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Nutritional Composition, Textural And Sensory Properties of *Ocimum basilicum* L. Seeds Incorporated Steamed Rice Cake

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Abstract

The incidence of obesity and prediabetes is high, especially in the southern Indian states, Kerala and Tamilnadu, which will pave its way for other chronic metabolic diseases. The steamed rice cake or Idli, the staple diet, of South Indian population is high in glycaemic index. Despite, the diabetics from middle and high income population consume Idli for at least twice a day, for many ages. Hence, in this study, the notion of incorporating *Ocimum basilicum* seeds, has been considered, to ascertain if this can add value to the staple diet of major populace i.e Idli or steamed rice cake. The raw or unprocessed, roasted and steamed *Ocimum basilicum* seeds in a proportion of 5%, 10%, 15% and 20% of the black gram was added to the steamed rice cake batter prepared by standardised procedure and was steamed until doneness. All the variations of *Ocimum basilicum* seed incorporated Idlis were subjected to proximate, textural and sensory analysis. The proximate analysis results depicted that the composition of parameters viz. moisture, energy, protein, fibre and ash, of the *Ocimum basilicum* seed incorporated steamed rice cake showed significant difference ($p<0.05$) in all the variations, on comparison with control. The TPA results signify that the textural parameters of Idlis with 15% of roasted *O.basilicum* seeds (V7) and 20% of roasted *O.basilicum* seeds (V8) incorporation seem to be more acceptable. On organoleptic analysis, the mean score for overall acceptability of the 20% raw *O.basilicum* seeds incorporated variation and 20% roasted *O.basilicum* seeds incorporated variations of the steamed rice cake was maximum and showed acceptance index parallel to the control. Thus, it can be opined that the seeds of *Ocimum basilicum* can be used in steamed rice cake preparation as a means of value addition.

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Keywords

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Introduction

Ocimum basilicum.L (Basil) is one of the endemic plants and its seed is especially used for its pharmaceutical property.[1] This plant is grown in many parts of the globe chiefly in warm regions of Asia, Africa, and Central and South America. Besides its use as a standard medicine, basil seeds are commonly incorporated into food products, like puddings, sweets, ice-creams and liquid refreshments, and are used as a source of dietary fiber. Basil seeds contain 9.19% moisture, 17.32% crude protein, 9.68% crude fat, 5.80% ash, 7.11% fiber, 50.9 % carbohydrates and 63.78±1.75 mg GAE/g of total phenolic content.[2]

Basilseeds are proven to have good antimicrobial, antioxidant and anticancer activities.Bioactivity of *O.basilicum* seeds has projected the great importance of functional foods.[3]

Idli being a fermented and steamed food, contributes to wholesome meal with sufficient carbohydrates, source of protein and B-Complex vitamins[4] and has been accepted as a healthy breakfast for all ages by the different health organizations, including WHO. The main ingredients in Idli are rice and black gram. The synergistic interactions between the polysaccharides, starch and mucilage in black gram, results in an enhanced foam stability during and after fermentation, and also the increased viscosity offers a spongy porous[5] steamed rice cake.

The rising popularity of *O.basilicum* seeds and its gelatin-like consistency, has created an interest to use these seeds as an effective ingredient to enrich the steamed rice cakes.[6] It has also been reported that the polysaccharides proportion of basil seeds namely glucomannan, xylan, glucan and the presence of a highly branched arabinogalactan[7] contribute to the mucilaginous or gelatin like property. This property of the basil seed is utilized in the steamed rice cake preparation, instead of black gram, which is a prime ingredient and a causative factor for obtaining a soft textured steamed rice cake.[8]

Even though, most breakfast grains and traditional food items have a unique place with the power pack of nutrients,[9] the misfortune is that they are categorized as carbohydrate rich foods, and this is applicable for steamed rice cake too. Hence, this study has been devised with the primary objective of preparing value added steamed rice cakes by incorporating various proportions of unprocessed and processed basil seeds and also, to analyse the proximate, textural and sensory characteristics and its acceptance in comparison with the control steamed rice cake.

