



Development And Evaluation Of Kukul Millet Bites

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There has been an increasing awareness regarding the ill effects of the junk foods in the society. Consumers prefer healthy and nutritious foods in place of junk foods these days. Calcium is required during all stages of the human life cycle. Millets are a rich source of calcium and is locally available and affordable to all economical segments of the society. Kulkuls, are popular ready to eat sweet snacks usually prepared during Christmas. The commercially available ready to eat snacks are not nutrient dense and does not serve any calcium requirements. An investigation was undertaken to develop a ready to eat value added fried snack **Kukul millet bites**. Development and standardization trials of the Kulkuls (basic) and three variations of value added kukul millet bites (V_1 , V_2 , V_3) was carried out in the Food and Nutrition laboratory. In this study, sensory evaluation, proximate analysis and shelf life study of the Kukul millet bites was taken up. The standardized products were subjected to sensory evaluation by 15 semi trained panelists using a 9-point hedonic rating scale. Sensory attributes included appearance, colour, texture, taste, odour and overall acceptability. Sensory evaluation results indicated Kukul millet bites variation (V_1) containing Ragi 50%, Egg - 20%, Butter - 15%, Sugar 8%, kalonji seeds -3%, fennel seeds - 2%, sesame seeds-2% was best accepted. The sensory attributes of value added Kukul millet bites with reference to appearance, colour, texture and overall acceptability exhibited notable differences among the variations. However, taste and odour did not show statistically significant differences. Nutritional analysis of the best accepted variation (V_1) showed to contain 7.48% moisture, 4.56 g protein, 31.13 g fat, 5.33 g total fiber, 1.37 g ash, 50.13g carbohydrate, 456.02 kcal energy and 58.9 mg calcium per 100 g of value added kukul millet bites, on cooked weight basis with a shelf life of 10 days at room temperature. This easy to prepare, tasty, nutrient dense Kukul millet bites, developed in this investigation could replace the junk food snacks and can be used anytime of the year. It can also be used by people who are calcium deficient and gluten intolerant.

Keywords: Kulkuls, Finger millet, value added snack, sensory evaluation.

Introduction

At every phase of life from birth till old age there is a requirement of adequate amounts of different vitamins, minerals and nutrients to keep an individual healthy and functional. The need for the mineral calcium starts from early years and ranges from 600mg/d for 1-9 years children and increasing up to 1200mg/d for adults (1). Around 99% of total body calcium is stored in the bones and teeth, where it is essential for growth and maintenance (2). Around 1% is found in blood and muscles for other bodily functions. Calcium is necessary during various phases for life to maintain better health of an individual (3).

