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Studies on development of rice cake using rice flour with blackcherry pulp supplemented with basil

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Abstract
Rice cakes are made in many cultures and have wide range of processing and product characteristics. These cakes are made from rice flours which are grounded into fine powders. Rice cakes had been made by different methods using different ingredients by different cultures. The main aim for this prepared Rice cake was to develop a rice cake using rice flour with Blackcherry pulp supplemented with Basil. The rice flours, the blackcherry and basil are being treated at different levels, with 100% of rice flour i.e. 100:0 which is (T_0) served as control, in (T_1) with 98% of rice flour,1% of blackcherry and 1% of basil i.e. 98:1:1, in (T_2) with 96% of rice flour, 3% of blackcherry and 1% basil i.e. 96:3:1, in (T_3) with 94% rice flour, 5% blackcherry and 1% basil i.e. 94:5:1.The study was conducted to developed Rice cake fortified with Blackcherry pulp and Basil. Trials were conducted to adjust the most acceptable levels of Blackcherry pulp (1%, 3% and 5%) and basil (1%, 1% and 1%) on the basis of sensory and Physico-chemical analysis of the product. The Final optimized product i.e. (T3) which was highly acceptable and was used to develop a product without adversely affecting the sensory attributes. The Rice cake prepared without addition of Blackcherry pulp supplemented with basil was treated as Control. The optimized product contains 0.4% Fat, 2.76% Protein, 2.33% Ash Content, 54.01% Carbohydrate, 1.16% Iron, 42.22% Moisture, 2.46% Dietary Fibre, 36.00mg Calcium, 186.20mg Potassium. The product possesses good level of Potassium, Magnesium and Carbohydrate. The price for manufacturing 100g of Blackcherry pulp supplemented with Basil was found out to be Rs7.85 and for Control Rice Cake is Rs 8.05.

Keywords: Rice cake, blackcherry, basil, supplemented, optimized

Introduction

Rice products are staple foods, especially in Asia with more than 50% of the population depending on rice as the primary source of dietary calories. Rice products have many unique attributes, such as ease of digestion, bland taste, and hypoallergenic properties. Rice is an excellent food to include in a balanced diet. Rice has no fat, no cholesterol and is sodium free. Rice lipids, which include fatty acids, are investigated for their anti-bacterial effects and potential to prevent cancer and cardiovascular diseases (FAO, 1997) [3]. The immense diversity of rice is a rich source for many rice based products and is also used for treating many health related maladies such as indigestion, diabetes, arthritis, paralysis, epilepsy and give strength to pregnant and lactating mothers. Cherries are prehistoric fruits, originating throughout West and North America and parts of Turkey.

The cherries which taste bittersweet may be eaten raw and can be used in Jellies/jams and also as a flavour extract in syrups. Black cherry fruit contains high levels of anthocyanins and other Phenolic compounds, mainly flavonols and ellagitannins which contributes to its high antioxidant capacity and liver restoration potential.

The antioxidants in Cherries fight free radicals and therefore reduce the risk of cancer, slow sign of ageing. Black cherries are considered beneficial for your heart because they provide protection against damage to your arterial walls. Melatonin present in black cherries helps to reduce the risk of stroke and heart disease by lowering blood lipid levels.

The anthocyanin compounds also act as protective agents against heart disease (Chang *et al.* 2002). Basil is native to areas in Asia and Africa and grows wild as a perennial on some pacific islands. Basil was brought from India to Europe through the Middle East in the sixteenth century, and subsequently to America in the seventeenth century. Basil is one of the most important herbs to many cultures and cuisines, including Italian, Thai, Vietnamese. One of the most important capabilities of basil found in recent times is its antidiabetic activity

(Mandal *et al.*, 1993; Nair *et al.* 2009) [7, 8]. Basil has been used as a folk remedy for an enormous number of ailments, including boredom, cancer, convulsion, deafness, diarrhea, epilepsy, gout, hiccup, impotency, insanity, nausea, sore throat, toothaches, and whooping cough

Materials and Methods
The experiment "Development of Rice cake using Rice flour with Blackcherry pulp supplemented with Basil" has been carried out in research lab, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj U.P (India), 210007.