Materials and Methods

Selection of Samples

The raw materials required for the study such as parboiled rice (*Oryza sativa*), dehulled black gram (*Vigna mungo*) and basil or sabja seeds (*Ocimum basilicum* L.), were purchased from the local market of Salem district, Tamilnadu. The ingredients rice and dhal were hand sorted, to make sure that only quality grains are used and the impurities were removed by washing with water. The basil seeds were hand sorted and sieved to ensure quality.

Formulation of *Ocimum basilicum* L. Seed Incorporated Steamed Rice Cake

The cleaned parboiled rice and dehulled black gram were soaked separately in the ratio of 4:1 (100g,25g) for control and different proportions for respective variations, as depicted in Table-1 for 5 hrs in water at room temperature.[10] The rice was ground coarsely, while black gram to a fine batter with requisite amount of water for grinding. Salt was added as required for taste and the batter was allowed to ferment for 7 hours.[11] For variations V1, V2, V3 and V4 raw basil seeds of 1.25g, 2.5g, 3.75g and 5g were added respectively in the batter. Meanwhile, the basil seeds for variations V5, V6, V7 and V8 (1.25g, 2.5g, 3. 75g and 5g) was dry roasted at 1150C for 6-8 minutes and cooled, roasting beyond this temperature charred the seeds, while roasting lesser than 1150C did not bring about changes in the colour and aroma. The basil seeds required for the variations V9 (1.25g), V10 (2.5g), V11 (3.75g) and V12 (5g) was steamed for 8-10 minutes. The batter was beaten well and basil seeds (unprocessed and processed) at 5, 10, 15, and 20% levels of black gram were incorporated into the respective proportions of batter and was allowed to stand for a period of 15 minutes,[12] for the seeds to gel. Soaking for a longer period of time will result in unfavorable batter consistency. About 40ml of the batter with appropriate proportion of basil seed for each variation was poured in

an Idli steamer and steamed till doneness which approximated to 5 to 8 minutes.[13] The *O. basilicum* seed incorporated steamed rice cake is done. Simultaneously the control steamed rice cake was prepared by following the same procedure without the addition of basil seeds.

Table 1: Ingredients for the Preparation of Different Variations of Steamed Rice Cake

Ingredients	Level of Incorporation (g)												
	Control	**V1**	**V2**	**V3**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Rice	100	100	100	100	100	100	100	100	100	100	100	100	100
Black Gram	25	23.75	22.5	21.25	20	23.75	22.5	21.25	20	23.75	22.5	21.25	20
Raw *O.basilicum Seeds*	0	1.25	2.5	3.75	5	-	-	-	-	-	-	-	-
Roasted *O. basilicum Seeds*	-	-	-	-	-	1.25	2.5	3.75	5	-	-	-	-
Steamed *O.basilicum Seeds*	-	-	-	-	-	-	-	-	-	1.25	2.5	3.75	5

Proximate Analysis

Proximate composition such as moisture, ash, fat, protein and fiber of unprocessed, roasted and steamed basil seeds incorporated steamed rice cake was determined according to the standard procedures. The standard procedures recommended by FSSAI (2016)[14] for cereal and cereal products, was used as a test method for determination of moisture, ash and fibre and fat. The FAO (2002)[15] procedure was used to determine the amount of calories present in the developed product.

Texture Profile Analysis

The Texture Profile Analysis (TPA) test consists of compressing a bite-size piece of steamed rice cake two times in a reciprocating motion that imitates the action of the jaw. The texture of each steamed rice cake was analyzed using P/25mm compression plate in Texture Analyzer (Perten Instruments, Sweden). The steamed rice cake was cooled to room temperature and was cut into an inch cube using an inch cubic mould. The extra top and bottom layers were sliced off to make the steamed rice cake fit to the mould. The cut piece was placed on the heavy duty platform and the test speed was set to 5mm/sec and the probe compressed a distance of 10 mm of the cut steamed rice cake to get the TPA of the steamed rice cake. Parameters like peak force, stringiness, stickiness, adhesiveness, springiness, cohesiveness, chewiness and gumminess has been calculated based on the force deformation curves, captured as a graph and stored in separate projects/files for analysis and export to spreadsheet programs.[16]