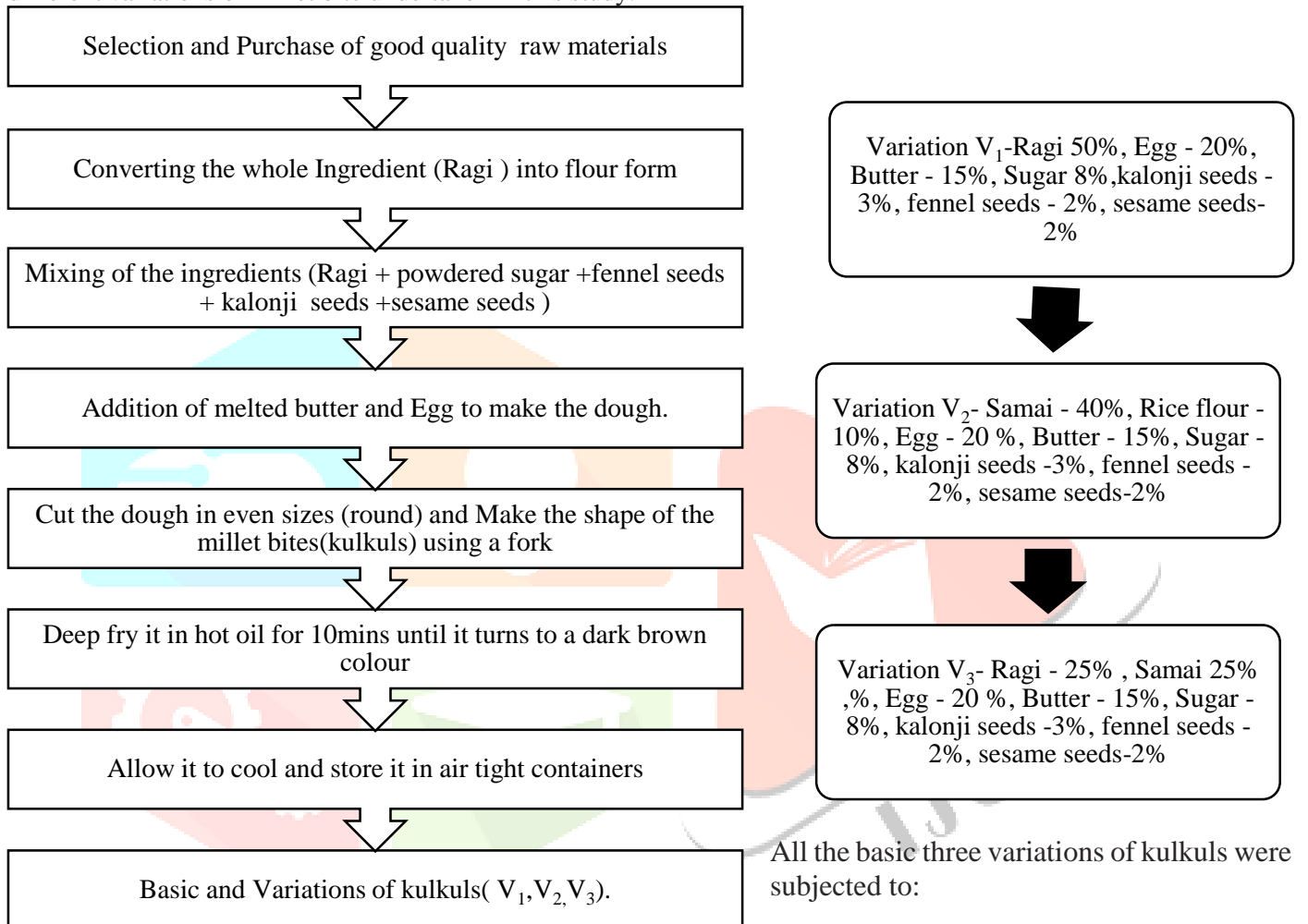
Nutritious snacks have been replaced by junk and ready to eat snacks because of easy availability artificially enhance taste, flavor, better appearance combined with relentless advertising. As per the National Institute of Nutrition (NIN), "unhealthy foods are those containing little/no proteins, vitamins or minerals but are rich in salt, sugar, fats and high in energy" (4). Kulkuls are prepared commercially usually during Christmas season and contain high energy, fats and sugar (5).

Bakery foods are the most popular snack foods that are easily available (6). Instead of eating junk food during school hours, as evening snacks, between meals snacks, consumers can opt for a calcium rich, fiber rich and a healthy carbohydrate snack (7). The developed healthy snack can help in bone and teeth development at all the stages of life (8).

Value addition of ready to eat snacks, using millets is one way to meet the calcium needs. Cupcakes, cookies, breads and other ready to eat snack foods have been successfully produced from different types of cereal based grains (9). In comparison to maida, ragi millet helps in weight loss and glucose control. Samai millet which is rich in phyto-chemicals and helps in reducing cholesterol levels. Kalonji seeds is a source of oil, monosaccharides and valuable nutrients. Fennel seeds contains minerals and helps to regulate blood pressure (10).

Materials and methods

Millet bites can be consumed by growing children, people affected by osteoporosis,calcium deficient, diabetic and gluten intolerant individuals. During the preliminary experimental trials,kulkuls(basic) and different variations of Kulkul millet bites (V₁,V₂,V₃) were prepared in the Food and Nutrition laboratory of Smt VHD Central Institute of Home Science.Basic Kulkuls (using refined wheat flour) and variations of Kulkul Millet bites were prepared using different millets and various other functional ingredients. Figure 1. Shows the plan of work with compositions of different variations of millet bite undertaken in this study.