Treatment combination of Rice cake
T0 - Rice cake was prepared by blending 100% of rice flour
T1 – Rice cake was prepared by blending 98% of rice flour with 1% black cherrypulp and 1% basil
T2- Rice cake was prepared by blending 96% of rice flour with 3% blackcherry pulp and 1% basil
T3 – Rice cake was prepared by blending 94% of rice flour with 5% blackcherry pulp and 1% basil.
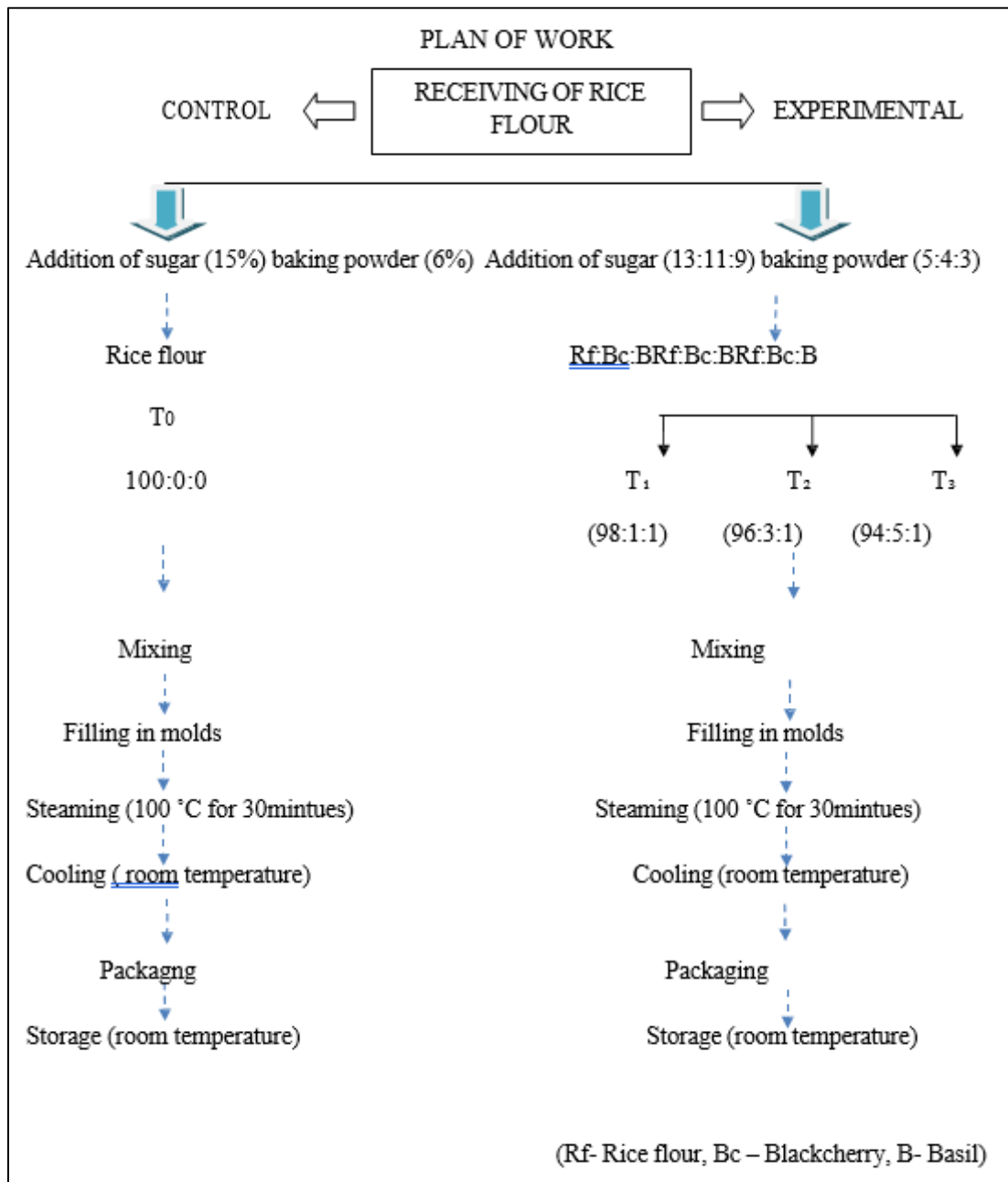
Fig 1: Flow diagram of Development of rice cake using rice flour with Blackcherry pulp supplemented with basil

