Antioxidant Properties of Fibre Rich Dietetic Chocolate Cake Developed by Jackfruit (*Artocarpus heterophyllus* L.) Seed Flour

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***Abstract*—Food is a subject of vital interest to everyone in the world. A majority of consumers shown concern regarding restrictions for limiting of high calorie and cholesterol in daily diet, as higher intake of fat is linked with development of cardiovascular disease stated by American Cancer Society. Due to compositional benefit of Jackfruit seeds i.e., being rich in protein and Carbohydrate, low in fat and calorific value, it is pertinent to convert Jackfruit seed into flour to be used in several functional foods. Conversely, an attempt has been made to blend 5-15% Jackfruit Seed Flour (JFSF) for cake preparation by partial replacement of wheat flour. In the present investigation jackfruit seed flour and wheat flour were used to formulate low calorie chocolate cake. The refined wheat flour and jackfruit seed flour were mixed in the ratio of 95:5, 90:10, 85:15 and 100% refined wheat flour (control). The total dietary fibre content increased from 3.43 – 9.06% with incorporation of 15% Jackfruit seed flour. The antioxidant activity increased from 52.42 – 97.82mg/g. The chocolate cake samples of different treatments and control were analyzed for protein, fat, ash, dietary fibre and antioxidant for estimating its content and food safety. Organoleptic characteristics (flavour and taste, body and texture, colour and appearance, overall acceptability) were checked by hedonic scale. The treatment containing 10% level of jackfruit seeds scored the highest value. Thus, product acceptability judged by organoleptic evaluation and therapeutic value, the treatment can be rated as $T_2 > T_0 > T_1 > T_3$.**

***Index Terms*—jackfruit, low calorie, fibre, antioxidant, chocolate cake**

I. Introduction

Cake is well linked by consumers all over the world. It is a very important product in bakery industry. The high calorie content and over consumption of cake contributed to obesity among the consumers. Awareness on nutritional and health program among consumers resulted in accelerated demand for reduced or low calorie and high fibre foods, Akinimutimi [1]. Numerous high fibre additives have been introduced as ingredients in a variety of foods, especially in baked products, to satisfy consumer demand for increase fibre content in foods, without sacrificing preferred sensory properties. The *Artocarpus heterophyllusis* a species of tree of Malaysian origin and is commonly known as jackfruit. The seeds of jackfruit are rich in protein contains 6.6% protein and 38% carbohydrate and 0.4% fat. They are high in starch, low in calcium and iron and good source of vitamin B [2]. Conversion of seeds to flour gives extra benefit as the jackfruit have shorter shelf life and highly seasonal so it can be used in inter mediatory products and blended with other flours for value addition and sensory properties of final product. The addition of jackfruit seed flour to deep fat products has reduced the fat content remarkably. The jackfruit is known as poor man's food and people in some areas preferred it over rice for their daily meal [3]. The seeds can be eaten after boiling or roasted, dried and salted [4]. Proximate composition of Jackfruit seed flour was found moisture 14.00%, protein 9%, fat 1.10%, crude fibre 2.55%, total mineral matter 3.01%, total carbohydrates 70.26% and Calorific value was 327K. Cal. [5]-[9] Jackfruit seed flour can be substituted at a certain level for wheat flour to satisfy consumer demands to increase fibre content in foods. The seed of Jackfruit which is a waste from the fruit industry has commercial potential for application as a cheap source of fibre replacing whole meal, Ockloo *et al.* [5], the product made out of JFSF found to be high in phenolic and antioxidant activities. Antioxidants are best known for their potential to protect against oxidative cell damage caused by free radicals within our bodies. Free radicals are produced due to oxidative stress. These free radicals damages DNA of the cell and turns the normal cell into a cancer cell. Oxidative cell damage can lead to diseases like Alzheimer's, cancer and heart disease. Antioxidants neutralize these free radicals and acts as a shield to protect DNA from free radicals. JFSF is a proven source for antioxidants.