Note: Ragi millet/Finger millet(Eleusine coracana),Little millet/Samai millet(Panicum sumatrense),Kalonji seeds/black onion seeds(Nigella Sativa).

Figure 1.- Plan of work for Development of Kulkuls (Basic) and value added Kulkul Millet Bites

Table 1.
Ingredients used for Kulkuls (Basic) and variations of Kulkul Millet Bites

Ingredients	Percentage variation			
	Basic	Variation V ₁	Variation V ₂	Variation V ₃
Maida	50%	-	-	-
Finger millet (Ragi) flour	-	50 %	-	25%
Saamai flour	-	-	40%	25%
Rice flour	10%	-	10%	-
Egg	-	20%	20%	20%
Butter	25%	15%	15%	15%
Sugar	15%	8%	8%	8%
Kalonji seeds	-	3%	3%	3%
Fennel seeds	-	2%	2%	2%
Sesame seeds	-	2%	2%	2%

Sensory Evaluation

Sensory evaluation of (Basic, V₁, V₂, V₃) was carried out to find the acceptability of Kulkul millet bites using a 9-point Hedonic scale by 15 semi trained panellists. Various characteristics like appearance, colour, texture, taste, odour, flavour and overall acceptability were scored using a rating scale of 9 to 1. The sensory scores were statistically analysed.

Nutritional Composition

Nutritional composition of Kulkul millet bites was determined by conducting proximate analysis (moisture, carbohydrate, ash, fiber, fat, protein and energy) of final standardized product using standard methods (IS7874, IS 4656 and Physico chemical method).

Shelf life study

Shelf life studies were conducted under two conditions, refrigeration (0-5°C) and at room temperature(34°C). Food graded plastics containers were used as packaging material.

Nutritional Labelling

Nutritional labelling is an important process in the food processing chain and label bridges the gap a consumer and the producer. It has been labelled with halal certification.

Costing

Ingredients	Quantity per 100g	Cost in rupees
Finger millet (Ragi) flour	50g	5/-
Egg	20g	3/-
Butter	15g	8/-
Sugar	8g	0.50/-
Kalonji seeds	3g	2/-
Sesame seeds	2g	4/-
Fennel seeds	2g	0.05/-
Total ingredients cost per 100g of raw ingredients	-	23/-

Results and Discussion

Table 2.
Experimental trials during standardization of kulkul millet bites

Sl. No.	Trials	Ratio	Description profile of millet bites
1.	Basic	Maida(50%)	Light brown, soft, acceptable taste, smooth mouth feel.
2.	V ₁	Finger millet(Ragi) (50%)	Dark brown, soft, acceptable taste, smooth mouth feel.
3.	V ₂	Samai : rice flour (40%:10%)	Off white, creamish, coarse, acceptable taste, course mouth feel
4.	V ₃	Finger millet (Ragi) : samai (25%:25)	Light brown, semi-soft, average taste, course mouth feel.

- **Remaining ingredients like egg, butter, sugar, kalonji seeds, fennel seeds and sesame seeds are in same quantities.** Trials for standardization of millet bites were carried out for inclusion of different functional ingredients.

Table 3.
Statistical Analysis (One way ANOVA) of Kulkul Millet Bites(V₁,V₂,V₃)