Organoleptic Analysis

The organoleptic characteristics of the different variations of prepared steamed rice cake was determined using 120 panelist. All members were familiar with the steamed rice cake as it is a common and frequently consumed food. The samples of uniform size and shape were coded with random numbers. The panelists were asked to score and comment on the color, appearance, texture, mouth feel, taste, flavour and overall acceptability. These sensory attributes were measured on a 9-point hedonic scale with the highest score being extremely good and the lowest being poor.

Statistical Analysis

All experiments in the present analysis were conducted in triplicate, and mean values were reported. The descriptive statistical analyses were performed using IBM SPSS Statistics 16 Software package. The data were subjected to analysis of variance (One-way ANOVA) with Duncan's Post Hoc test ($P<0.05$) to determine the significant difference between the means.

Results and Discussion

Proximate Analysis

The processing methods are employed to enhance the sensory characteristics like aroma and texture. Food processing also improve the nutritional and antioxidant values by reducing the anti-nutritional factors, destruction of seed microflora, improving the carbohydrate and protein digestibility, increasing the prebiotic dietary fiber, shelf life and consumer acceptance of the developed value-added dietary products.[17] To trace the difference in the acceptability and nutritional parameters the processing methods like roasting and steaming were done along with the utilization of raw *O.basilicium* seeds for developing value added Idlis.

The results of proximate analysis presented in Table-2 is discussed herewith. The moisture content of the raw *O. basilicum* seeds incorporated steamed rice cakes ranged from 57.72 to 63.91%, which shows a gradual decrease of moisture content in variations. The decrease in moisture content is proportional to the increase in the quantity of basil seeds, which may be attributed to the water holding capacity of basil seeds.[18] The moisture percentage was found least in the roasted variations, as the roasting time and temperature play a vital role in moisture control.[19] The steamed rice cake variations V9 to V12 with steamed basil seeds projected more moisture, V9 showing the highest percentage 69.33. The cause of increased moisture being, during steaming a certain proportion of steam was absorbed by the seeds, as the basil seeds have more affinity to water.[20] Moisture is an important parameter in the quality and acceptability of food products, as it influences texture and affects the shelf life and microbial growth throughout storage.[21]

Table -2 indicates that the calorie content of the variations has significantly increased when compared to control product. It should also be pointed that the variations with roasted basil seed provided more calories (141-159 Kcals) than the control (139.14 Kcals) followed by the raw seeds incorporated steamed cakes(137.17-151.55 Kcals), while the steamed basil seeds incorporated variations of steamed rice cakes provided lesser calories(113-115 Kcals), which proves similarity with the results of Uche Samuel Ndidi *etal*.[22]

Table 2: Mean Proximate Analysis of the Raw, Roasted and Steamed *Ocimum basilicum* L. Seeds Incorporated Steamed Rice Cake

Variations	Moisture (%)	Energy (kcal)	Protein (%)	Fat (%)	Ash (%)	Fiber (%)
Control	62.14 ±0.34^{c}	139.14 ±0.75^{b}	7.29 ±0.30^{a}	0.99 ±0.04^{b}	0.84 ±0.17^{a}	0.93 ±0.17^{a}
Raw *O. basilicum* Seeds Incorporated Steamed Rice Cake						
V1	63.35 ±0.61^{d}	137.17 ±0.58^{b}	9.98 ±0.20^{ac}	0.92 ±0.06^{a}	1.49 ±0.165^{b}	1.88 ±0.105^{b}
V2	63.91 ±0.62^{ac}	140.57 ±.2.70^{c}	11.38 ±0.44^{b}	1.54 ±0.10^{abc}	1.53 ±0.176^{c}	4.85 ±0.081^{ac}
V3	59.35 ±0.48^{b}	143.77 ±1.833^{ac}	11.24 ±0.22^{b}	1.74 ±0.13^{bc}	1.65 ±0.105^{d}	5.79 ±0.058^{d}
V4	57.72 ±0.48^{a}	151.55 ±2.75^{d}	13.51 ±0.32^{d}	1.64 ±0.11^{d}	1.67 ±0.19^{d}	5.55 ±0.10^{c}
Roasted *O. basilicum* Seeds Incorporated Steamed Rice Cake						
V5	55.54 ± 0.48^{c}	141c ± 0.51^{b}	11.49 ± 0.43^{b}	1.26 ± 0.09^{bc}	1.69 ± 0.04^{b}	4.70 ± 0.06^{d}