II. Materials and Methods

A. Material Required

Material required for preparation of control and experimental chocolate cake. Flour, Milk, Jackfruit seed flour, Sugar, Salt, Flavor (vanilla), Butter, Baking powder, Baker ś yeast, Egg, Cocoa powder.

Manuscript received February 12, 2016; revised August 23, 2016.

doi: 10.18178/ijfe.2.2.132-135

Jackfruit Seed Flour (JFSF) preparation:

Jackfruit Seed Flour (JFSF) was prepared by drying of the seeds, followed by grinding it into flour with 60 mesh particle size Ockloo *et al.* [5] (Fig. 1).

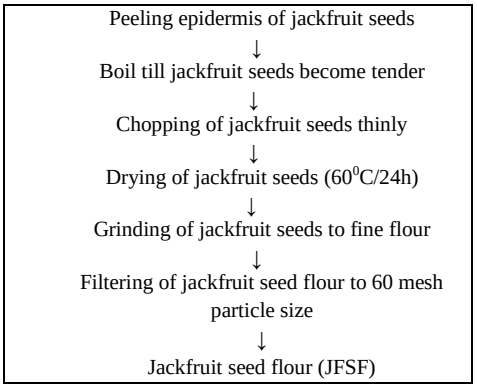

Figure 1. Flow chart for preparation of Jackfruit Seed Flour (JFSF)

B. Cake Preparation

For cake preparation all the dry ingredients were mixed together. Normal chocolate cake served as control (T_0), whereas 5% replacement of Jackfruit seed flour was in T_1, 10% replacement was in T_2 and 15% replacement was in T_3 (Table I). Ingredients along with milk, butter, eggs were mixed at 18℃. After that boiling water was added and mixed at a low speed. Flavorings agent was added and blend. Now the batter is baked at 190℃ for 15-20 minutes and cooled it at room temperature. Then, JFSF added chocolate cake was ready [10]-[12].

TABLE I. DETAILS OF DIFFERENT TREATMENTS FOR MAKING OF JFSF CHOCOLATE CAKE

Materials (%)	Different treatments			
	T0	T1	T2	T3
Flour	100	95	90	85
Jackfruit seed flour (JFSF)	-	05	10	15

Sample Analysis: the samples were analyzed for Physicochemical, microbial and organoleptic qualities as per the procedure laid down by AACC [13], AOAC [14], ICAR manual in Dairy Chemistry [15] and microbiology [16]. Freshly prepared cakes were served for evaluation to panel members consisting of 5 experienced persons. 9 point hedonic scale proforma was used as suggested by Amerine *et al.* [17]. The data collected on different aspects as per plan were tabulated and statistically analyzed as per Chandel [18].

III. RESULT AND DISCUSSION

Table II showed average data obtained on different parameters.

A. Physiochemical Poperties

The highest mean for protein percentage in Jackfruit seed flour (JFSF) cake was found in T_3 (8.48), followed by T_2 (8.16), T_1 (7.82) and T_0 (7.71). The treatments were differed significantly. The highest mean for fat percentage in JFSF cake was found in T_0 (14.86), followed by T_1 (13.75), T_2 (13.06), and T_3 (12.57). Significant difference was found among the treatments which were due to Jackfruit seed flour addition. The highest mean for ash percentage in JFSF cake was in T_3 (2.43), followed by T_2 (1.93), T_1 (1.56) and T_0 (1.43). There were significant differences found among the treatments. The highest mean for moisture percentage was found in T_3 (22.20), followed by T_2 (21.67) T_1 (20.63) and T_0 (19.13). The highest mean for carbohydrate percentage in JFSF cake was found in T_0 (56.87), followed by T_1 (56.26), T_2 (55.72) and T_3 (54.31). The highest mean for total solids content in JFSF cake was in T_0 (80.87), followed by T_1 (79.37), T_2 (78.33) and T_3 (77.80). The treatments differ significantly due to addition of JFSF in different proportion.