Physico-chemical analysis
- Carbohydrates – AOAC Official method 19th Edtn;2012Vol II,986.25
- Protein - by IS 7219;1973 Rffm 2010
- Dietary fibre- AOAC Official Method 19th Ed,2012,985.29
- Moisture- Hot air oven AOAC 1990
- Ash – (IS: 10501, 1983)

- Fat- AOAC Official Methods 19th Edtn, 2012;Vol- II, 963.15

Micronutrients analysis
- Calcium- FSSAI lab manual Metals 2016
- Iron – FSSAI lab manual Metals 2016
- Magnesium- FSSAI lab Manual Metals 2016
- Potassium- FSSAI lab Manual metals 2016

Sensory Evaluation (Determined by 9-point hedonic (Amerine *et al.* 1965) by panel of 5 judges)
- Colour and Appearance
- Body and texture
- Flavour
- Overall acceptability

Cost analysis
Statistical Analysis
Data was analysed by using Analysis of Variance (ANOVA) technique and Critical Difference (C.D) in WASP software and excel software.

Results and Discussion
The present study 'Studies on the nutrition and chemical quality of Rice cake using rice flour
with blackcherry pulp supplemented with basil'. The data collected on different aspects were tabulated and analyzed statistically using the methods of variance and critical difference. The significant and non-significant differences observed have been analyzed critically within and between the treatment combinations. The results obtained from the analysis are presented in this chapter under the following headings.

Physico-chemical characteristics
From the table 1 it can be observed that the highest value of carbohydrates was found to be in
T0 (65.58) containing 100% rice flour and lowest value of carbohydrate was found to be in T3 (54.01) containing 94% rice flour 5% Blackcherry and 1% basil. Highest value of protein was found to be in T0 (4.10) and lowest value was found to be in T2 (2.70). Highest value of fat was found to be in T0 and T2 (0.5) and lowest value was found to be in T1 and T3 (0.4). Highest value of Moisture was found to be in T3 (42.22) and lowest value was found to be in T0 (27.93). Highest value of Ash was found to be in T3 (2.33) and lowest value was found to be in T2 (1.83). Highest value of Energy was found to be in T0 (278.66) and lowest value was found to be in T2 (230.65). Highest value of Iron was found to be in T3 (1.06) and lowest value was found to be in T0 (0.27). Highest value of Calcium was found to be in T3 (36.05) and lowest value was found to be in T0 (8.06). Highest value of Magnesium was found to be in T3 (35.20) and lowest value was found to be in T0 (19.80). Highest value of Dietary fibre was found to be in T3 (2.46) and lowest value was found to be in T0 (2.32). Highest value of Potassium was found to be in T3 (186.20) and lowest value was found to be in T0 (64.00).