V6	55.71 ± 0.34^{d}	142 ± 1.60^{ac}	11.61 ± 0.14^{b}	1.36 ± 0.16^{bc}	1.38 ± 0.07^{a}	4.22 ± 0.13^{c}
V7	53.92 ± 0.25^{b}	150 ± 1.61^{e}	13.88 ± 0.07^{d}	2.22 ± 0.11^{d}	1.77 ± 0.14^{b}	5.83 ± 0.13^{e}
V8	53.35 ± 0.37^{a}	159 ± 2.87^{f}	14.55 ± 0.39^{e}	2.45 ± 0.21^{d}	1.81 ± 0.15^{b}	6.8 ± 0.07^{f}
Steamed *O. basilicum* Seeds Incorporated Steamed Rice Cake						
V9	69.33 ± 0.56^{f}	113 ± 1.44^{a}	10.47 ± 0.33^{a}	0.91 ± 0.06^{a}	1.17 ± 0.10^{a}	2.82 ± 0.11^{b}
V10	67.56 ± 0.50^{e}	114 ± 2.51^{ab}	10.46 ± 0.47^{a}	1.21 ± 0.14^{b}	1.36 ±. 0.23^{a}	4.35 ± 0.18^{c}
V11	67.18 ± 0.65^{e}	123 ± 1.60^{c}	11.38 ± 0.45^{b}	0.92 ± 0.06^{a}	1.17 ± 0.17^{a}	2.22 ± 0.10^{a}
V12	67.59 ± 0.53^{e}	115 ± 1.03^{ab}	12.32 ± 0.27^{c}	1.48 ± 0.16^{c}	1.14 ± 1.10^{a}	4.58 ± 0.17^{d}

Each value in the table are represented as Mean ± SD (n=3). Statistically significant at $p < 0.05$, where $^{a<b<c<d<e<f}$ in each column. Different superscripts denote significant difference at ($p<0.05$).

Protein composition of all the variations of steamed rice cake has increased marginally when compared to control as the raw basil seeds contribute to 17 to 20% of protein, which is twice more than that of the contribution from black gram. Of all, the roasted basil seeds incorporated steamed rice cake projects more protein, which is also justified by the study of Olawepo *etal*.[23]

Results on ash reveal that on comparison with the control steamed rice cake, the processed as well the unprocessed variations have higher ash content. Ash content increment is an indication of the level of mineral composition of the substrates.[24] The 20% roasted basil seed incorporated variation, V8 records highest percentage (1.81%) of ash, which may be due to the fact that roasting retains more nutritents.[25] The fat percentage was more in the roasted basil seeds incorporated variation, while steaming has reduced the fat.

It is evident from Table -2 that, the fiber content has shown a drastic increase in the highest proportion of roasted basil seed incorporated variation V8, favouring the nutritional profile. A similar effect of increased fibre on dry roasting of chia seeds has also been reported.[26] The dietary fibre in basil seeds regulate blood sugar levels and proves beneficial for Type 2 diabetes.[27] It may be correlated to the fact that the presence of fibre in the roasted basil seeds steamed rice cake could increase the micro flora population that uses fiber in their metabolism and would prove to be a promising source of prebiotic.[28]

It is also important to understand that combination of foods or food groups improve the nutritional value of meal and elicits a positive outcome on post prandial blood glucose levels.[29] Hence this amalgamation of *O. basilicum* seeds into high glycemic indexed Idlis may decrease post prandial glycemic response which can be proved by clinical trials.