TABLE II. AVERAGE OF DIFFERENT PHYSIOCHEMICAL PARAMETERS

Parameters (%)	Treatments			
	T0	T1	T2	T3
Protein	7.71	7.82	8.16	8.48
Fat	14.86	13.75	13.06	12.57
Ash	1.43	1.56	1.95	2.43
Moisture	19.13	20.63	21.67	22.20
Carbohydrates	56.87	56.26	55.72	54.31
Total Solids	80.87	79.37	78.33	77.80

B. Organoleptic Parameters

As per Table III the highest mean for flavour and taste for JFSF cake was found in T_1 (8.04), followed by T_2 (7.88), T_3 (7.80) and T_0 (7.64) (Fig. 2). There were significant difference existed among the treatments. The highest mean for body and texture was found in T_2 (8.04), followed by T_0 (7.88), T_1 (7.76) and T_3 (7.72) (Fig. 3). There were no significant differences found among the treatments due to different proportions of JFSF. The highest mean for colour and appearance was found in T_3 (8.06), followed by T_0 (8.00), T_1 (7.92) and T_2 (7. 84) (Fig. 4). The values did not differ significantly.

TABLE III. ORGANOLEPTIC PARAMETERS

Parameters (%)	Treatments			
	T0	T1	T2	T3
Flavour & Taste	7.64	8.04	7.88	7.80
Body& Texture	7.88	7.76	8.04	7.72
Colour & Appearance	8.00	7.92	7.84	8.06

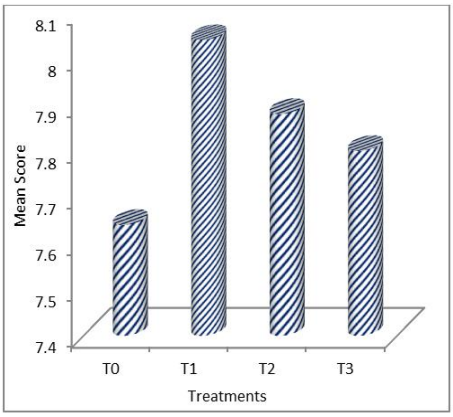

Figure 2. Flavour and taste

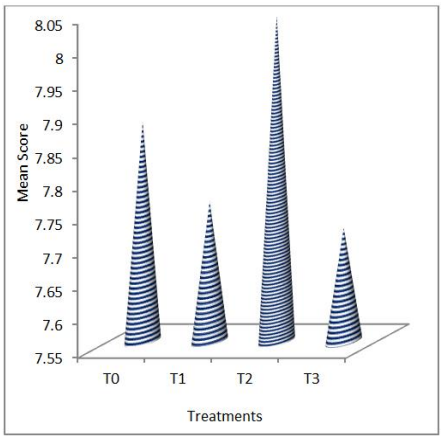

Figure 3. Body and texture

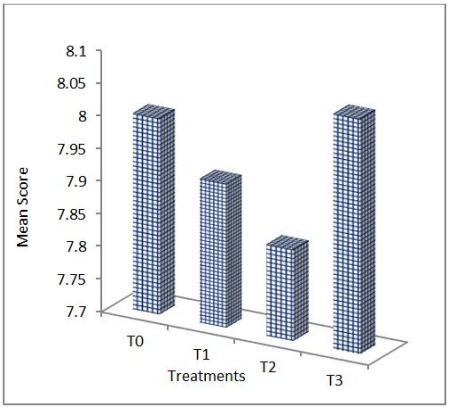

Figure 4. Color and appearance

C. Dietary Fibre Content of JFSF Chocolate Cake

As per Table IV and Fig. 5, the highest mean for dietary fibre content was found in T_3 (9.55), followed by T_2 (6.9), T_1 (3.45) and T_0 (0.42). The differences among the treatments were significant.