Table 1: Physico-chemical and Micronutrients parameters of Rice cake

Parameters	Treatments			
	T0	T1	T2	T3
Carbohydrates (g/100g)	$65.58^a+0.09$	$60.15^6+0.09$	$54.96^b\pm0.09$	$54.01^d\pm0.09$
Protein (g/100g)	$4.10^a+0.13$	$3.26^{13}+0.13$	$2.70^{cd}\pm0.13$	$2.76^d\pm0.13$
Fat (g/100g)	$0.50^a+0.04$	$0.40^{ab}\pm0.04$	$0.50^{abc}+0.04$	$0.40^{abcd}\pm0.04$
Moisture (%)	$27.93^d\pm1.23$	$34.27^c\pm1.23$	$38.99^b\pm1.23$	$42.22^a\pm1.23$
Ash (%)	$2.0^a\pm0.08$	$1.9^a+0.08$	$1.8^a\pm0.08$	$2.3^a\pm0.08$
Dietary fibre %(w/w)	$2.32+0.02$	$2.36^6+0.02$	$2.43^b\pm0.02$	$2.45^b\pm0.02$
Iron(mg/100g)	$0.27^{bc}+0.11$	$0.45^{abc}+0.11$	$0.83^a\pm0.11$	$1.06^a\pm0.11$
Calcium(mg/100g)	$8.06^d\pm0.91$	$15.03^c\pm0.91$	$27.06^b\pm0.91$	$36.05^a\pm0.91$
Magnesium (mg/100g)	$19.80^d\pm1.43$	$24.60^c+1.43$	$29.20^b\pm1.43$	$35.20^a\pm1.43$
Potassium (mg/100g)	$64.00^d\pm2.46$	$83.40^c\pm2.46$	$136.40^b\pm2.46$	$186.20^a\pm2.46$

Figures are the Mean ± Standard error of four replication. Means in each row with different superscript are significantly different ($P\leq0.05$).

Table 2: Sensory Analysis

Sensory Scores (9 Point Hedonic Scale)				
Flavor	$7.38^d\pm0.12$	$7.26^c\pm0.12$	$7.22^b\pm0.12$	$7.60^a\pm0.12$
Body and Texture	$7.26^a\pm0.12$	$7.06^a\pm0.12$	$7.06^a\pm0.12$	$7.40^b\pm0.12$
Color and Appearance	$7.46^a\pm0.07$	$7.28^b\pm0.07$	$7.22^{bc}\pm0.07$	$7.34^c\pm0.07$
Overall Acceptability	$7.38^{ab}\pm0.05$	$7.28ab\pm0.05$	$7.42^b\pm0.05$	$7.46^c\pm0.05$

Figures are the Mean ± Standard error of four replication. Means in each row with different superscript are significantly different ($P\leq0.05$).

Physico-Chemical
Carbohydrate percent of rice cake
The average percentage for Carbohydrate in rice cake samples of different treatment and control, the highest mean was recorded in T0 (65.58) followed by T1 (60.15), T2 (54.96), T3 (54.01). There were significant difference ($P<0.05$) observed between treatments and control, T0 was recorded as the highest as rice flour maintained at 100%, contributed more towards the carbohydrate percentage compared to other treatments wherein the rice flour content was being reduced. This shows that rice has high carbohydrates percentage which corresponds with the work of (Shin *et al.*, 2010) [11].
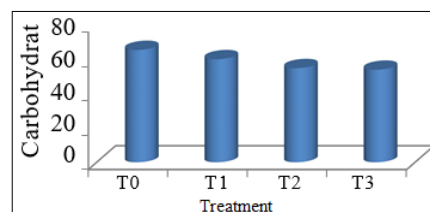
Fig 2: Carbohydrate content of Rice cake

Protein percent of rice cake
The average percentage of protein in rice cake samples of control and rice flour supplemented with blackcherry pulp and

basil were recorded as such that the highest mean was found in T0 (4,10). Followed by T1 (3.26), T3 (2.76), T2 (2.70) respectively. There were significant difference ($P<0.05$) observed between treatments. The results showed that protein content was high in T0 (4.10) as rice flour maintained at 100%. The calorific value from protein has been provided by plants (Rice), so it is a good source of protein (Aashitosh *et al*., 2015) [1].
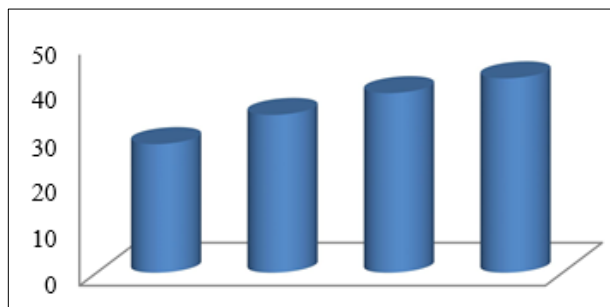