Texture Profile Analysis of the raw, roasted and steamed *Ocimum basilicum* L. seeds incorporated steamed rice cake is presented in Table-3.

Results of Table-3 has shown that there was a significant difference ($p<0.05$) in the hardness of the basil seed incorporated steamed rice cake prepared from different variations. Firmness or hardness which has been represented by peak force A, increased with the increase in basil seed proportion. Greatest hardness was noticed in variation 12. Lower the hardness softer is the Idli.[30] The hardness may be correlated with the moisture percentage of the steamed rice cakes, as well the level of incorporation of carbon dioxide, which could have been hampered because of the intact packaging of the seeds.

Table 3: Texture Profile Analysis of the Unprocessed, Roasted and Steamed Ocimum basilicum L. Seeds Incorporated Steamed Rice Cake

Variations	Peak Force A (N)	Stickiness (N)	Springiness	Cohesiveness	Stringiness (mm)	Chewiness (N)	Adhesiveness(J)	Gumminess (N)
Control	3.82±0.26^{a}	-0.77±0.23^{c}	0.77±0.12^{b}	0.47±0.000^{b}	2.32±0.80^{c}	1.42±0.320^{a}	0.92±0.67^{c}	1.82±0.13^{a}
Raw *O. basilicum* Seeds Incorporated Steamed Rice Cake								
V1	3.50±0.43^{bc}	-0.6±0.11^{b}	0.88±0.05^{c}	0.57±0.167^{c}	0.113±0.05^{a}	1.78±0.536^{a}	0.003±0.001^{a}	2.038±0.717^{b}
V2	5.39±0.139^{ac}	-0.77±0.445^{c}	0.835±0.140^{c}	0.467±0.009^{a}	1.51±1.50^{c}	2.117±0.455^{b}	0.78±1.093^{bc}	2.5201±0.134^{ac}
V3	5.41±0.169^{b}	-0.546±0.357^{ab}	0.87±0.032^{ab}	0.466±0.019^{a}	1.287±1.18^{b}	2.194±0.269^{b}	0.470±0.60^{b}	2.519±0.066^{ab}
V4	5.24±0.357^{d}	-0.508±0.233^{a}	0.68±0.066^{a}	0.463±0.023^{a}	1.22± 1.13^{b}	2.084±0.166^{b}	0.403±0.509^{b}	2.422±0.091^{b}
Raw *O. basilicum* Seeds Incorporated Steamed Rice Cake								
V5	3.184± 0.20^{a}	-0.20± 0.06^{cd}	0.93± 0.01^{d}	0.76± 0.25^{d}	0.187±0.24^{a}	2.246±0.666^{c}	0.007±0.01^{a}	2.404±0.67^{ac}
V6	4.44± 0.31^{ab}	-0.61± 0.26^{bc}	0.82± 0.09^{d}	0.47± 0.01^{b}	0.96±1.5a^{c}	1.71±0.259^{a}	0.43±0.745^{b}	2.086±0.13^{ac}
V7	5.36± 0.19^{b}	-0.97± 0.51^{ac}	0.76± 0.143^{ac}	0.47± 0.00^{b}	2.48±0.94^{c}	1.93±0.35^{a}	1.397±1.39^{c}	2.542±0.06^{c}
V8	6.18± 0.17^{c}	-1.18± 0.66^{d}	0.74± 0.14^{b}	0.47± 0.012^{b}	2.64±0.92^{c}	2.19±0.413^{b}	1.837±1.83^{c}	2.964±0.15^{c}
Steamed *O. basilicum* Seeds Incorporated Steamed Rice Cake								
V9	4.67±0.116^{ac}	-0.45±0.24^{ac}	0.84±0.119^{b}	0.47±0.018^{b}	1.23±1.33^{b}	1.87±0.34^{a}	0.36±0.55^{ab}	2.197±0.11^{ab}
V10	5.04±0.119^{b}	-0.42±0.25^{ab}	0.862±0.104^{ac}	0.470±0.01^{b}	0.927±1.49^{ac}	2.050±0.324^{ab}	0.33±0.577^{ab}	2.36±0.106^{bc}
V11	5.75±0.90a^{b}	-0.92±0.55^{ac}	0.782±0.1466^{bc}	0.46±0.005^{a}	1.75±1.65^{bc}	2.09±0.448^{ab}	1.12±1.522^{c}	2.69±0.404^{c}
V12	7.42±0.29^{d}	-1.71±0.53^{d}	0.670±0.114^{a}	0.475±0.012^{ab}	3.37±0.66^{d}	2.36±0.452^{d}	3.34±1.687^{d}	3.52±0.086^{d}