		Mean	Std. Deviation	F test statistics	Sig.	Post Hoc Comparisons
Appearance	Basic	8.427	0.2285	7.733	<0.000	0.009
	VariationV ₁	8.733	0.2285			0.000
	VariationV ₂	8.333	0.2285			0.030
	VariationV ₃	7.667	0.2285			
Colour	Basic	8.393	0.2285	7.478	<0.000	0.006
	VariationV ₁	8.600	0.2285			0.014
	VariationV ₂	8.333	0.2285			
	VariationV ₃	7.667	0.2285			
Texture	Basic	8.293	0.2285	5.839	0.002	0.005
	VariationV ₁	8.267	0.2285			0.008
	VariationV ₂	8.267	0.2091			
	VariationV ₃	7.600	0.2091			
Taste	Basic	8.460	0.2091	2.516	0.067	NA
	VariationV ₁	8.133	0.2091			
	VariationV ₂	8.000	0.2091			
	VariationV ₃	7.933	0.2091			
Odour	Basic	8.320	0.2091	0.921	0.437	NA
	VariationV ₁	8.267	0.2091			
	VariationV ₂	8.067	0.2091			
	VariationV ₃	8.000	0.2091			
Overall acceptability	Basic	8.573	0.1978	7.576	<0.000	0.000
	VariationV ₁	8.440	0.1978			0.006
	VariationV ₂	8.200	0.1978			
	VariationV ₃	7.960	0.1978			
Total	Basic	50.269	2.7811	0.921	0.067	0.030
	VariationV ₁	50.440	2.6320			0.014
	VariationV ₂	49.200	2.964			0.009
	VariationV ₃	46.827	3.7357			

Note: Basic Vs Variation 1, variation 1 Vs variation 2, variation 2 Vs variation 3, variation 3 Vs variation 1. (p value using ANOVA. P value < 0.05 consider as a statistically significant), (Post Hoc test using Bonferroni test).

Table 3 shows the mean scores of each attribute among the different variations. Variation V₁ (Ragi 50%, Egg 20%, Butter 15%, Sugar 8%, Kalonji seeds 3%, Fennel seeds 2%, Sesame seeds 2%) was highly acceptable. The mean scores ranged from 8.13 to 8.73 with lowest score for taste (8.13) and highest score for appearance (8.73). The basic and variations were subjected to one-way ANOVA and post Hoc Test (Table 3). There was a significant difference in the mean responses on the appearance with respect to the different variation of components with F = 7.733, P-value = < 0.001.

A lowest significance difference (LSD) post hoc test was used showing significant mean difference between basic and variation V₁ (p-value = 0.009), basic and variation V₂ (P-value = < 0.001) and basic and variation V₃ (p-value = 0.030) with respect to appearance.

Variation V₁ had significantly higher mean score of 8.733 (p 0.05). There was significant difference with respect to texture among the variations (P-value = 0.002) at 5% level of significance with F = 5.839. A lowest significance difference (LSD) post hoc test showed that there was significant mean difference between basic and variation V₁ (p-value = 0.005) with respect to texture. It is evident from the table that there is significant difference with respect to colour among different variations of components with F = 7.478, p-value = < 0.001.

A post hoc test revealed significant mean difference between basic and variation V₁ (p-value = 0.014). No significant difference was found among the variations (p > 0.05) with respect to overall acceptability. At 5% level of significance, there was significant difference in the total mean judges responses with respect to the different variation of components with F = 0.921, p-value = 0.067. After the sensory evaluation result and statistical analysis the best product was selected.