Fig 3: Protein content of rice cake

Moisture percent of rice cake
Moisture percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (42.22), followed by T2 (38.99), T1 (34.99), T0 (27.93). There were significant difference ($P<0.05$) observed between treatments. T3 (42.22) was recorded the highest percentage of moisture was due to the blackcherry pulp that conserved the moisture for a longer period compared to the other treatments.
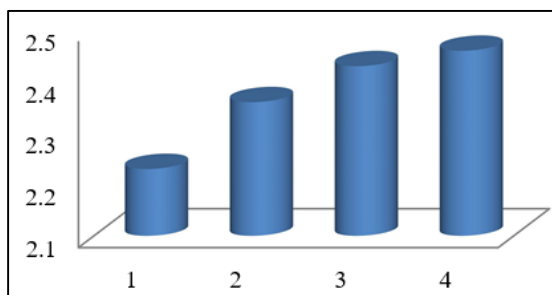

Fig 4: Moisture content of rice cake

Dietary fibre percent of rice cake
The average Dietary fibre percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (2.46). Followed by T2 (2.43), T1 (2.36), T0 (2.32).). There were significant difference ($P<0.05$) observed between treatments. The dietary fibre was found to be highest in T3 (2.46) compared to the other treatments due basil and blackcherry pulp that contributed more towards dietary fibre, Basil and blackcherry pulp reduce constipation and anti-diabetic activity. This result correspond to the study of (Lopez *et al*., 2004) [6].
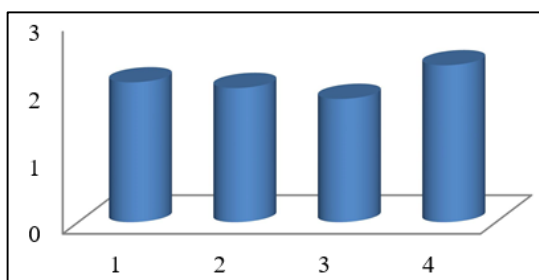

Fig 5: Dietary fibre content of rice cake

Ash percent of rice cake
The average Ash percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (2.33). Followed by T0 (2.076), T1 (1.992), T2 (1.83). There were significant difference ($P<0.05$) observed between treatments. T3 (2.33) showed the highest ash percent as the rice flour maintained at 94%, blackcherry at 5% and basil at 1% contained the highest amount of minerals as compared to T0, T1 and T2. The results obtained from present study are in agreement with the finding of (Hardeep *et al*., 2012) [5].
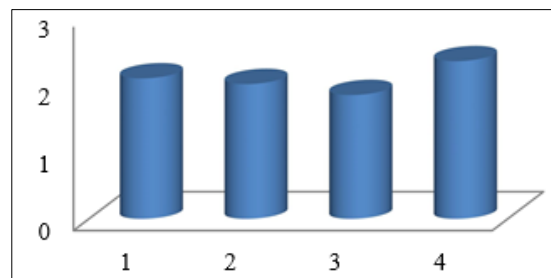

Fig 6: Ash content of rice cake

Fat percent of rice cake
Fat percentage in rice cake samples of different treatment and control, the highest mean was recorded in T0 (0.5) and T2 (0.05) followed by (T1) and (T3), There were significant difference ($P<0.05$) observed between treatments. The many studies has mentioned about fat (Ghufran*et al*., 2009) [4].
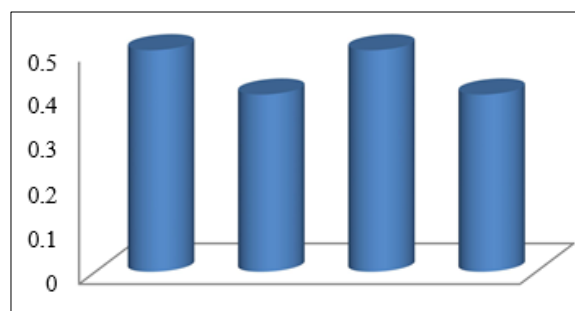