Each value in the table are represented as Mean ± SD (n=3). Statistically significant at $p < 0.05$, where a<b<c<d in each column. Different superscripts denote significant difference at ($p<0.05$).

Stickiness is the force required to separate the material that sticks to the teeth while eating.[31] The stickiness ranged between -0.5 and -1.71 N. In this more stickiness was observed in V12 and lowest was found in V4. The gelation in the steamed basil seeds may be a contributing factor for more stickiness in V12. The lowest stickiness shows that the variation 4 -steamed rice cake has a good firm texture.

Springiness is related to fluffiness as it determines the extent of recovery between the first and second compression.[32] Springiness ranged from 0.67 to 0.93 and there were significant differences in the springiness between variations and control sample ($p < 0.05$). Table 3 depicts that more springiness has been observed in roasted basil seeds incorporated steamed rice cakes. Springiness reflects the softness of steamed rice cake which in turn depends on the quantity and quality of the black gram used. The globulin and arabinogalactan components in black gram play a vital role in the steamed rice cake. Also as stated earlier, the polysaccharides present in basil seeds also owe to springiness of steamed rice cake.

Table 4: Mean Organoleptic Analysis of the Unprocessed, Roasted and Steamed *Ocimum basilicum* L. Seeds Incorporated Steamed Rice Cake

Variations	Appearance	Colour	Flavour	Texture	Taste	Mouth Feel	Overall acceptability
Control	8.00±0.58^{c}	8.60±0.75^{d}	8.10±0.78^{c}	8.08±0.81^{c}	8.13±1.19^{c}	8.56±0.75^{c}	8.645±0.51d
Raw *O. basilicum* Seeds Incorporated Steamed Rice Cake							
V1	8.12±0.50^{c}	8.15±.36^{c}	8.40±0.50^{c}	7.75±.44^{bc}	8.20±0.41^{c}	8.15±0.36^{c}	8.211±0.00^{c}
V2	8.20±0.78^{c}	8.03±0.73^{c}	8.23±0.78^{c}	8.00±0.81^{c}	8.10±1.19^{c}	8.90±0.73^{d}	8.152±0.51^{c}
V3	8.23±0.73^{c}	8.02±0.73^{c}	8.52±0.78^{d}	8.40±0.96^{c}	8.12±0.73^{c}	8.71±0.73^{d}	8.23±0.41^{c}
V4	8.42±0.81^{c}	7.90±0.73bc	8.60±0.78^{d}	8.10±1.19^{c}	8.27±0.73^{c}	8.90±0.73^{d}	8.63±0.51^{d}
Roasted *O. basilicum* Seeds Incorporated Steamed Rice Cake							
V5	8.38±0.41^{c}	8.45±0.26^{c}	8.61±0.42^{d}	8.13±0.34^{c}	8.32±0.42^{c}	8.33±0.31^{c}	8.47±0.07^{c}
V6	8.52±0.68^{d}	8.63±0.37^{d}	8.74±0.73^{d}	8.21±0.35^{c}	8.46±0.24^{c}	8.31±0.26^{c}	8.32±0.42^{c}
V7	8.53±0.63^{d}	8.72±0.63^{d}	8.56±0.63^{d}	8.26±0.31^{c}	8.28±0.39^{c}	8.29±0.51^{c}	8.49±0.34^{c}
V8	8.90±0.91^{d}	8.73±0.53^{d}	8.82±0.19^{d}	8.44± 0.21^{c}	8.91±0.23^{d}	8.93±0.62^{d}	8.93±0.67^{d}
Steamed *O. basilicum* Seeds Incorporated Steamed Rice Cake							
V9	6.32±0.42^{b}	6.15±0.22^{ab}	6.40±0.51^{b}	6.12±0.43^{ab}	6.20±0.41^{b}	5.15±0.36^{a}	6.17±0.03^{ab}
V10	6.29±0.68^{b}	6.03±0.13^{ab}	6.32±0.31^{b}	6.51±0.60^{b}	6.10±0.21^{ab}	5.90±0.34^{a}	6.15±0.31^{ab}
V11	6.23±0.59^{b}	6.02±0.32^{ab}	6.54±0.28^{b}	6.30±0.36^{b}	5.12±0.43^{a}	5.71±0.25^{a}	5.93±0.42^{a}
V12	5.92±0.72^{a}	5.90±0.26^{a}	6.10±0.23^{ab}	5.98±0.19^{a}	5.27±0.17^{a}	5.90±0.36^{a}	5.72±0.47^{a}

