5$	Mean
D$_1$	7.256±1.038	7.489±0.814	7.244±1.29	8.022±0.690	7.533±0.696	7.504
D$_2$	7.544±0.541	7.611±1.089	7.678±0.790	7.644±0.731	7.967±0.638	7.684
D$_3$	7.578±0.945	7.133±0.85	6.911±1.291	7.189±0.937	6.278± 1.319	7.012
Mean	7.459	7.411	7.277	7.618	7.618	7.405

	SE			CD		
T	1.427			4.080		
D	1.105			3.160		
T×D	2.472			7.140		

From the sensory score of the cupcake develops from the jackfruit seed flour (%) and baking temperature (°C) are non-significant effect at P≤0.01 on colour, flavour, taste and texture was observed. It can be concluded that treatment T_4 with incorporation of Jackfruit seed flour (14%) and Finger millet flour (10%) incorporated cupcake with baking temperature 170°C has the highest score (colour 7.91±0.416, flavour 7.95±0.620, taste 7.94±0.654 and texture 8.02±0.690) resulted the best treatment compared with all other treatments.

Correlation between the objective and subjective scores

The best sensory score of the product have been obtained from section 3.13 and 3.14 at Jackfruit seed flour 14% and Finger millet flour 10% incorporation in cupcake baked at 170°C temperature, product achieved that the higher colour 7.911, Flavour 7.956, Texture 8.02 and Taste 7.94 protein 4.72 %, fat 11.82%, fibre 2.23 %, ash 1.56% and carbohydrate 55.82% which resulted best product among all the treatments.

CONCLUSION

The best quality of Jackfruit seed and Finger millet flour cupcake based can be produced with incorporation of Jackfruit seed flour 14% and Finger millet flour 10% and baking temperature at 170**°C**. The cake has moisture content 23.830 %, protein 4.723 %, fat 11.820 %, Fibre 2.233 %, ash 1.566 %, Carbohydrates 55.826, Browning index 24.612 %, Hardness 46.666 N, gumminess 42g, Chewiness 24.666g, Cohesiveness 0.865g, Adhesiveness 11.466 J, Springiness 0.633 and have heights sensory score colour 7.911, flavor7.956, taste 7.944 and texture 8.022.

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