Fig 7: Fat content of rice cake

Micronutrients
Iron percent of rice cake
Iron percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (1.06), followed by T2 (0.83), T1 (0.45), T0 (0.27). There was significant difference ($P<0.05$) observed between treatments and control, T3 (1.06) was recorded the highest as the blackcherry pulp was maintained at 5% and basil at 1%. Iron content of blackcherry pulp and basil was higher than control, suggesting that blackcherry pulp and basil represents a good complementary source of minerals (Yan *et al*., 2002).
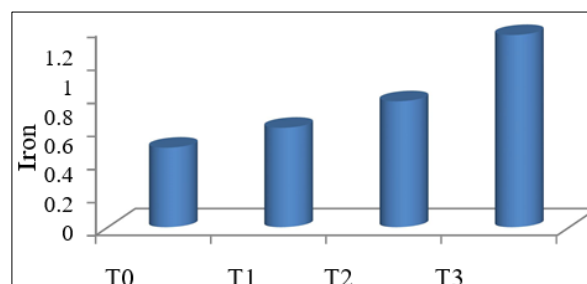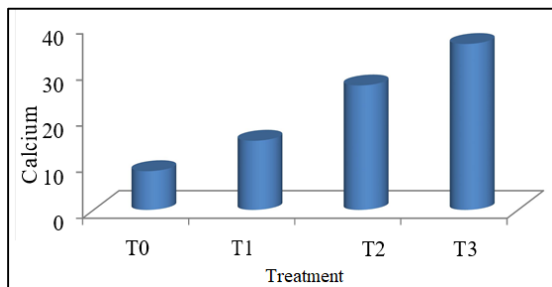

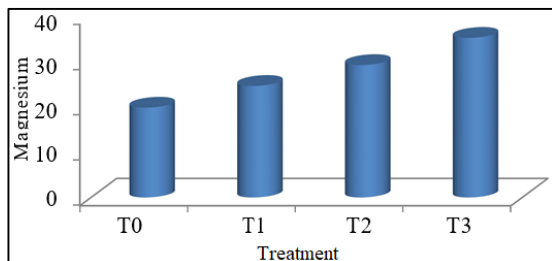**Fig 8:** Iron content of rice cake

Calcium percent of rice cake

Calcium percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (36.05), followed by T2 (27.06),T1 (15.03), T0 (8.06). There was significant difference (P<0.05) observed between treatments and control, T3 (1.06) was recorded the highest as the blackcherry pulp was maintained at 5% and basil at 1%. Calcium content of blackcherry pulp and basil was higher than control, suggesting that blackcherry pulp and basil represents a good complementary source of minerals (Yan *et al*., 2002).

Fig 9: Calcium content of rice cake
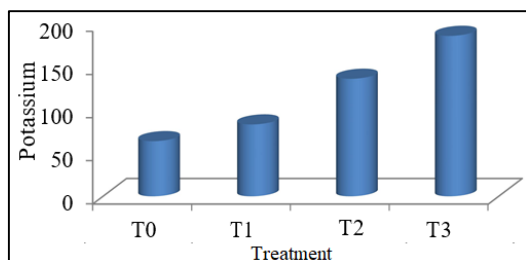
Magnesium percent of rice cake

The average Magnesium percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (35.20), followed by T2 (29.20), T1 (24.60), T0 (19.80). There were significant difference (*P*<0.05) between control and the treatments. T3 showed the highest magnesium percentage as the blackcherry pulp was maintained at 5% and basil at 1%. Magnesium content of blackcherry pulp and basil was higher than control, suggesting that blackcherry pulp and basil recorded comparatively higher amount of magnesium.