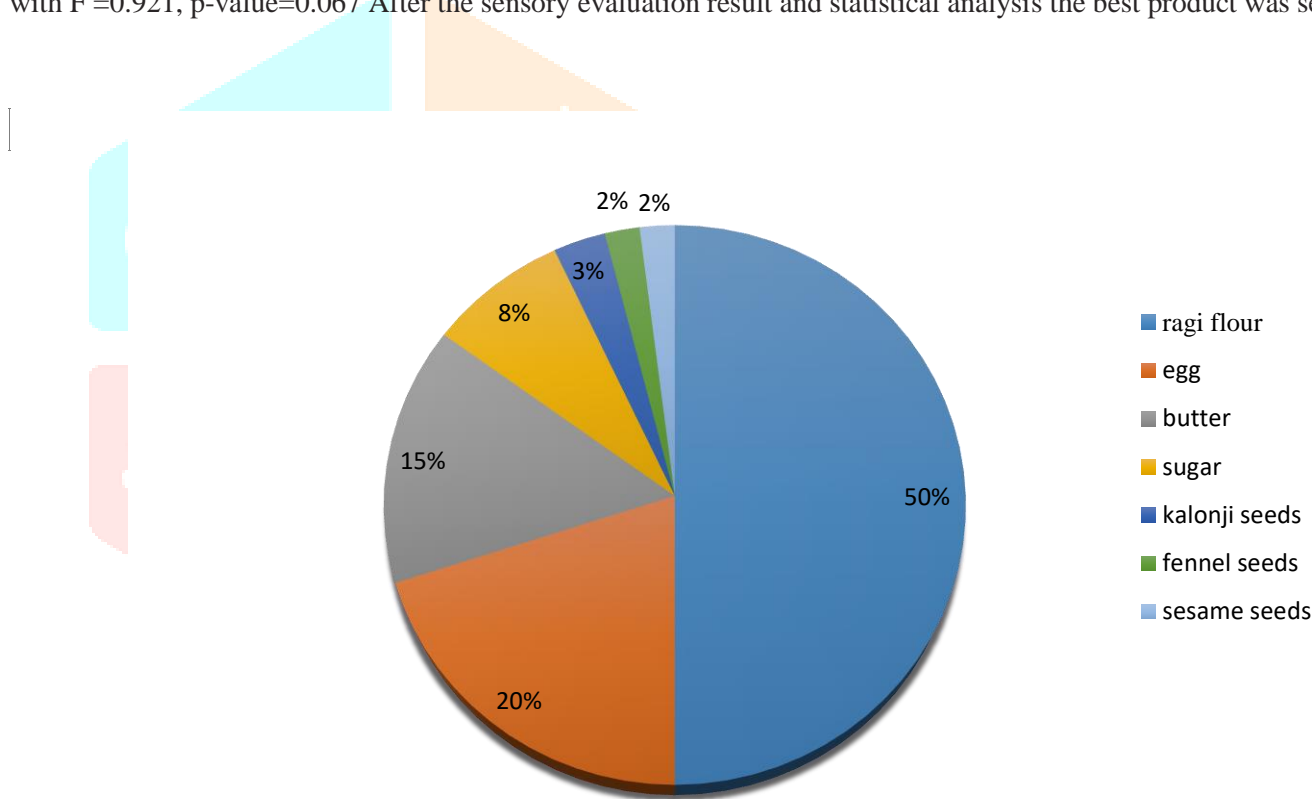


Figure 2. Ingredients used in best accepted Standardized Kukul Millet Bites(V₁), per 100g