Each value in the table are represented as Mean ± SD (n=3. Means with same superscript are not significantly different using Duncan's Multiple Range Test ($P < 0.05$).

Adhesiveness depends on the gelatinization and more fluidity of rice starch structure in the cooked samples.[33] In this study the gelation property of basil seeds would have contributed to adhesiveness, stickiness, chewiness and gumminess of the

steamed rice cakes. However, the textural attributes such as hardness, stickiness, cohesiveness and springiness are dependent on one another.[34] Though, the variations were significantly different when compared with the control, it need not necessarily mean that the products are unacceptable. The entire TPA results signify that the textural parameters of Variations, V7 and V8 seem to be more acceptable, but cannot be concluded. Hence, all the variations were further subjected to organoleptic evaluation.

The sensory scores of raw and processed (roasted and steamed) basil seeds incorporated steamed rice cakes are depicted in Table-4. According to the results presented, there is a significant difference between the appearance, colour, flavor, texture, taste, mouth feel and overall acceptability of the steamed *O.basilicum* seeds incorporated variations of the steamed rice cake, with respect to the processing techniques. The overall acceptability of the variations V9 to V12 was very less which is also slightly similar to the results depicted by TPA. Wherein, the overall acceptability of the raw or unprocessed *O.basilicum* seeds incorporated variations and roasted *O.basilicum* seeds incorporated variations of the steamed rice cake was maximum and the variations V4 and V8 show acceptance index parallel to the control. Although the TPA and the organoleptic evaluation indicate different results, as in certain parameters, (V7 was more competent to V8 than V4), the acceptability by human subjects will be of high significance. The literature has also stated that the TPA data need not be relevant substitutions for the sensory attributes always.[35]

Conclusion

Steamed rice cakes being a versatile conventional product, the acceptability after value addition poses doubt. Hence prior to supplementation it was proposed to subject the developed twelve variations of steamed rice cake to different analytical procedures to test its nutritional, textural and sensory properties. It can be concluded from the results that the nutritional parameters were better in variation 8 and the organoleptic analysis has projected an overall acceptability of Variation 8 in which 20% of the roasted basil seeds were incorporated. Hence, considering the nutritional profile, textural analysis outcomes and the overall acceptability steamed rice cake with 20% of roasted basil seeds incorporation can be considered optimal for further studies, which will prove beneficial to persons who should be devoid of proteins from pulses for example, as in case of gout and other renal diseases. Further being a source of protein, minerals and fibre and can be recommended for diabetics, subjects with cardiovascular disorder and gastrointestinal disorders. With these inferences, the accepted variation (V8) will be subjected to supplementation in future studies and the constructive reports will be stated accordingly.

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Conflict of Interest

The authors do not have any conflict of interest.

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