Fig 10: Magnesium content of rice cake

Potassium percent of rice cake

Potassium percentage in rice cake samples of different treatment and control, the highest mean was recorded in T3 (186.20) followed by T2 (136.40),T1 (83.40), T0 (64.00).There were significant difference (P<0.05) between control and the treatments. T3 showed the highest potassium percentage as the blackcherry at 5% and basil at 1%.


Fig 11: Potassium content of rice cake

Sensory Analysis
Flavour

The average percentage on the Flavor of rice cake samples of different treatment and control, are written as follows (T0)7.38, (T1)7.26 (T2)7.22 (T3) 7.60.(T3) with 7.60 score was recorded the highest with 94% rice flour supplemented with 5% blackcherry pulp and 1% basil. It can be concluded that the addition of blackcherry pulp and basil to the rice flour adds in more flavor and taste to the rice cake. Taste is a caused that is a sensation that is received by taste buds in the oral cavity caused by water soluble compounds that acts in the tongue. (Roper and Claudhari 2017) [9].
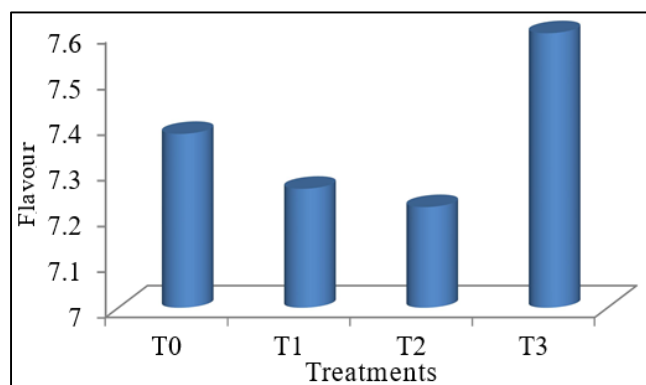
Fig 12: Flavour of Rice cake

Body and texture

The average percentage of Body and texture in rice cake samples of different treatment and control, the highest mean for texture was recorded in(T3)7.40 followed by (T0) 7.26, (T1)7.06 and (T2) 7.06. Supplementation of blackcherry pulp and basil to the rice flour results in more acceptable texture. This work corresponds with the work of (Rozylo *et al*., 2014) [10].
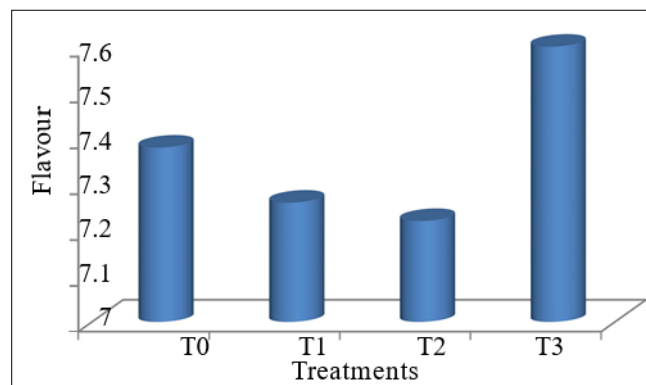
Fig 13: Body and texture of Rice cake

Color and appearance

The average percentage of Color and appearance in rice cake samples of different treatment and control, the highest mean was recorded in (T0) 7.46, followed by (T3)7.34,(T1) 7.28, and (T2)7.22 respectively.T0(control) shows the highest score and there were slight significant difference in the treatments. The lowest score which is less acceptable was obtained in T2 which resulted in light purplish rice cake color. It can be concluded that the addition of blackcherry pulp and basil to the rice flour affects the rice cake color from light grayish purple to dark purplish. (Elsin *et al*., 1971)[2].
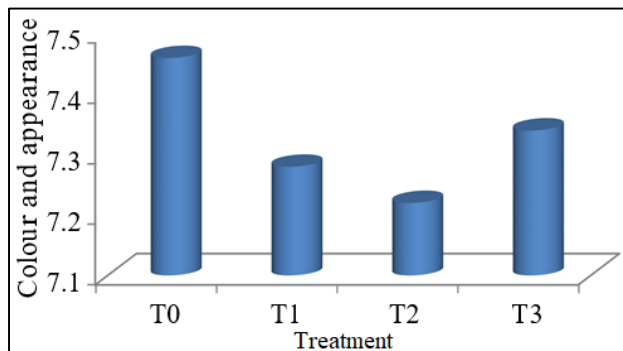
Fig 14: Colour and appearance of rice cake