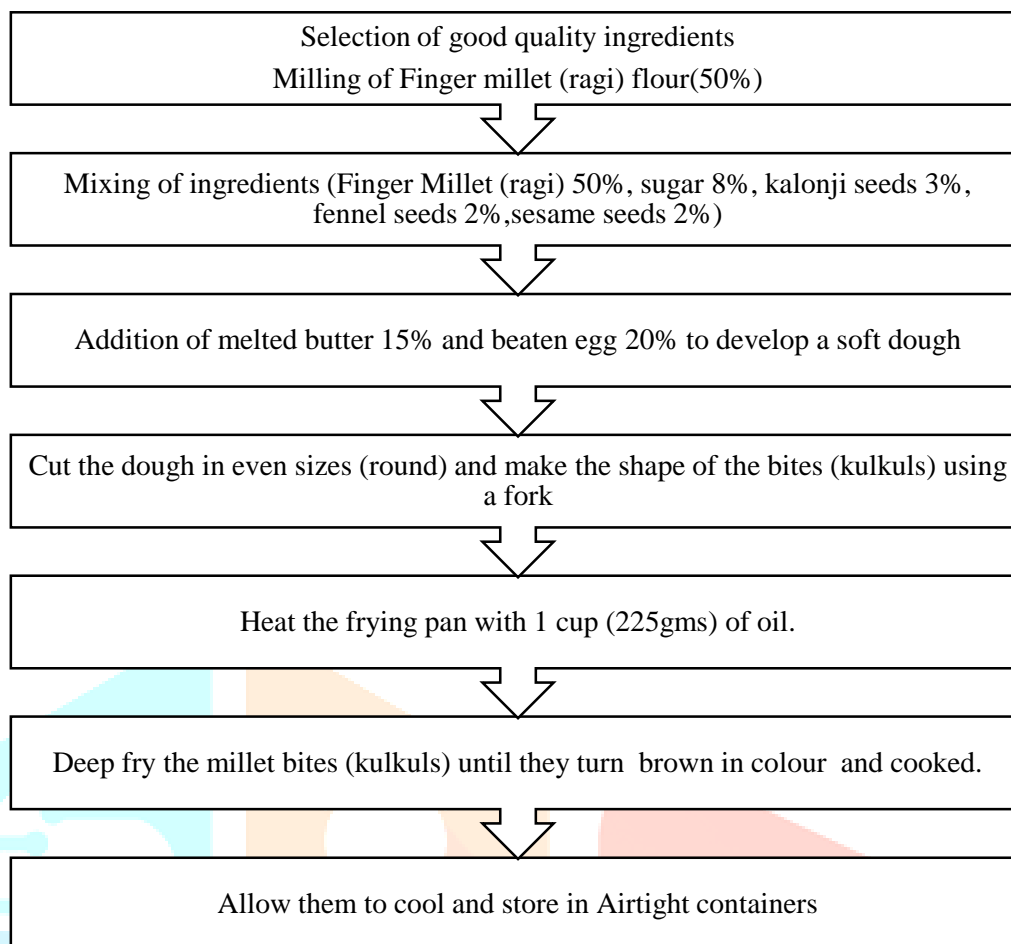


Figure 3. Standardized Kukul Millet bites Best accepted Variation (V₁)

Table 4.
Nutritional content of the best accepted Standardized Kukul Millet Bites /100 g

Nutrients	Kukul Millet bites /100g
Energy (kcal)	456.02
Protein (g)	4.56
Fat (g)	34.13
Fibre (g)	5.33
Carbohydrate (g)	50.13
Ash %	1.37
Moisture %	7.48
Calcium (mg)	58.9

The percentage of Indian Adult RDA is 2110-3470 Kcal. Standardized ,best accepted Millet bites (V₁) contributes 456.02 Kcal/ gram and the amount of calcium required by an Indian Adult is 800 mg/d out of which kukul millet bites contribute 58.9 mg.

Note for Table 4 Proximate Analysis by MS RAMAIAH FOOD LABORATORY, Bangalore.

Table 5.

Shelf Life of Millet Bites (V₁) at Refrigeration temperature (- 19°C) and at room temperature (36°C).

Physical examination	At room temperature (36°C)*			
	5 th day	10 th day	14 th day	15 th day
Appearance	Dark brown	Dark brown	Dark brown	Dark brown
Texture	Crisp	Crisp	Less Crisp	Soft
Odour	No off odour	No off odour	No off odour	Slight off odour
Presence of rancid smell	Absent	Absent	Absent	Absent
Acceptability	Acceptable	Acceptable	Less acceptable	Not acceptable

Physical examination	At Refrigeration temperature (-19°C)*			
	5 th day	10 th day	15 th day	20 th day
Appearance	Dark brown	Dark brown	Dark brown	Dull brown
Texture	Crisp	Crisp	Crisp	Not very crisp
Odour	No off odour	No off odour	No off odour	Slight off odour
Presence of rancid smell	Absent	Absent	Absent	Absent
Acceptability	Acceptable	Acceptable	Acceptable	Not acceptable

Note: *In an air tight food grade packaging Table 5 shows The Standardized Kulkul Millet Bites were best and stable at room temperature as the appearance, odour and texture was unchanged and acceptable until 13 days. At refrigeration temperature the odour and texture had changed, with slight off odour on the 20th day. The prepared product is best suggested to be consumed within 10 days after preparation when stored at room temperature.

Conclusion

Standardized Kulkul millet bites (V_1) developed in this investigation was best accepted organoleptically on a 9-point hedonic rating scale, and has the advantage of possessing micronutrients with a shelf life of 10 days at room temperature. Millets that are locally grown and available all over our country can be used as a base for the manufacture of a wide variety of low cost nutritious ready to eat snacks and savouries.

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