TABLE IV. DIETARY FIBRE CONTENT OF JFSF CHOCOLATE CAKE

REPLICATION	*TREATMENTS*			
	T0	T1	T2	T3
R1	0.45	3.65	5.97	9.0
R2	0.47	3.59	6.0	9.29
R3	0.39	2.99	6.19	8.89
R4	0.40	3.49	6.20	9.04
Mean	0.42	3.45	6.9	9.55

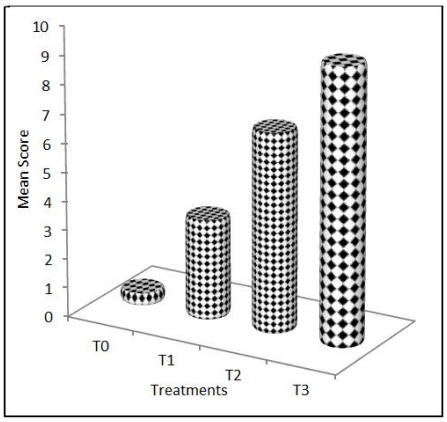

Figure 5. Dietary fibre content of JFSF chocolate cake

D. Antioxidant Properties

As per Table V and Fig. 6 the highest mean for antioxidant content was found in T_3 (98.20), followed by T_2 (77.0), T_1 (51.60) and T_0 (0.00). The treatments differed significantly.

TABLE V. ANTIOXIDANT PROPERTIES

Replication	Treatments			
	T0	T1	T2	T3
R1	0.0	51.0	78.7	97.4
R2	0.0	53.0	75.7	97.0
R3	0.0	50.5	78.1	100.03
R4	0.0	52.2	75.5	97.4
Mean	0.0	51.6	77.0	98.2

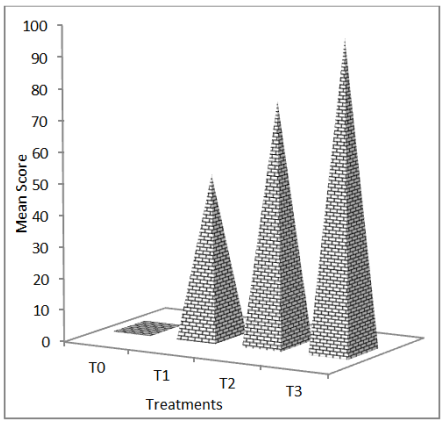

Figure 6. Antioxidant properties

E. Overall Acceptability

As per Table VI and Fig. 7 the overall acceptability of JFSF cake. The highest mean value was found in T_1 (8.16), followed by T_2 (8.12), T_3 (8.14) and T_0 (8.04). There were no significant differences found in overall acceptability of JFSF cake due to JFSF. The product was as good as control.

TABLE VI. OVERALL ACCEPTABILITY OF THE PRODUCT

Replication	Treatments			
	T0	T1	T2	T3
R1	8.0	7.6	7.8	8.1
R2	8.4	8.4	8.0	8.0
R3	8.2	8.2	8.0	8.0
R4	7.8	8.0	8.6	8.0
R5	7.8	8.6	8.2	8.6
Mean	8.04	8.16	8.12	8.14

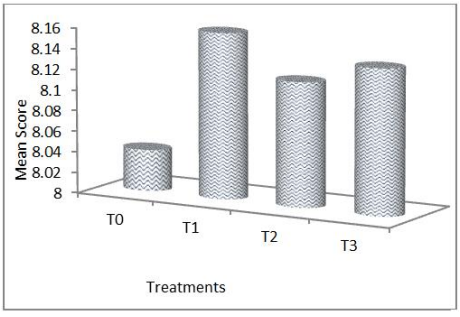

Figure 7. Overall acceptability of the product

IV. Conclusion

From the above parameters and data observed it may be concluded that Jackfruit seed flour can be satisfactorily added to common flour to improve dietary fibre and to produce low calorie cake. As per sensory evaluation (over all acceptability) T_1 (Flour: JFSF = 95:05) found to be best among all the treatments. The antioxidant activity level and dietary fiber in chocolate cake found to be increasing with increase in the percentage of JFSF. Thus it can be concluded that the enrichment of chocolate cake with JFSF will enhance the antioxidant properties as well as dietary fibre content. As per dietary fibre and antioxidant content, T_3 found to be best among all the treatments.

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