Overall acceptability

The average percentage of Overall acceptability in rice cake samples of different treatment and control, the highest mean was recorded in (T3)7.46, (T2) 7.42 (T0) 7.38 and (T1)7.28.

The overall result of sensory evaluation of rice cake supplemented with blackcherry pulp and basil which were maintained at 5% blackcherry pulp and 1% basil was the most preferred by the penalist.
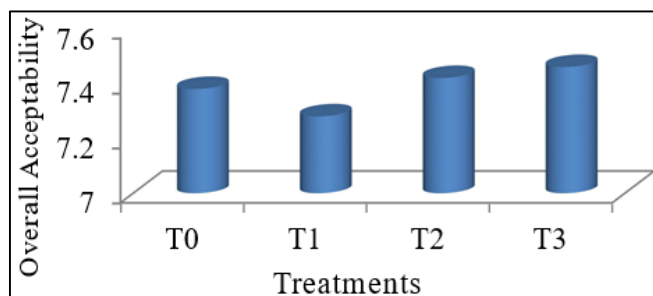

Fig 15: Overall acceptability of rice cake

Cost Analysis

Cost analysis of Development of Rice cake using Rice flour with Blackcherry pulp supplemented with Basil.

Table 3: Cost Analysis of the ingredients

Items	Treatment's cost for per kg production of Rice cake							
	T0		T1		T2		T3	
	Quantity(g)	Cost(Rs.)	Quantity(g)	Cost(Rs.)	Quantity(g)	Cost(Rs.)	Quantity(g)	Cost(Rs.)
Expenditure (Raw material Cost)								
Rice flour@70/kg	100	7	98	6.86	96	6.72	94	6.58
Blackcherry@110/kg	-	-	1	0.11	3	0.33	5	0.55
Basil @!09/kg	-	-	1	0.10	1	0.10	1	0.10
Sugar @4o/kg	15	0.6	13	0.52	11	0.44	9	0.36
Baking Powder@75/kg	6	0.45	5	0.37	4	0.3	3	0.22
Total cost of per 100 g production of rice cake in Rs								
Cost	-	8.05	-	7.97	-	7.89	-	7.85
Other Analysis								
Product obtained from /kg	121	8.05	118	7.97	115	7.89	112	7.85

From the above table it is seen that the production cost range depends upon the Rice flour of the experimental rice cake. It can also be observed that the highest mean cost (Rs.) was recorded in rice cake prepared by rice flour in sample T0 Rs. (8.05) followed by Rs.T1 (7.97), T2 Rs.(7.89),T3Rs. (7.85).

Conclusion

The present study of Rice cake using Rice flour and Blackcherry pulp supplemented with basil was carried out and was found that the product has a higher content of Carbohydrate mainly because rice flour is rich in carbohydrate it provides more energy and with the addition and supplementation of Blackcherry pulp and Basil it was found that it has a higher content of minerals. Blackcherry plays an important role since the fruit is rich in anthocyanin hence we can see the difference in each product used by

different treatment. On the other hand even though Basil is a low calorie herb but has anti-oxidant, anti-inflammatory, antibacterial and powerful adaptogen. Hence by the incorporation of Blackcherry pulp and basil to the rice flour has improved the color, flavor, taste and the overall acceptability as seen in the sensory score card obtained with the highest score i.e. addition of 5% blackcherry pulp and 1% basil (T3). The product possesses good level of Potassium, Magnesium and Carbohydrate.

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